SUSITNA HYDROELECTRIC PROJECT

WATER QUALITY ANNUAL REPORT 1981

DECEMBER 1981

PREPARED BY:

R&M CONSULTANTS, INC.

PREPARED FOR:

ACRES

ALASKA POWER AUTHORITY

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

TASK 3 - HYDROLOGY

WATER QUALITY ANNUAL REPORT 1981

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Prepared for:

ACRES AMERICAN INCORPORATED
1000 Liberty Bank Building
Main at Court
Buffalo, New York 14202
Telephone (716) 853-7525

Prepared by:

R&M CONSULTANTS, INC.
5024 Cordova Street
Anchorage, Alaska 99502
Telephone (907) 279-0483

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

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WATER QUALITY ANNUAL REPORT - 1981

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1 - INTRODUCTION

1.1 - Objectives

This report describes the water quality program conducted by R&M Consultants during Phase 1 of the Susitna Hydroelectric Project, and presents all the water quality data collected to date under Subtask 3.03.

The aim of the data collection program is to provide basic water quality information for fisheries studies, reservoir studies and for the establishment of baseline parameters on the Susitna River. From the data, regional and local variations in water quality will be defined, as well as seasonal variations as they relate to streamflow and climate. This information can then be used to determine the effects dam construction and impoundment with regulated flow might have on water quality upstream and downstream of the proposed damsites.

1.2 - Report Contents

Following a general description of the water data collection program, the data are presented with respect to the year in which they were collected. Any variances from the procedures in the R&M Consultants Procedures Manual, July 1980, are described relative to each data set. Water quality data collected during 1980 are presented in Section 3.0, and 1981 data in Section 4.0. Suspended sediment analyses results are also divided into the year in which the samples were collected along with a description of sampling techniques. A summary of water quality parameters collected by the U.S. Geological Survey is included in Section 5.0 with R&M data summarized in the same format for comparison.

Section 6.0 presents the data collected by the continuous water quality recorder in a summarized format with a description of its operation to date. Attachment A contains water temperature data available from the U.S.G.S. dating back to 1974 at Gold Creek. Also included are existing data from Vee Canyon, Susitna Station and temperature data collected by R&M during 1980 and 1981. A revised version of the R&M Consultants Procedures Manual for Water Quality Data Collection is presented in Attachment B.

2 - SAMPLING LOCATIONS AND FREQUENCY

R&M Consultants has collected samples for water quality analysis on the Susitna River at Vee Canyon (U.S.G.S. "near Cantwell" site), Figure 2.1, and at Gold Creek, Figure 2.2, on an event oriented basis. During the 1980 field season five analyses were conducted at Vee Canyon and two at Gold Creek. For 1981 the program was expanded to include two complete hydrograph samples for a total of nine analyses at Vee Canyon and nine at Gold Creek. The dates and descriptions of specific events along with sampling results are further outlined in Sections 4 and 5.

Generally the sampling was scheduled according to the following events.

1. Breakup
2. Early summer (maximum effect of glacier runoff and snowmelt)
3. Heavy rainstorm
4. Pre-freezeup
5. Winter (under ice cover)

For the purposes of this schedule the seasons are defined:

Breakup - from the time ice begins to breakup until recession of spring runoff.

Summer - from the end of breakup until the water temperature drops to essentially 0°C in the fall.

Winter - from the end of summer until breakup begins.

The sampling schedule should satisfactorily supplement the U.S.G.S. program, which is oriented towards a fixed sampling time interval.

Table 2.1 presents a listing of the parameters monitored by R&M Consultants with respective methods used for analysis and their detection limits. In some instances the detection limits vary below or above the values in Table 2.1. This is attributed to inconsistencies in values received from the laboratory. All values are presented as received from the lab with few exceptions. The exceptions include typographic errors made at the laboratory which were verified as mistakes.

TABLE 2.1
WATER QUALITY PARAMETERS ANALYSED
FROM VEE CANYON AND GOLD CREEK
BY R&M CONSULTANTS, INC.[1]

	Method[2]	Detection Limit[3]	Data Available from the U.S.G.S.[4]
Field Parameters			
Dissolved Oxygen	SM 421F	0.1	GC
Percent Saturation, %	C	1	GC
pH, pH units	EPA p239	±0.01	GC, VC
Conductivity, umhos/cm	EPA p275	1	GC, VC
Temperature, °C	SM 212	0.1	GC, VC
Carbon Dioxide	SM 407A	1	GC, VC
Alkalinity as $CaCO_3$	EPA p3	2	GC, VC
Settleable Solids, ml/l	EPA p273	0.1	-
Laboratory Parameters			
Ammonia Nitrogen	EPA p159	0.05	GC
Organic Nitrogen	Kjeldahl	0.1	GC
Kjeldahl Nitrogen	EPA p175	0.1	-
Nitrate Nitrogen	EPA p197	0.1	GC, VC
Nitrite Nitrogen	EPA p215	0.01	GC
Total Nitrogen	EPA p175	0.1	GC
Ortho-Phosphate	EPA p249	0.01	GC
Total Phosphorus	EPA p249	0.01	GC
Chemical Oxygen Demand	EPA p20	1	-

TABLE 2.1 - CONTINUED

	Method[2]	Detection Limit[3]	Data Available from the U.S.G.S.[4]
Laboratory Parameters (Cont'd)			
Chloride	EPA p29	0.2	GC, VC
Color	EPA p36	1	GC, VC
Hardness	C	1	GC, VC
Sulfate	EPA p277	1	GC, VC
Total Dissolved Solids[5]	EPA p266	1	GC, VC
Total Suspended Solids[6]	EPA p268	1	GC, VC
Turbidity	EPA p295	0.05	-
Uranium	Fluorescence	0.075	-
Gross Alpha picocurie/liter	EPA p264	3	GC
Total Organic Carbon	EPA p415	1.0	GC
Total Inorganic Carbon	EPA p415	1.0	-
Organic Chemicals			
Endrin	SM 509A	0.0002	-
Lindane	SM 509A	0.004	-
Methoxychlor	SM 509A	0.1	-
Toxaphene	SM 509A	0.005	-
2, 4-D	SM 509B	0.1	-
2, 4, 5-TP Silvex	SM 509B	0.01	-
ICAP SCAN[7]			
Ag, Silver		0.05	GC
Al, Aluminum		0.05	-
As, Arsenic		0.10	-
Au, Gold		0.05	-
B, Boron		0.05	-
Ba, Barium		0.05	GC

TABLE 2.1 - CONTINUED

	Method[2]	Detection Limit[3]	Data Available from the U.S.G.S.[4]
Laboratory Parameters (Cont'd)			
ICAP SCAN - (Cont'd)			
Bi, Bismuth		0.05	-
Ca, Calcium		0.05	GC, VC
Cd, Cadmium		0.01	GC
Co, Cobalt		0.05	GC
Cr, Chromium		0.05	GC
Cu, Copper		0.05	GC
Fe, Iron		0.05	GC, VC
Hg, Mercury		0.1	GC
K, Potassium		0.05	GC, VC
Mg, Magnesium		0.05	GC, VC
Mn, Manganese		0.05	GC, VC
Mo, Molybdenum		0.05	-
Na, Sodium		0.05	GC, VC
Ni, Nickel		0.05	GC
Pb, Lead		0.05	GC
Pt, Platinum		0.05	-
Sb, Antimony		0.10	-
Se, Selenium		0.10	GC
Si, Silicon		0.05	-
Sn, Tin		0.10	-
Sr, Strontium		0.05	-
Ti, Titanium		0.05	-
W, Tungsten		1.0	-
V, Vanadium		0.05	-

TABLE 2.1 - CONTINUED

	Method[2]	Detection Limit[3]	Data Available from the U.S.G.S.[4]
Laboratory Parameters (Cont'd)			
ICAP SCAN - (Cont'd)			
Zn, Zinc		0.05	GC
Zr, Zirconium		0.05	-

(1) Chemical & Geological Laboratories of Alaska, Inc., has been contracted to provide laboratory analyses. They are one of two private labs in Alaska certified by the Alaska Department of Environmental Conservation to provide water quality analyses.

(2) SM - Standard Methods for the Examination of Water and Wastewater, 15th edition, 1980.

EPA - Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020.

C - Value computed by R&M Consultants, Inc.

Kjeldahl - SM 420

Fluorescence - Following the accepted method outlined by G.K. Turner Associates.

(3) All values are expressed in mg/l unless otherwise noted.

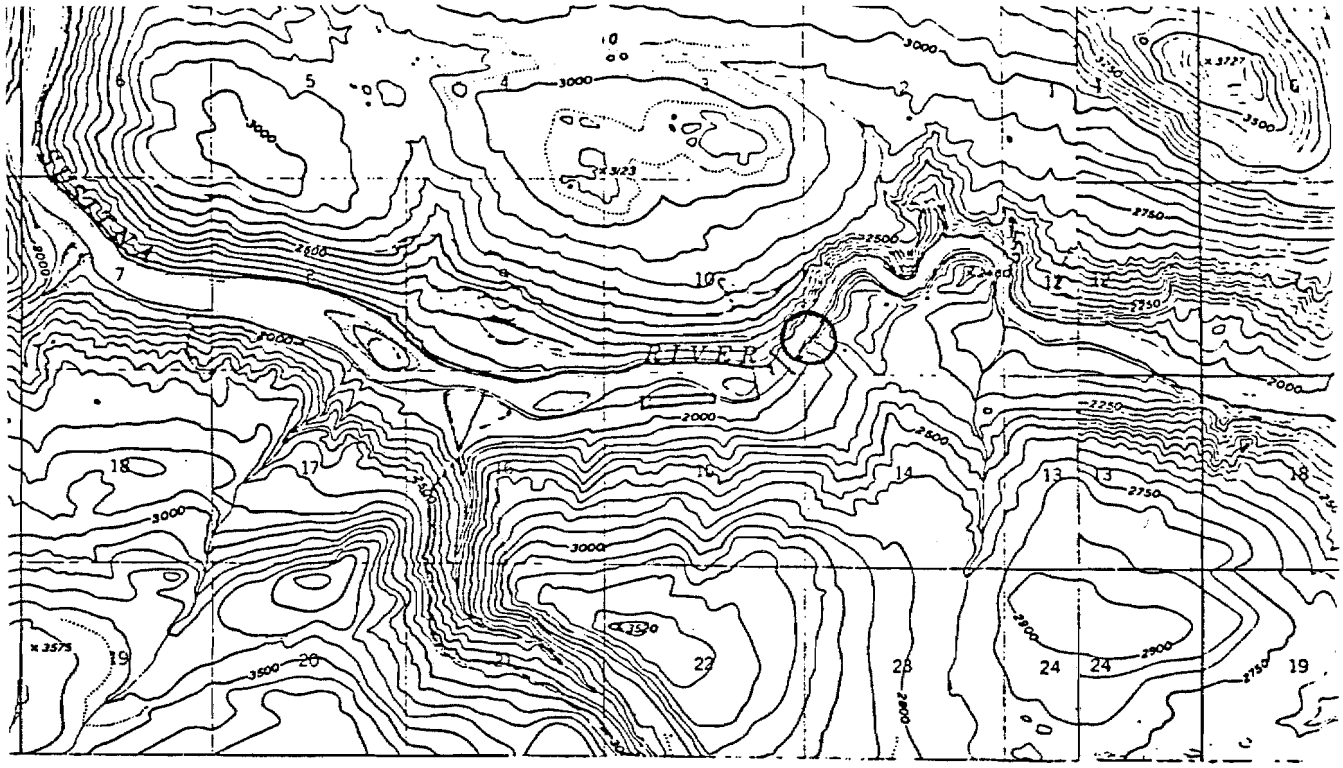
(4) GC - Parameters measured by the U.S. Geological Survey at Gold Creek.

VC - Parameters measured by the U.S. Geological Survey at Vee Canyon (near Cantwell site), summer only.

(5) TDS - (filterable) material that passes through a standard glass fiber filter and remains after evaporation (SM p93).

(6) TSS - (nonfilterable) material retained on a standard glass fiber filter after filtration of a well-mixed sample.

(7) ICAP SCAN - thirty two (32) element computerized scan in parts/million (Ag, Al, As, Au, B, Ba, Bi, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Mo, Na, Ni, Pb, Pt, Sb, Se, Si, Sn, Sr, Ti, V, W, Zn, Zr)



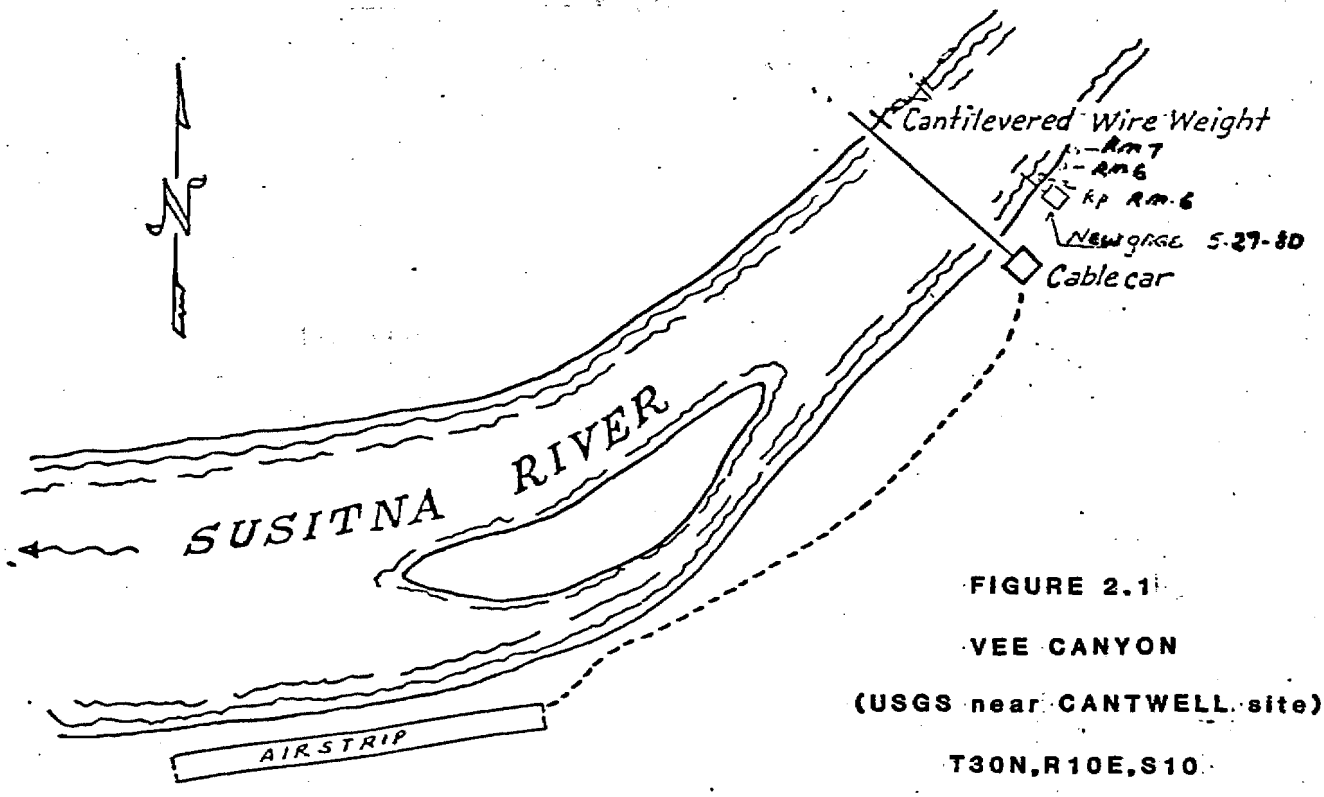


FIGURE 2.1

VEE CANYON

(USGS near CANTWELL site)

T30N,R10E,S10

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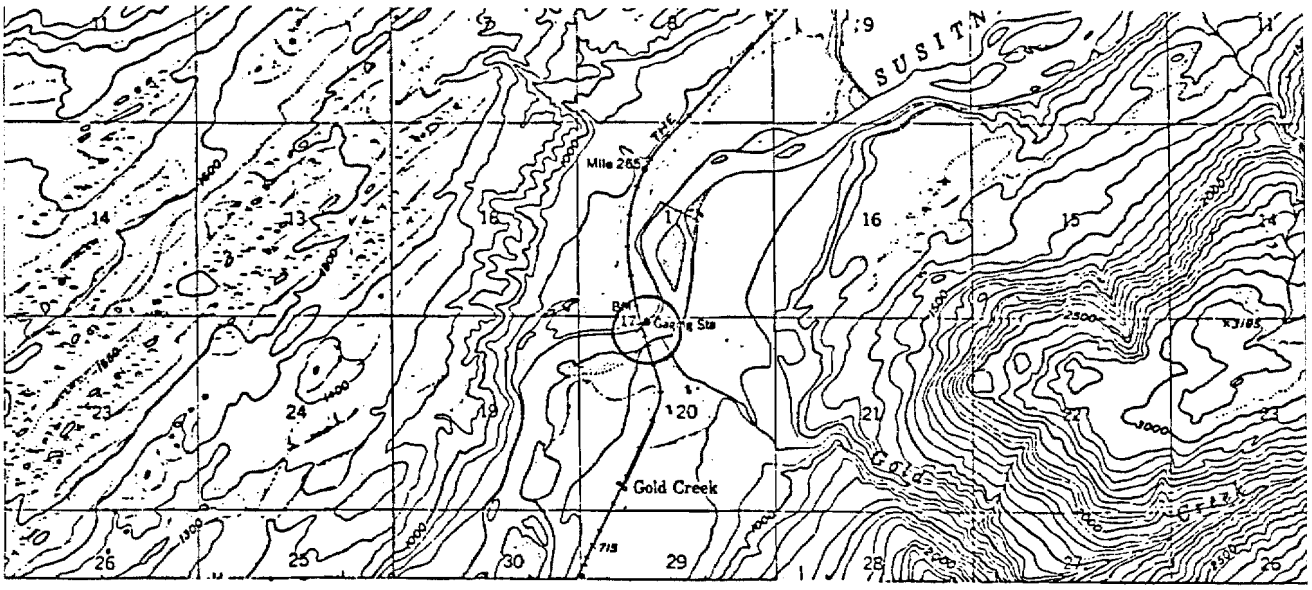

FIGURE 2.2
GOLD CREEK SITE
T31N,R2W,S20

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3 - 1980 WATER QUALITY DATA COLLECTION

3.1 - Description

Samples for lab analysis and *in situ* measurements were taken at Vee Canyon on the following dates and are listed with the corresponding sampling event.

6/19/80	Sampling the effects of glacier runoff and snowmelt.
8/8/80	After a heavy summer rain.
9/5/80	Low summer discharge.
9/17/80	After heavy rains.
10/17/80	Pre-freezeup.

Field data and laboratory analysis results from Vee Canyon are presented in Table 3.1.

Data were collected similarly at Gold Creek at the following dates and events.

8/8/80	After a heavy summer rain.
10/14/80	Pre-freezeup.

Results are listed in Table 3.2.

Procedures for water sample collection and field measurements are detailed in Attachment B. These are, however, the revised procedures and the following variances in methods were applied to the 1980 season.

Field measurements of dissolved oxygen, pH, conductivity, temperature, alkalinity and settleable solids were taken from samples collected with a Van Dorn, 2.2 liter, sampling bottle. Samples were obtained one foot below the surface and at three locations across the channel. These locations are marked on a cableway at both Vee Canyon and Gold Creek to insure that the samples are taken at consistent points throughout the season. The width of the channel at high water is roughly divided into quarters, and sampling is conducted at the left quarter, at midchannel and at the right quarter. When a sufficient quantity of water is collected at each site, each sample is analysed for dissolved oxygen, temperature and settleable solids. The three samples are then combined and mixed well before measuring the pH, conductivity and alkalinity. This composite is then stirred again before separating into five 1-quart bottles for quantitative analysis. The 5 unfiltered samples (3 preserved) were then sent directly to the lab on ice.

Additional samples for the analysis of organic chemicals (pesticides, herbicides), gross alpha radiation, and uranium were collected on August 8, 1980 at Vee Canyon and Gold Creek. However, only a low concentration of gross alpha was detected. Problems with instrument calibration prevented the measurement of dissolved oxygen on August 8 and September 5 at Vee Canyon. The low D.O. reading on August 8 at Gold Creek is possibly further evidence of calibration problems. Another significant deviation to the program is the lack of data points for total organic carbon and total inorganic carbon. These parameters were not routinely analysed in 1980.

3.2 - Suspended Sediment Analysis

During the 1980 field data collection season, R&M acquired a depth integrated sampler for the purpose of obtaining more representative sediment samples to facilitate a detailed analysis of suspended sediment. Previous studies were limited to measurement of total suspended sediment from the composited grab samples obtained at a depth of one foot. The use of a depth integrated sampler provides a representative sample from the entire column. Total suspended sediment from the grab samples is still measured. These values, however, are not directly comparable to the depth integrated values since variations in sediment concentrations can be expected throughout the water column.

At least ten depth integrated samples are collected across the channel at each site. Three of these samples were selected for particle size analysis. The particle size count is done by Chemical and Geological Laboratories of Alaska, Inc. The procedure is basically to count, under a microscope, the suspended sediment particles of a certain size range, then calculate the percentage of that size range within a grid.

The results from the 1980 suspended sediment analyses are presented in Tables 3.3 to 3.5, for Vee Canyon, and Table 3.6 for Gold Creek.

TABLE 3.1

R&M CONSULTANTS, INC.

1980 WATER QUALITY DATA - SUSITNA RIVER

AT VEE CANYON

NOTE: Dash indicates data not available.

	Date Sampled				
	6/19/80	8/8/80	9/5/80	9/17/80	10/17/80
Field Parameters (1)					
Dissolved Oxygen	12.4	----	----	9.7	13.8
Percent Saturation	98	----	----	84	104
pH, pH Units	7.8	7.9	7.8	7.6	7.6
Conductivity, umhos/cm @ 25°C	----	144	171	124	142
Temperature, °C	5.7	9.3	5.3	5.9	-0.1
Free Carbon Dioxide (2)	2.0	1.7	3.6	4.5	5.5
Alkalinity, as $CaCO_3$	47	54	81	63	88
Settleable Solids, ml/l	0.1	<0.1	<0.1	<0.1	≪0.1
Discharge c.f.s.	24,800	17,300	5,040	14,200	<5,000
Laboratory Parameters (1)(3)					
Ammonia Nitrogen	0.26	----	0.10	<0.05	0.26
Organic Nitrogen	<0.1	----	0.22	0.62	0.28
Kjeldahl Nitrogen	0.26	----	0.32	0.62	0.54
Nitrate Nitrogen	0.19	0.15	0.15	0.09	<0.10
Nitrite Nitrogen	<0.01	----	<0.01	<0.01	<0.01
Total Nitrogen	0.45	----	0.47	0.71	0.54
Ortho-Phosphate	<0.01	0.03	0.05	<0.05	<0.01
Total Phosphorus	0.05	0.03	0.09	0.10	<0.01
Alkalinity, as $CaCO_3$	----	----	----	----	66
Chemical Oxygen Demand	28	13	----	----	6

TABLE 3.1 - CONTINUED

	Date Sampled				
	6/19/80	8/8/80	9/5/80	9/17/80	10/17/80
Laboratory Parameters (1)(3) (continued)					
Chloride	3	9	11	8	18
Conductivity, umhos/cm @ 25°C	150	----	----	----	190
True Color, Color Units	----	40	10	45	10
Hardness, as $CaCO_3$ (4)	51	76	69	55	90
Sulfate	4	9	9	7	13
Total Dissolved Solids	70	90	114	38	115
Total Suspended Solids	242	310	25	132	8.3
Turbidity, NTU	94	97	10	33	1.8
Uranium	----	<0.05	----	----	----
Radioactivity, Gross Alpha, pCi/l	----	11.6±0.6	----	----	----
Total Organic Carbon	----	----	----	----	----
Total Inorganic Carbon	----	----	----	----	21
Organic Chemicals					
Endrin	----	<0.0001	----	----	----
Lindane	----	<0.001	----	----	----
Methoxychlor	----	<0.05	----	----	----
Toxaphene	----	<0.001	----	----	----
2, 4-D	----	<0.05	----	----	----
2, 4, 5-TP Silvex	----	<0.005	----	----	----
ICAP Scan					
Ag, Silver	<0.05	<0.05	<0.05	<0.05	<0.05
Al, Aluminum	1.6	<0.1	0.28	2.2	0.18
As, Arsenic	<0.05	<0.1	<0.1	<0.1	<0.1
Au, Gold	<0.05	<0.05	<0.05	<0.05	<0.05
B, Boron	<0.05	<0.05	<0.05	<0.05	<0.05

TABLE 3.1 - CONTINUED

Laboratory Parameters (1)(3) (continued)	Date Sampled 6/19/80	8/8/80	9/5/80	9/17/80	10/17/80
Ba, Barium	<0.1	0.11	<0.05	0.07	<0.05
Bi, Bismuth	<0.05	<0.05	<0.05	<0.05	<0.05
Ca, Calcium	13	16	22	18	28
Cd, Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01
Co, Cobalt	<0.05	<0.05	<0.05	<0.05	<0.05
Cr, Chromium	<0.05	<0.05	<0.05	<0.05	<0.05
Cu, Copper	<0.05	<0.05	<0.05	<0.05	<0.05
Fe, Iron	2.1	4.0	0.46	2.7	0.37
Hg, Mercury	<0.05	<0.1	<0.1	<0.1	<0.1
K, Potassium	<1.0	2.3	2.1	5.0	<1.0
Mg, Magnesium	1.4	3.4	3.1	1.2	4.5
Mn, Manganese	<0.05	0.10	<0.05	0.07	<0.05
Mo, Molybdenum	<0.05	<0.05	<0.05	<0.05	<0.05
Na, Sodium	2.6	2.4	5.1	3.5	7.2
Ni, Nickel	<0.05	<0.05	<0.05	<0.05	<0.05
Pb, Lead	<0.05	<0.05	<0.05	<0.05	<0.05
Pt, Platinum	<0.05	<0.05	<0.05	<0.05	<0.05
Sb, Antimony	<0.1	<0.1	<0.05	<0.1	<0.1
Se, Selenium	<0.05	<0.1	<0.1	<0.1	<0.1
Si, Silicon	4.8	5.3	3.6	6.9	4.1
Sn, Tin	<0.1	<0.1	<0.1	<0.1	<0.1
Sr, Strontium	0.05	0.06	0.07	0.07	0.10
Ti, Titanium	0.13	0.24	<0.05	0.17	<0.05

TABLE 3.1 - CONTINUED

	Date Sampled				
	6/19/80	8/8/80	9/5/80	9/17/80	10/17/80
Laboratory Parameters (1)(3) (continued)					
W, Tungsten	<1.0	<1.0	<1.0	----	<1.0
V, Vanadium	<0.05	<0.05	<0.05	<0.05	<0.05
Zn, Zinc	<0.05	<0.05	<0.05	<0.05	<0.05
Zr, Zirconium	<0.05	<0.05	<0.05	<0.05	<0.05

(1) Table values are mg/l unless noted otherwise.

(2) All values for free CO_2 determined from nomograph on p. 297 of Standard Method, 14th edition.

(3) Samples for all parameters except chemical oxygen demand, dissolved and suspended solids, and turbidity were filtered.

(4) Hardness calculated by R&M personnel.

TABLE 3.2
R&M CONSULTANTS, INC.
1980 WATER QUALITY DATA - SUSITNA RIVER
AT GOLD CREEK

NOTE: Dash indicates data not available

	Date Sampled	
	08/08/80	10/14/80
Field Parameters (1)		
Dissolved Oxygen	8.6	14.0
Percent Saturation	81	100
pH, pH Units	7.8	7.8
Conductivity, umhos/cm @ 25°C	169	167
Temperature, °C	11.7	0.0
Free Carbon Dioxide (2)	2.1	3.2
Alkalinity, as $CaCO_3$	55	74
Settleable Solids, ml/l	<0.1	≪0.1
Discharge c.f.s.	22,900	7,200
Laboratory Parameters (1)(3)		
Ammonia Nitrogen	----	0.32
Organic Nitrogen	----	0.34
Kjeldahl Nitrogen	----	0.66
Nitrate Nitrogen	0.18	<0.10
Nitrite Nitrogen	----	<0.01
Total Nitrogen	----	0.66
Ortho-Phosphate	<0.02	<0.01
Total Phosphorus	<0.02	<0.01
Alkalinity, as $CaCO_3$	----	57
Chemical Oxygen Demand	14	8

TABLE 3.2 - CONTINUED

	Date Sampled	
	08/08/80	10/14/80
Laboratory Parameters (1)(3) (Cont'd)		
Chloride	14	16
Conductivity, umhos/cm @ 25°C	----	165
True Color, Color Units	45	10
Hardness, as $CaCO_3$ (4)	62	74
Sulfate	12	10
Total Dissolved Solids	74	100
Total Suspended Solids	175	7.7
Turbidity, NTU	58	0.9
Uranium	<0.05	----
Radioactivity, Gross Alpha, pCi/l	2.6±0.4	----
Total Organic Carbon	----	27
Total Inorganic Carbon	----	----
Organic Chemicals		
Endrin	<0.0001	----
Lindane	<0.001	----
Methoxychlor	<0.05	----
Toxaphene	<0.001	----
2, 4-D	<0.05	----
2, 4, 5-TP Silvex	<0.005	----
ICAP Scan		
Ag, Silver	<0.05	<0.05
Al, Aluminum	0.70	0.18
As, Arsenic	<0.1	<0.1
Au, Gold	<0.05	<0.05
B, Boron	<0.05	<0.05

TABLE 3.2 - CONTINUED

	Date Sampled	
	08/08/80	10/14/80
Laboratory Parameters (1)(3) (Cont'd)		
Ba, Barium	0.08	<0.05
Bi, Bismuth	<0.05	<0.05
Ca, Calcium	15	23
Cd, Cadmium	<0.01	<0.01
Co, Cobalt	<0.05	<0.05
Cr, Chromium	<0.05	<0.05
Cu, Copper	<0.05	<0.05
Fe, Iron	2.30	0.35
Hg, Mercury	<0.1	<0.1
K, Potassium	1.8	----
Mg, Magnesium	2.7	3.7
Mn, Manganese	0.05	<0.05
Mo, Molybdenum	<0.05	<0.05
Na, Sodium	3.3	8.5
Ni, Nickel	<0.05	<0.05
Pb, Lead	<0.05	<0.05
Pt, Platinum	<0.05	<0.05
Sb, Antimony	<0.10	<0.10
Se, Selenium	<0.1	<0.1
Si, Silicon	4.6	4.2
Sn, Tin	<0.1	<0.1
Sr, Strontium	<0.05	0.11
Ti, Titanium	0.14	<0.05

TABLE 3.2 - CONTINUED

	Date Sampled	
	08/08/80	10/14/80
Laboratory Parameters (1)(3) (Cont'd)		
W, Tungsten	<1.0	<1.0
V, Vanadium	<0.05	<0.05
Zn, Zinc	<0.05	<0.05
Zr, Zirconium	<0.05	<0.05

(1) Table values are mg/l unless noted otherwise.

(2) All values for free CO_2 determined from nomograph on p. 297 of Standard Method, 14th edition.

(3) Samples for all parameters except chemical oxygen demand, dissolved and suspended solids, and turbidity were filtered.

(4) Hardness calculated by R&M personnel.

TABLE 3.3
R&M CONSULTANTS, INC.
SUSPENDED SEDIMENT ANALYSIS
SUSITNA RIVER AT VEE CANYON

Date: September 5, 1980 REW: 00+05
Water Temperature: 5.3°C LEW: 03+85
Instantaneous Discharge: 5,040 c.f.s.

Sample No.	Time	Station	Sediment (mg/l.)
1	5:15 pm	00+15	33
2		00+35	36
3		00+55	35
4		00+75	54
5		00+95	63
6		01+15	36
7		01+35	68
8		01+55	62
9		01+75	74
10		01+95	68
11		02+15	73
12		02+35	72
13		02+55	78
14		02+75	84
15		02+95	67
16		03+15	82
17		03+35	53
18	6:45 pm	03+55	56
			Average 61

Particle Distribution
% by Size

Size (Microns)	Sample: 4	Sample: 9	Sample: 14	Average
5	99.57	98.52	97.21	98.43
5-10	0.22	0.97	1.42	0.87
10-20	0.12	0.25	0.66	0.34
20-50	0.03	0.04	0.38	0.15
50	0.06	0.22	0.33	0.20

Suspended Sediment Discharge (Tons/Day): 827

TABLE 3.4
R&M CONSULTANTS, INC.
SUSPENDED SEDIMENT ANALYSIS
SUSITNA RIVER AT VEE CANYON

Date: September 17, 1980 REW: 00+00
Water Temperature: 5.9°C LEW: 04+00
Instantaneous Discharge: 14,200 c.f.s.

Sample No.	Time	Station	Sediment (mg/l.)
1	5:30 pm	00+30	167
2		00+50	170
3		00+70	174
4		00+90	185
5		01+10	196
6		01+30	425
7		01+50	325
8		01+70	331
9		01+90	218
10		02+10	201
11		02+30	513
12		02+50	169
13		02+70	436
14		02+90	418
15		03+10	591
16		03+30	322
17		03+50	342
18		03+70	163
19	6:35 pm	03+85	300
			Average 297

Particle Distribution
% by Size

Size (Microns)	Sample: 3	Sample: 8	Sample: 13	Average
5	98.53	98.83	99.19	98.85
5-10	0.96	0.44	0.30	0.57
10-20	0.30	0.23	0.10	0.21
20-50	0.15	0.10	0.07	0.11
50	0.06	0.40	0.34	0.27

Suspended Sediment Discharge (Tons/Day): 11,345

TABLE 3.5
R&M CONSULTANTS, INC.
SUSPENDED SEDIMENT ANALYSIS
SUSITNA RIVER AT VEE CANYON

Date: October 18, 1980 REW: 00+00
Water Temperature: 0.0°C LEW: 03+78
Instantaneous Discharge: 5,000 c.f.s.

Sample No.	Time	Station	Sediment (mg/l.)
1	12:30 pm	00+07	6.0
2		00+36	6.6
3		00+70	4.8
4		01+05	4.2
5		01+38	4.6
6		01+74	6.3
7		02+07	4.4
8		02+38	5.0
9		02+73	7.7
10		03+08	7.4
11	1:15 pm	03+39	5.8
			Average 5.7

Particle Distribution
% by Size

Size (Microns)	Sample: 3	Sample: 6	Sample: 9	Average
5	77.0	82.6	79.5	79.7
5-10	12.7	8.1	15.5	12.1
10-20	5.4	4.5	3.2	4.4
20-50	4.4	4.2	1.2	3.3
50	0.5	0.6	0.6	0.6

Suspended Sediment Discharge (Tons/Day): 77

TABLE 3.6
R&M CONSULTANTS, INC.
SUSPENDED SEDIMENT ANALYSIS
SUSITNA RIVER AT GOLD CREEK

Date: October 16, 1980 REW: 12+01
Water Temperature: 0.0°C LEW: 15+74
Instantaneous Discharge: 7,000 c.f.s.

Sample No.	Time	Station	Sediment (mg/l.)
1	4:22 pm	12+45	8.4
2		12+76	9.0
3		13+11	9.2
4		13+46	7.2
5		13+81	11.0
6		14+16	8.0
7		14+51	7.8
8		14+86	8.0
9	5:30 pm	15+21	1.2
		Average	7.8

Particle Distribution
% by Size

Size (Microns)	Sample: 2	Sample: 5	Sample: 8	Average
5	77.4	78.1	74.1	76.5
5-10	13.2	11.6	13.4	12.7
10-20	5.6	7.4	6.4	6.5
20-50	3.3	2.3	5.7	3.8
50	0.5	0.6	0.4	0.5

Suspended Sediment Discharge (Tons/Day): 147

4 - 1981 WATER QUALITY DATA COLLECTION

4.1 - Description

The 1981 program was expanded to include a more detailed analysis of variances in water quality during flood events as well as additional low-discharge studies.

Samples were obtained at the same locations at Vee Canyon and Gold Creek as in 1980. The collection procedures were modified so that the depth integrated sampler was substituted for the Van Dorn grab sampler. Late in May of 1981, following breakup, a comparative analysis was conducted at Gold Creek between the grab sampling technique and a sample obtained through the water column using the depth integrated sampler. The results from the grab sample appear in Table 4.3 under May 27, 1981 (A), and the data from the depth integrated analysis are listed under May 27, 1981 (B). These data and U.S.G.S. data also collected on May 27, 1982, are compared in Section 4.4. Although no significant differences in most data points were immediately evident it was nevertheless felt that the depth integrated method could provide a more representative sample. Therefore this technique was incorporated into the field procedures for all subsequent sampling. During freezeup and winter sampling the depth integrated sampler could not be used due to frazil ice blocking the inlet port. Logistics involved in cutting a hole through the ice to accommodate the sampler were also not feasible. Consequently during these events the grab sample method was employed.

The standardization procedure for the YSI Model 51B dissolved oxygen meter has been modified somewhat. An air calibration method has been added to verify the calibration setting from the saturated oxygen method. Using the latter method only introduces the possibility of inaccurate calibration due to misreading of the barometer or taking a reading from a barometer out of calibration. See the revised procedures manual in Attachment B for further details.

Three of the five samples for quantitative analysis are now filtered in the field through a glass fiber filter and a 0.45 micrometer (um) membrane filter.

Procedures for measurement of the field parameters have undergone further modification, after recommendations were made by Dana Schmidt (TES). Dissolved oxygen and temperature measurements are taken directly in the river at the sampling locations. Conductivity and pH are measured in each sample, instead of the composite, and a mean value is reported. Alkalinity is determined from a well mixed composite of the three samples.

Due to time restraints, from sampling both Vee Canyon and Gold Creek on the same day, titration of the alkalinity sample is performed at Watana Camp. However, the sample is kept on ice until titration begins. The pH sensor failures prevented the measurement of alkalinity during several sampling periods at both sites. When this problem occurred in August 1981, the alkalinity was determined in the laboratory and it should be noted that there was a significant delay between obtaining the sample and alkalinity measurement.

Uranium measurements have always fallen below the detection limit and random samples of gross alpha radiation show levels below 15 pCi/l, the minimum standard for drinking water.

Organic chemicals were measured twice this season, once during a hydrograph peak in July and again at a low discharge in September, at both sites. Concentrations of PCB's, chlorinated hydrocarbons and phenoxy acids (pesticides and herbicides) fall below the minimum detection limits for all samples collected.

Total organic carbon and total inorganic carbon have been determined for all sampling events. This parameter is measured out of state which means a lag period in reported data.

Sampling was conducted on the following dates and corresponding events.

Vee Canyon	Gold Creek	Event
1/13/81	1/14/81	Winter, under ice cover.
5/20/81	5/27/81	Breakup, majority of river is ice free.
6/18/81	6/17/81	Early summer, glacier runoff and snowmelt.
-	6/30/81	Heavy rainstorm, peak of hydrograph.
6/30/81	7/1/81	After heavy rains, descending limb of hydrograph.
8/2/81	-	Heavy rain, rising limb of hydrograph.
8/3/81	8/2/81	Heavy rain, peak of hydrograph.
8/3/81	8/3/81	After heavy rains, descending limb of hydrograph.
9/15/81	9/14/81	Late summer, low discharge.
10/7/81	10/8/81	Pre-freezeup.

Results from these analyses are presented for Vee Canyon in Tables 4.1 and 4.2, and Gold Creek in Tables 4.3 and 4.4.

4.2 - Suspended Sediment Analysis

An extensive suspended sediment study at both Vee Canyon and Gold Creek was conducted during 1981. The results of these analyses are presented in Tables 4.5 to 4.12 for Vee Canyon, and Tables 4.13 to 4.20 for Gold Creek. At least ten suspended sediment samples were collected at each site, per event, with the depth integrated sampler. The winter samples were collected with a handheld, depth integrated sampler and at only three points across the channel. The results of this study should accurately define the particle size distribution across the channel as well as provide an estimate for suspended sediment discharge.

It should be noted that the U.S. Geological Survey reports particle distribution as a percentage by weight and R&M Consultants is reporting percent by size. Therefore, these values are not directly comparable.

4.3 - Bedload Sampling

During the summer of 1981, R&M Consultants, in cooperation with the U.S. Geological Survey, collected bedload samples on the Susitna River at Sunshine and Gold Creek, on the Talkeetna River near Talkeetna, and on the Chulitna River at the Chulitna gauging station (near Talkeetna). The purpose of the investigation was to define a value for bedload transport as related to discharge. Each site was sampled three times, covering a broad range of river discharges. The U.S.G.S. is responsible for sample analysis and data reduction. Provisional data is presented in Table 4.21.

4.4 - Comparison of Sampling Techniques

A comparison was made by L.A. Peterson & Associates of the laboratory analyses of water samples collected by R&M at Gold Creek on May 27, 1981, using grab and depth-integrated sampling techniques. The following conclusions were made concerning the comparison of grab and depth-integrated sampling at Gold Creek.

1. Generally, there was no major difference in the water quality characteristics of the two samples. The magnitude of variation for those parameters that displayed a difference was much less than an order-of-magnitude.

2. The different levels displayed by some parameters were too minor to be able to draw a definite conclusion as to the reason(s) for their respective differences. However, it is likely that TSS and turbidity varied as the result of the two sampling techniques. Chloride data showed minor differences, but still indicated very low values.

3. Any of the following possibilities could account for the different values noted in some paramters:

   A. Sampling techniques caused the difference,

   B. Sample times were different by 2¼ hours and the water quality may have actually changed slightly during this period, and,

   C. Laboratory error.

A comparison was also made between depth-integrated samples collected by R&M and by U.S.G.S. Significant differences in values were apparent for TOC and nitrogen. TOC data collected by R&M are believed to be in error for this sample. Discussion with U.S.G.S. personnel indicated that the variances in nitrogen values may have been due to differences in the analytical procedures used in the laboratories. Both values were within the range of observed values for summer.

TABLE 4.1

R&M CONSULTANTS, INC.

1981 WATER QUALITY DATA - SUSITNA RIVER

AT VEE CANYON

NOTE: Dash indicates data not available

	Date			
	1/13/81	5/20/81	6/18/81	6/30/81
Field Parameters (1)				
Dissolved Oxygen	10.7	10.4	----	11.6
Percent Saturation	84	83	----	99
pH, pH Units	7.2	6.6	7.8	7.7
Conductivity, umhos/cm @ 25°C	242	100	120	124
Temperature, °C	0.1	6.5	11.9	7.9
Free Carbon Dioxide (2)	20.0	----	3.2	2.2
Alkalinity, as $CaCO_3$	99	----	79	41
Settleable Solids, ml/l	≪0.1	≪0.1	≪0.1	<0.1
Discharge c.f.s.	1,800	9,810	11,600	13,700
Laboratory Parameters (1)(3)				
Ammonia Nitrogen	<0.05	0.13	0.12	<0.05
Organic Nitrogen	0.85	0.34	0.63	0.39
Kjeldahl Nitrogen	0.85	0.47	0.75	0.39
Nitrate Nitrogen	<0.1	<0.1	<0.10	<0.10
Nitrite Nitrogen	<0.01	<0.01	<0.01	<0.01
Total Nitrogen	0.85	0.47	0.75	0.39
Ortho-Phosphate	<0.01	<0.01	<0.01	0.49
Total Phosphorus	0.07	<0.05	<0.05	0.49
Alkalinity, as $CaCO_3$	----	----	----	----
Chemical Oxygen Demand	12	8	8	16

TABLE 4.1 - CONTINUED

	Date			
	1/13/81	5/20/81	6/18/81	6/30/81
Laboratory Parameters (1)(3) (Cont'd)				
Chloride	18	4.5	5.0	5.0
Conductivity, umhos/cm @ 25°C	----	----	----	----
True Color, Color Units	10	15	5	20
Hardness, as $CaCO_3$ (4)	121	40	49	59
Sulfate	16	4	8	7
Total Dissolved Solids	149	100	170	91
Total Suspended Solids	0.6	93	340	130
Turbidity, NTU	0.35	25	66	29
Uranium	<0.05	----	----	----
Radioactivity, Gross Alpha, pCi/l	10.3±0.6	----	----	----
Total Organic Carbon	23	40	11	23
Total Inorganic Carbon	106	46	46	59
Organic Chemicals				
Endrin	<0.0002	----	----	<0.0002
Lindane	<0.004	----	----	<0.004
Methoxychlor	<0.1	----	----	<0.1
Toxaphene	<0.005	----	----	<0.005
2, 4-D	<0.1	----	----	<0.1
2, 4, 5-TP Silvex	<0.01	----	----	<0.01
ICAP Scan				
Ag, Silver	<0.05	<0.05	<0.05	<0.05
Al, Aluminum	<0.05	<0.05	<0.05	<0.05
As, Arsenic	<0.10	<0.10	<0.10	<0.10
Au, Gold	<0.05	<0.05	<0.05	<0.05
B, Boron	<0.05	<0.05	<0.05	<0.05

TABLE 4.1 - CONTINUED

	Date			
	1/13/81	5/20/81	6/18/81	6/30/81
Laboratory Parameters (1)(3) (Cont'd)				
Ba, Barium	<0.05	<0.05	0.07	0.11
Bi, Bismuth	<0.05	<0.05	<0.05	0.19
Ca, Calcium	36	13	16	19
Cd, Cadmium	<0.01	<0.01	<0.01	<0.01
Co, Cobalt	<0.05	<0.05	<0.05	<0.05
Cr, Chromium	<0.05	<0.05	<0.05	<0.05
Cu, Copper	<0.05	<0.05	<0.05	<0.05
Fe, Iron	<0.05	0.08	0.05	0.07
Hg, Mercury	<0.10	<0.10	<0.10	<0.10
K, Potassium	2	1.6	2.0	2.1
Mg, Magnesium	7.6	1.7	2.0	2.8
Mn, Manganese	<0.05	<0.05	<0.05	<0.05
Mo, Molybdenum	<0.05	<0.05	<0.05	<0.05
Na, Sodium	6.6	2.0	3.3	4.6
Ni, Nickel	<0.05	<0.05	<0.05	<0.05
Pb, Lead	<0.05	<0.05	<0.05	<0.05
Pt, Platinum	<0.05	<0.05	<0.05	<0.05
Sb, Antimony	<0.10	<0.10	<0.10	<0.10
Se, Selenium	<0.10	<0.10	<0.10	<0.10
Si, Silicon	5.0	1.7	2.0	2.6
Sn, Tin	<0.10	<0.10	<0.10	<0.10
Sr, Strontium	0.13	<0.05	0.06	0.07
Ti, Titanium	<0.05	<0.05	<0.05	<0.05

TABLE 4.1 - CONTINUED

	Date			
	1/13/81	5/20/81	6/18/81	6/30/81
Laboratory Parameters (1)(3) (Cont'd)				
W, Tungsten	0.4	<1.0	<1.0	<1.0
V, Vanadium	<0.05	<0.05	<0.05	<0.05
Zn, Zinc	<0.05	<0.05	0.07	<0.05
Zr, Zirconium	<0.05	<0.05	<0.05	<0.05

(1) Table values are mg/l unless noted otherwise.

(2) All values for free CO_2 determined from nomograph on p. 297 of Standard Method, 14th edition.

(3) Samples for all parameters except chemical oxygen demand, dissolved and suspended solids, and turbidity were filtered.

(4) Hardness calculated by R&M personnel.

TABLE 4.2

R&M CONSULTANTS, INC.

1981 WATER QUALITY DATA - SUSITNA RIVER

AT VEE CANYON

NOTE: Dash indicates data not available.

	Date Sampled				
	8/2/81	8/3/81	8/3/81	9/15/81	10/7/81
Field Parameters (1)					
Dissolved Oxygen	11.8	12.6	12.3	12.6	13.2
Percent Saturation	104	107	107	110	102
pH, pH Units	7.1	7.0	7.2	7.7	7.5
Conductivity, umhos/cm @ 25°C	108	106	103	162	130
Temperature, °C	8.3	7.5	9.1	5.9	0.0
Free Carbon Dioxide (2)	----	----	----	3.5	5.5
Alkalinity, as $CaCO_3$	----	----	----	62	57
Settleable Solids, ml/l	1.0	0.9	0.7	≪0.1	≪0.1
Discharge c.f.s.	26,375	29,420	28,700	7,790	<4,500
Laboratory Parameters (1)(3)					
Ammonia Nitrogen	0.27	0.09	0.11	<0.05	0.09
Organic Nitrogen	0.52	0.48	0.63	0.45	0.08
Kjeldahl Nitrogen	0.79	0.57	0.74	0.45	0.17
Nitrate Nitrogen	0.13	<0.10	<0.10	<0.10	<0.10
Nitrite Nitrogen	<0.01	<0.01	<0.01	<0.01	<0.01
Total Nitrogen	0.92	0.57	0.74	0.45	0.17
Ortho-Phosphate	<0.01	<0.01	<0.01	<0.01	0.02
Total Phosphorus	<0.05	0.08	<0.05	<0.05	<0.05
Alkalinity, as $CaCO_3$	44	46	40	60	----

TABLE 4.2 - CONTINUED

	Date Sampled				
	8/2/81	8/3/81	8/3/81	9/15/81	10/7/81
Laboratory Parameters (1)(3) (continued)					
Chemical Oxygen Demand	27	39	20	8	8
Chloride	<1.0	<1.0	<1.0	6	16
Conductivity, umhos/cm @ 25°C	----	----	----	----	----
True Color, Color Units	150	150	175	50	30
Hardness, as $CaCO_3$ (4)	51	51	51	72	78
Sulfate	4	2	2	8	11
Total Dissolved Solids	90	105	91	120	143
Total Suspended Solids	1150	870	745	40	14
Turbidity, NTU	108	120	112	8.7	2.5
Uranium	<0.05	<0.05	<0.05	<0.05	<0.05
Radioactivity, Gross Alpha, pCi/l	----	----	----	5.0±2.5	----
Total Organic Carbon	15	20	13	----	----
Total Inorganic Carbon	54	56	49	60	----
Organic Chemicals					
Endrin	----	----	----	<0.0002	----
Lindane	----	----	----	<0.004	----
Methoxychlor	----	----	----	<0.1	----
Toxaphene	----	----	----	<0.005	----
2, 4-D	----	----	----	<0.1	----
2, 4, 5-TP Silvex	----	----	----	<0.01	----
ICAP Scan					
Ag, Silver	<0.05	<0.05	<0.05	<0.05	<0.05
Al, Aluminum	<0.05	<0.05	<0.05	<0.05	<0.05
As, Arsenic	<0.10	<0.10	<0.10	<0.10	<0.10
Au, Gold	<0.05	<0.05	<0.05	<0.05	<0.05
B, Boron	<0.05	<0.05	<0.05	<0.05	<0.05

TABLE 4.2 - CONTINUED

Laboratory Parameters (1)(3) (continued)	Date Sampled 8/2/81	8/3/81	8/3/81	9/15/81	10/7/81
Ba, Barium	0.12	0.10	0.10	<0.05	<0.05
Bi, Bismuth	<0.05	<0.05	<0.05	<0.05	<0.05
Ca, Calcium	17	17	17	23	25
Cd, Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01
Co, Cobalt	<0.05	<0.05	<0.05	<0.05	<0.05
Cr, Chromium	<0.05	<0.05	<0.05	<0.05	<0.05
Cu, Copper	<0.05	<0.05	<0.05	<0.05	<0.05
Fe, Iron	0.13	0.10	0.08	<0.05	<0.05
Hg, Mercury	<0.10	<0.10	<0.10	<0.10	<0.10
K, Potassium	1.9	1.9	1.7	2	9.0
Mg, Magnesium	2.1	2.0	2.1	3.4	3.8
Mn, Manganese	<0.05	<0.05	<0.05	<0.05	<0.05
Mo, Molybdenum	<0.05	<0.05	<0.05	<0.05	<0.05
Na, Sodium	2.7	2.5	2.6	5.1	6.3
Ni, Nickel	<0.05	<0.05	<0.05	<0.05	<0.05
Pb, Lead	<0.05	<0.05	<0.05	<0.05	<0.05
Pt, Platinum	<0.05	<0.05	<0.05	<0.05	<0.05
Sb, Antimony	<0.10	<0.10	<0.10	<0.10	<0.10
Se, Selenium	<0.10	<0.10	<0.10	<0.10	<0.10
Si, Silicon	2.2	2.2	2.4	3.2	3.7
Sn, Tin	<0.10	<0.10	<0.10	<0.10	<0.10
Sr, Strontium	0.06	<0.05	0.06	0.08	0.06
Ti, Titanium	<0.05	<0.05	<0.05	<0.05	<0.05

TABLE 4.2 - CONTINUED

	Date Sampled				
	8/2/81	8/3/81	8/3/81	9/15/81	10/7/81
Laboratory Parameters (1)(3) (continued)					
W, Tungsten	<1.0	<1.0	<1.0	<1.0	<1.0
V, Vanadium	<0.05	<0.05	<0.05	<0.05	<0.05
Zn, Zinc	<0.05	<0.05	<0.05	<0.05	<0.05
Zr, Zirconium	<0.05	<0.05	<0.05	<0.05	<0.05

(1) Table values are mg/l unless noted otherwise.

(2) All values for free CO_2 determined from nomograph on p. 297 of Standard Method, 14th edition.

(3) Samples for all parameters except chemical oxygen demand, dissolved and suspended solids, and turbidity were filtered.

(4) Hardness calculated by R&M personnel.

TABLE 4.3

R&M CONSULTANTS, INC.

1981 WATER QUALITY DATA - SUSITNA RIVER

AT GOLD CREEK

NOTE: Dash indicates data not available.

	Date			
	1/14/81	5/27/81 (A)	5/27/81 (B)	6/17/81
Field Parameters (1)				
Dissolved Oxygen	13.3	11.2	11.5	----
Percent Saturation	101	102	101	----
pH, pH Units	7.1	6.7	6.4	7.7
Conductivity, umhos/cm @ 25°C	249	105	106	126
Temperature, °C	0.3	10.5	10.3	12.8
Free Carbon Dioxide (2)	20.0	----	----	3.0
Alkalinity, as $CaCO_3$	74	----	----	64
Settleable Solids, ml/l	≪0.1	≪0.10	<0.10	≪0.10
Discharge c.f.s.	----	14,400	14,400	17,700
Laboratory Parameters (1)(3)				
Ammonia Nitrogen	<0.05	<0.05	0.08	0.09
Organic Nitrogen	0.81	0.34	0.27	0.39
Kjeldahl Nitrogen	0.81	0.34	0.35	0.48
Nitrate Nitrogen	0.18	<0.10	<0.10	<0.10
Nitrite Nitrogen	<0.01	<0.01	<0.01	<0.01
Total Nitrogen	0.99	0.34	0.35	0.48
Ortho-Phosphate	<0.01	<0.01	<0.01	<0.01
Total Phosphorus	<0.01	0.08	<0.05	<0.05
Alkalinity, as $CaCO_3$	----	----	----	----

TABLE 4.3 - CONTINUED

	Date			
	1/14/81	5/27/81 (A)	5/27/81 (B)	6/17/81
Laboratory Parameters (1)(3) (Cont'd)				
Chemical Oxygen Demand	16	8	12	12
Chloride	29	10	6	5
Conductivity, umhos/cm @ 25°C	----	----	----	----
True Color, Color Units	10	15	10	5
Hardness, as $CaCO_3$ (4)	121	43	43	52
Sulfate	16	6	5	5
Total Dissolved Solids	188	90	87	98
Total Suspended Solids	<1.0	56	49	120
Turbidity, NTU	0.30	15	19	31
Uranium	<0.05	----	----	----
Radioactivity, Gross Alpha, pCi/l	2.0±0.4	----	----	----
Total Organic Carbon	39	15	25	41
Total Inorganic Carbon	90	41	44	45
Organic Chemicals				
Endrin	<0.0002	----	----	----
Lindane	<0.004	----	----	----
Methoxychlor	<0.1	----	----	----
Toxaphene	<0.005	----	----	----
2, 4-D	<0.1	----	----	----
2, 4, 5-TP Silvex	<0.01	----	----	----
ICAP Scan				
Ag, Silver	<0.05	<0.05	<0.05	<0.05
Al, Aluminum	<0.05	<0.05	<0.05	----
As, Arsenic	<0.1	<0.10	<0.10	<0.10
Au, Gold	<0.05	<0.05	<0.05	<0.05
B, Boron	<0.05	<0.05	<0.05	<0.05

TABLE 4.3 - CONTINUED

	Date			
	1/14/81	5/27/81 (A)	5/27/81 (B)	6/17/81
Laboratory Parameters (1)(3) (Cont'd)				
Ba, Barium	0.05	0.07	0.05	0.06
Bi, Bismuth	0.07	<0.05	<0.05	<0.05
Ca, Calcium	32	14	14	15
Cd, Cadmium	<0.01	<0.01	<0.01	<0.01
Co, Cobalt	<0.05	<0.05	<0.05	<0.05
Cr, Chromium	<0.05	<0.05	<0.05	<0.05
Cu, Copper	<0.05	<0.05	<0.05	<0.05
Fe, Iron	<0.05	0.07	<0.05	2.0
Hg, Mercury	<0.1	<0.10	<0.10	<0.10
K, Potassium	2.0	1.9	1.8	2.0
Mg, Magnesium	10	2.0	2.0	2.6
Mn, Manganese	<0.05	<0.05	<0.05	<0.05
Mo, Molybdenum	<0.05	<0.05	<0.05	<0.05
Na, Sodium	13	4.1	3.9	3.8
Ni, Nickel	<0.05	<0.05	<0.05	<0.05
Pb, Lead	<0.05	<0.05	<0.05	<0.05
Pt, Platinum	<0.05	<0.05	<0.05	<0.05
Sb, Antimony	<0.10	<0.10	<0.10	<0.10
Se, Selenium	<0.10	<0.10	<0.10	<0.10
Si, Silicon	5.0	2.5	2.4	5.9
Sn, Tin	<0.10	<0.10	<0.10	<0.10
Sr, Strontium	0.19	0.07	0.06	0.06
Ti, Titanium	<0.05	<0.05	<0.05	0.11

TABLE 4.3 - CONTINUED

	Date			
	1/14/81	5/27/81 (A)	5/27/81 (B)	6/17/81
Laboratory Parameters (1)(3) (Cont'd)				
W, Tungsten	<1.0	<1.0	<1.0	<1.0
V, Vanadium	<0.05	<0.05	<0.05	<0.05
Zn, Zinc	<0.05	<0.05	<0.05	<0.05
Zr, Zirconium	<0.05	<0.05	<0.05	<0.05

(1) Table values are mg/l unless noted otherwise.

(2) All values for free CO_2 determined from nomograph on p. 297 of Standard Method, 14th edition.

(3) Samples for all parameters except chemical oxygen demand, dissolved and suspended solids, and turbidity were filtered.

(4) Hardness calculated by R&M personnel.

(A) Grab sampling method.

(B) Depth - integrated sampling method.

TABLE 4.4

R&M CONSULTANTS, INC.

1981 WATER QUALITY DATA - SUSITNA RIVER

AT GOLD CREEK

NOTE: Dash indicates data not available.

	Date Sampled					
	6/30/81	7/1/81	8/2/81	8/3/81	9/14/81	10/8/81
Field Parameters (1)						
Dissolved Oxygen	13.4	13.4	12.5	13.2	12.8	14.1
Percent Saturation	114	116	113	115	107	101
pH, pH Units	7.0	7.3	7.5	7.3	7.4	7.2
Conductivity, umhos/cm @ 25°C	98	109	75	91	144	162
Temperature, °C	7.3	8.6	9.3	9.2	6.8	0.8
Free Carbon Dioxide (2)	8.6	3.3	----	----	4.8	9.0
Alkalinity, as $CaCO_3$	33	25	----	----	45	46
Settleable Solids, ml/l	0.1	<0.1	<0.1	0.60	≪0.1	≪0.1
Discharge c.f.s.	24,550	21,700	51,100	46,000	12,600	6,300
Laboratory Parameters (1)(3)						
Ammonia Nitrogen	0.07	0.08	<0.05	<0.05	<0.05	0.52
Organic Nitrogen	0.48	0.39	0.63	0.67	0.74	0.47
Kjeldahl Nitrogen	0.55	0.47	0.63	0.67	0.74	0.99
Nitrate Nitrogen	0.22	0.17	0.32	0.18	<0.10	<0.10
Nitrite Nitrogen	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Nitrogen	0.77	0.64	0.95	0.85	0.74	0.99
Ortho-Phosphate	<0.01	0.10	<0.01	<0.01	<0.01	0.02
Total Phosphorus	0.12	0.24	0.07	<0.05	<0.05	<0.05
Alkalinity, as $CaCO_3$	----	----	28	36	----	----

TABLE 4.4 - CONTINUED

	Date Sampled					
	6/30/81	7/1/81	8/2/81	8/3/81	9/14/81	10/8/81
Laboratory Parameters (1)(3) (continued)						
Chemical Oxygen Demand	24	12	23	24	18	2
Chloride	4	5	<1	<1	8	14
Conductivity, umhos/cm @ 25°C	----	----	----	----	----	----
True Color, Color Units	30	20	90	110	50	40
Hardness, as $CaCO_3$ (4)	40	47	31	43	62	68
Sulfate	5.5	5.2	1.5	2.4	6.2	9.5
Total Dissolved Solids	68	79	63	96	99	118
Total Suspended Solids	140	68	490	1255	57	7.7
Turbidity, NTU	29	18	64	86	14	1.2
Uranium	----	----	<0.05	<0.05	<0.05	<0.05
Radioactivity, Gross Alpha, pCi/l	----	----	----	----	5.5±2.5	----
Total Organic Carbon	20	10	16	14	33	34
Total Inorganic Carbon	41	44	34	44	61	----
Organic Chemicals						
Endrin	----	<0.0002	----	----	<0.0002	----
Lindane	----	<0.004	----	----	<0.004	----
Methoxychlor	----	<0.1	----	----	<0.1	----
Toxaphene	----	<0.005	----	----	<0.005	----
2, 4-D	----	<0.1	----	----	<0.1	----
2, 4, 5-TP Silvex	----	<0.01	----	----	<0.01	----
ICAP Scan						
Ag, Silver	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Al, Aluminum	<0.05	<0.05	<0.05	0.08	<0.05	<0.05
As, Arsenic	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Au, Gold	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
B, Boron	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

TABLE 4.4 - CONTINUED

Laboratory Parameters (1)(3) (continued)	Date Sampled 6/30/81	7/1/81	8/2/81	8/3/81	9/14/81	10/8/81
Ba, Barium	0.09	0.10	0.09	0.11	0.11	<0.05
Bi, Bismuth	<0.05	<0.05	<0.05	0.19	<0.05	<0.05
Ca, Calcium	13	14	10	14	20	22
Cd, Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Co, Cobalt	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cr, Chromium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cu, Copper	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fe, Iron	0.07	0.07	0.10	0.07	<0.05	<0.05
Hg, Mercury	<0.01	<0.10	<0.10	<0.10	<0.10	<0.10
K, Potassium	1.4	1.5	1.3	1.9	2.0	2.4
Mg, Magnesium	1.8	2.8	1.4	1.9	2.9	3.2
Mn, Manganese	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mo, Molybdenum	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Na, Sodium	3.8	4.3	2.8	3.4	6.2	7.4
Ni, Nickel	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Pb, Lead	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Pt, Platinum	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sb, Antimony	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Se, Selenium	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Si, Silicon	2.6	2.8	2.6	2.7	3.4	3.9
Sn, Tin	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sr, Strontium	0.06	<0.06	<0.05	0.06	0.09	0.10
Ti, Titanium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

TABLE 4.4 - CONTINUED

	Date Sampled					
	6/30/81	7/1/81	8/2/81	8/3/81	9/14/81	10/8/81
Laboratory Parameters (1)(3) (continued)						
W, Tungsten	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
V, Vanadium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Zn, Zinc	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Zr, Zirconium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

(1) Table values are mg/l unless noted otherwise.

(2) All values for free CO_2 determined from nomograph on p. 297 of Standard Method, 14th edition.

(3) Samples for all parameters except chemical oxygen demand, dissolved and suspended solids, and turbidity were filtered.

(4) Hardness calculated by R&M personnel.

TABLE 4.5

R&M CONSULTANTS, INC.

SUSPENDED SEDIMENT ANALYSIS

SUSITNA RIVER AT VEE CANYON

Date: January 13, 1981

Water Temperature: 0.1°C

Instantaneous Discharge: 5000 c.f.s.

Sample No.	Time	Station	Sediment (mg/l.)
10	2:20 p.m.	Left Bank	0.1
11	2:30 p.m.	Center	1.0
12	2:35 p.m.	Right Bank	1.7
		Average	0.93

Particle Distribution
% by Size

Size (Microns)	Sample: 11	Sample:	Sample:	Average
< 10	98.7			98.7
10-20	0.9			0.9
25-50	0.3			0.3
50-100	0.1			0.1
>100	0.0			0.0

Suspended Sediment Discharge (Tons/Day): 12

TABLE 4.6
R&M CONSULTANTS, INC.
SUSPENDED SEDIMENT ANALYSIS
SUSITNA RIVER AT VEE CANYON

Date: May 20, 1981 REW: 00+05
Water Temperature: 6.5°C LEW: 04+00
Instantaneous Discharge: 9810 c.f.s.

Sample No.	Time	Station	Sediment (mg/l.)
1	4:34 p.m.	00+50	150
2		00+75	130
3		01+00	120
4		01+25	120
5		01+50	140
6		01+75	120
7		02+00	130
8		02+25	130
9		02+50	120
10		02+75	140
11		03+00	140
12		03+25	130
13		03+50	150
14	5:25 p.m.	03+75	130
			Average 132

Particle Distribution
% by Size

Size (Microns)	Sample: 4	Sample: 8	Sample: 11	Average
< 10	97.42	97.77	97.78	97.66
10-20	1.74	1.69	1.54	1.66
20-50	0.72	0.46	0.47	0.55
50-100	0.10	0.08	0.19	0.12
>100	0.02	0.00	0.02	0.10

Suspended Sediment Discharge (Tons/Day): 3,483

TABLE 4.7

R&M CONSULTANTS, INC.

SUSPENDED SEDIMENT ANALYSIS

SUSITNA RIVER AT VEE CANYON

Date: June 18, 1981 REW: 04+25

Water Temperature: 11.9°C LEW: 00+00

Instantaneous Discharge: 11,600 c.f.s.

Sample No.	Time	Station	Sediment (mg/l.)
1	2:30 p.m.	00+50	300
2		00+75	310
3		01+00	310
4		01+25	300
5		01+50	310
6		01+75	300
7		02+00	300
8		02+25	310
9		02+50	340
10		02+75	320
11		03+00	340
12		03+25	320
13		03+50	320
14	3:15 p.m.	03+75	350
		Average	316

Particle Distribution
% by Size

Size (Microns)	Sample: 4	Sample: 8	Sample: 11	Average
<10	97.88	98.49	99.05	98.51
10-20	1.70	1.19	0.62	1.17
20-50	0.39	0.25	0.23	0.29
50-100	0.03	0.06	0.08	0.06
>100	0.00	0.01	0.02	0.01

Suspended Sediment Discharge (Tons/Day): 9,860

TABLE 4.8

R&M CONSULTANTS, INC.

SUSPENDED SEDIMENT ANALYSIS

SUSITNA RIVER AT VEE CANYON

Date: June 30, 1981 REW: 04+00

Water Temperature: 7.9°C LEW: 00+00

Instantaneous Discharge: 13,700 c.f.s.

Sample No.	Time	Station	Sediment (mg/l.)
1	6:00 p.m.	00+15	140
2		00+40	160
3		00+80	195
4		01+20	180
5		01+60	160
6		02+00	200
7		02+40	180
8		02+80	190
9		03+20	160
10	6:30 p.m.	03+60	150
		Average	172

Particle Distribution
% by Size

Size (Microns)	Sample: 3	Sample: 6	Sample: 9	Average
<10	98.26	97.14	97.95	97.78
10-20	1.48	2.55	1.90	1.98
20-50	0.23	0.22	0.11	0.19
50-100	0.01	0.08	0.01	0.03
>100	0.02	0.01	0.03	0.02

Suspended Sediment Discharge (Tons/Day): 6,339

TABLE 4.9

R&M CONSULTANTS, INC.

SUSPENDED SEDIMENT ANALYSIS

SUSITNA RIVER AT VEE CANYON

Date: August 2, 1981 REW: 04+15

Water Temperature: 8.1°C LEW: 00+00

Instantaneous Discharge: 26,375 c.f.s.

Sample No.	Time	Station	Sediment (mg/l.)
1	4:00 p.m.	00+15	600
2		00+40	710
3		00+80	905
4		01+20	850
5		01+60	840
6		02+00	930
7		02+40	960
8		02+80	860
9		03+20	840
10	4:45 p.m.	03+60	830
		Average	839

Particle Distribution
% by Size

Size (Microns)	Sample: 3	Sample: 6	Sample: 9	Average
<10	91.82	93.22	94.90	93.31
10-20	6.02	4.85	4.04	4.97
20-50	1.77	1.62	0.93	1.44
50-100	0.26	0.26	0.07	0.20
>100	0.13	0.05	0.06	0.08

Suspended Sediment Discharge (Tons/Day): 59,526

TABLE 4.10

R&M CONSULTANTS, INC.

SUSPENDED SEDIMENT ANALYSIS

SUSITNA RIVER AT VEE CANYON

Date: August 3, 1981 REW: 04+15

Water Temperature: 8.1°C LEW: 00+00

Instantaneous Discharge: 29,420 c.f.s.

Sample No.	Time	Station	Sediment (mg/l.)
1	8:00 a.m.	00+15	805
2		00+40	860
3		00+80	705
4		01+20	705
5		01+60	770
6		02+00	790
7		02+40	750
8		02+80	760
9		03+20	725
10	8:45 a.m.	03+60	680
		Average	755

Particle Distribution
% by Size

Size (Microns)	Sample: 3	Sample: 6	Sample: 9	Average
<10	95.54	95.59	94.54	95.22
10-20	3.39	3.35	3.64	3.46
20-50	0.92	0.91	1.42	1.08
50-100	0.08	0.08	0.29	0.15
>10	0.07	0.07	0.11	0.08

Suspended Sediment Discharge (Tons/Day): 59,750

TABLE 4.11

R&M CONSULTANTS, INC.

SUSPENDED SEDIMENT ANALYSIS

SUSITNA RIVER AT VEE CANYON

Date: August 3, 1981 REW: 04+15

Water Temperature: 9.8°C LEW: 00+00

Instantaneous Discharge: 28,000 c.f.s.

Sample No.	Time	Station	Sediment (mg/l.)
1	2:30 p.m.	00+15	730
2		00+40	545
3		00+80	590
4		01+20	510
5		01+60	720
6		02+00	670
7		02+40	550
8		02+80	595
9		03+20	570
10	3:15 p.m.	03+60	675
		Average	616

Particle Distribution
% by Size

Size (Microns)	Sample: 3	Sample: 6	Sample: 9	Average
< 10	93.69	95.55	95.32	94.85
10-20	5.02	3.60	3.59	4.07
20-50	1.03	0.69	0.82	0.85
50-100	0.21	0.13	0.21	0.18
>100	0.05	0.03	0.06	0.05

Suspended Sediment Discharge (Tons/Day): 46,400

TABLE 4.12
R&M CONSULTANTS, INC.
SUSPENDED SEDIMENT ANALYSIS
SUSITNA RIVER AT VEE CANYON

Date: September 15, 1981 REW: 04+10
Water Temperature: 5.9°C LEW: 00+00
Instantaneous Discharge: 7790 c.f.s.

Sample No.	Time	Station	Sediment (mg/l.)
1	12:45 p.m.	00+40	54
2		00+80	50
3		01+20	44
4		01+60	43
5		02+00	49
6		02+40	46
7		02+80	62
8		03+20	32
9	1:30 p.m.	03+60	44
			Average 47

Particle Distribution
% by Size

Size (Microns)	Sample: 3	Sample: 6	Sample: 9	Average
<10	97.60	97.53	96.90	97.34
10-20	1.65	2.03	2.61	2.10
20-50	0.47	0.28	0.26	0.34
50-100	0.06	0.04	0.04	0.05
100-250	0.10	0.07	0.12	0.10
250-500	0.12	0.00	0.07	0.08
>500	0.00	0.00	0.00	0.00

Suspended Sediment Discharge (Tons/Day): 985

TABLE 4.13

R&M CONSULTANTS, INC.

SUSPENDED SEDIMENT ANALYSIS

SUSITNA RIVER AT GOLD CREEK

Date: January 14, 1981

Water Temperature: 0.3°C

Instantaneous Discharge: NA

Sample No.	Time	Station	Sediment (mg/l.)
4	1500	Left Bank	4.1
5	1515	Center	10.6
6	1535	Right Bank	10.4
		Average	8.4

Particle Distribution
% by Size

Size (Microns)	Sample: 4	Sample:	Sample:	Average
<10	80.0			80.0
10-20	7.5			7.5
20-50	9.2			9.2
50-100	2.5			2.5
>100	0.8			0.8

Suspended Sediment Discharge (Tons/Day): NA

TABLE 4.14

R&M CONSULTANTS, INC.

SUSPENDED SEDIMENT ANALYSIS

SUSITNA RIVER AT GOLD CREEK

Date: May 27, 1981 REW: 04+34

Water Temperature: 10.5°C LEW: 00+56

Instantaneous Discharge: 14,400 c.f.s.

Sample No.	Time	Station	Sediment (mg/l.)
1	4:11 p.m.	00+90	73
2		01+18	71
3		01+46	64
4		01+74	69
5		02+02	71
6		02+30	75
7		02+58	69
8		02+86	68
9		03+14	64
10		03+42	51
11		03+70	53
12	4:40 p.m.	03+98	49
			Average 65

Particle Distribution
% by Size

Size (Microns)	Sample: 4	Sample: 7	Sample: 10	Average
<10	97.94	97.29	97.94	97.72
10-20	1.62	2.23	1.62	1.82
20-50	0.36	0.46	0.36	0.36
50-100	0.05	0.02	0.05	0.04
>100	0.03	0.00	0.03	0.02

Suspended Sediment Discharge (Tons/Day): 2,520

TABLE 4.15

R&M CONSULTANTS, INC.

SUSPENDED SEDIMENT ANALYSIS

SUSITNA RIVER AT GOLD CREEK

Date: June 17, 1981 REW: 04+13

Water Temperature: 12.8°C LEW: 00+00

Instantaneous Discharge: 17,700 c.f.s.

Sample No.	Time	Station	Sediment (mg/l.)
1	4:30 p.m.	00+50	160
2		00+78	180
3		01+06	150
4		01+34	150
5		01+62	180
6		01+90	160
7		02+18	150
8		02+46	150
9		02+74	140
10		03+02	150
11		03+30	130
12	5:10 p.m.	03+58	110
			Average 151

Particle Distribution
% by Size

Size (Microns)	Sample: 4	Sample: 8	Sample: 11	Average
< 10	98.24	98.32	97.76	98.11
10-20	1.64	1.25	2.15	1.68
20-50	0.06	0.30	0.06	0.14
50-100	0.06	0.10	0.03	0.06
>100	0.00	0.03	0.00	0.01

Suspended Sediment Discharge (Tons/Day): 7,190

TABLE 4.16
R&M CONSULTANTS, INC.
SUSPENDED SEDIMENT ANALYSIS
SUSITNA RIVER AT GOLD CREEK

Date: June 30, 1981 REW: 04+14
Water Temperature: 7.3°C LEW: 00+00
Instantaneous Discharge: 24,550 c.f.s.

Sample No.	Time	Station	Sediment (mg/l.)
1	8:00 a.m.	00+84	230
2		01+26	190
3		01+68	190
4		02+10	210
5		02+52	180
6		02+94	160
7		03+36	150
8		03+78	160
9	10:00 a.m.	04+20	150
		Average	180

Particle Distribution
% by Size

Size (Microns)	Sample: 2	Sample: 5	Sample: 8	Average
<10	97.85	96.28	95.64	96.59
10-20	1.97	3.34	3.85	3.05
20-50	0.16	0.36	0.48	0.33
50-100	0.01	0.01	0.01	0.01
100-250	0.01	0.01	0.01	0.01
250-500	0	0	0.01	0
>500	0	0	0	0

Suspended Sediment Discharge (Tons/Day): 12,060

TABLE 4.17

R&M CONSULTANTS, INC.

SUSPENDED SEDIMENT ANALYSIS

SUSITNA RIVER AT GOLD CREEK

Date: July 1, 1981 REW: 03+90

Water Temperature: 8.6°C LEW: 00+00

Instantaneous Discharge: 21,900 c.f.s

Sample No.	Time	Station	Sediment (mg/l.)
1	1:00 a.m.	00+40	100
2		00+70	100
3		01+00	100
4		01+30	110
5		01+60	100
6		01+90	110
7		02+20	105
8		02+50	110
9		02+80	94
10		03+10	99
11	1:45 a.m.	03+40	74
			Average 100

Particle Distribution
% by Size

Size (Microns)	Sample: 3	Sample: 6	Sample: 9	Average
< 10	97.04	97.73	96.82	97.20
10-20	2.74	1.81	2.87	2.47
20-50	0.19	0.33	0.28	0.27
50-100	0.02	0.04	0.01	0.02
>100	0.01	0.09	0.02	0.04

Suspended Sediment Discharge (Tons/Day): 5,900

TABLE 4.18

R&M CONSULTANTS, INC.

SUSPENDED SEDIMENT ANALYSIS

SUSITNA RIVER AT GOLD CREEK

Date: August 2, 1981 REW: 04+20

Water Temperature: 9.2°C LEW: 00+00

Instantaneous Discharge: 51,000 c.f.s.

Sample No.	Time	Station	Sediment (mg/l.)
1	12:00 noon	01+12	260
2		01+40	250
3		01+68	380
4		01+96	270
5		02+24	300
6		02+80	450
7		03+08	750
8		03+36	640
9		03+92	450
10	1:00 p.m.	04+20	450
			Average 420

Particle Distribution
% by Size

Size (Microns)	Sample: 2	Sample: 5	Sample: 8	Average
< 10	98.39	97.56	97.90	97.95
10-20	1.08	1.63	1.60	1.44
20-50	0.34	0.55	0.29	0.39
50-100	0.05	0.04	0.01	0.03
100-250	0.12	0.15	0.16	0.14
250-500	0.01	0.05	0.03	0.03
>500	0.01	0.02	0.01	0.01

Suspended Sediment Discharge (Tons/Day): 57,600

TABLE 4.19

R&M CONSULTANTS, INC.

SUSPENDED SEDIMENT ANALYSIS

SUSITNA RIVER AT GOLD CREEK

Date: August 3, 1981 REW: 04+20

Water Temperature: 9.2°C LEW: 00+00

Instantaneous Discharge: 46,000 c.f.s.

Sample No.	Time	Station	Sediment (mg/l.)
1	12:40 p.m.	01+12	850
2		01+40	1200
3		01+68	900
4		01+96	850
5		02+24	770
6		02+80	875
7		03+08	780
8		03+36	720
9		03+92	560
10	1:15 p.m.	04+20	600
		Average	810

Particle Distribution
% by Size

Size (Microns)	Sample: 2	Sample: 5	Sample: 8	Average
<10	97.90	97.05	97.59	97.51
10-20	1.52	1.93	0.64	1.36
20-50	0.41	0.61	0.58	0.53
50-100	0.04	0.19	0.04	0.09
100-250	0.12	0.17	0.10	0.13
250-500	0.12	0.04	0.04	0.03
>500	0.00	0.01	0.01	0.01

Suspended Sediment Discharge (Tons/Day): 100,000

TABLE 4.20
R&M CONSULTANTS, INC.
SUSPENDED SEDIMENT ANALYSIS
SUSITNA RIVER AT GOLD CREEK

Date: September 14, 1981 REW: 03+78
Water Temperature: 6.8°C LEW: 00+00
Instantaneous Discharge: 12,600 c.f.s.

Sample No.	Time	Station	Sediment (mg/l.)
1	1:00 p.m.	00+84	45
2		01+12	75
3		01+40	94
4		01+48	112
5		01+96	84
6		02+24	47
7		02+52	67
8		02+80	42
9		03+08	72
10	1:30 p.m.	03+36	47
			Average 69

Particle Distribution
% by Size

Size (Microns)	Sample: 2	Sample: 5	Sample: 8	Average
< 10	97.60	96.51	97.16	97.09
10-20	1.63	2.85	2.18	2.22
20-50	0.39	0.44	0.60	0.48
50-100	0.18	0.01	0.03	0.07
100-250	0.13	0.16	0.01	0.10
250-500	0.07	0.02	0.01	0.03
> 500	0.00	0.01	0.01	0.01

Suspended Sediment Discharge (Tons/Day): 2,340

TABLE 4.21

R&M CONSULTANTS, INC.

AND U.S. GEOLOGICAL SURVEY

1981 BEDLOAD TRANSPORT DATA[1]

Sampling Site U.S.G.S. Gauge	Date	Bedload Transport Tons/Day	Discharge c.f.s.
Gold Creek	July 22	2180	37,200
Chulitna[2]	July 22	3450	31,900
Talkeetna	July 21	1940	16,800
Sunshine	July 22	3520	89,000
Gold Creek	August 26	380	25,900
Chulitna	August 25	5000	22,500
Talkeetna	August 25	800	9,900
Sunshine	August 26	4520	61,900
Gold Creek	September 28	1	8,540
Chulitna	September 29	3820	6,000
Talkeetna	September 29	30	2,910
Sunshine	September 30	400	19,100

1. Provisional data only.

2. Bedload sample obtained downstream of gauging station.

TABLE 4.22

SEDIMENT DISCHARGE, SUSITNA RIVER AT GOLD CREEK

Date	Streamflow (c.f.s.)	Water Temperature (°C)	Suspended Sediment	
			Concentration (mg/l)	Discharge (tons/day)
10/16/80	7,000	0.0	7.8	147
1/14/81	NA[1]	0.3	8.4	NA
5/27/81	14,400	10.5	65	2,520
6/3/81	27,900	7.3	180	12,060
6/17/81	17,700	12.8	151	7,190
7/1/81	21,900	8.6	100	5,900
8/1/81	51,000	9.2	420	57,600
8/3/81	46,000	9.2	810	100,000
9/14/81	12,600	6.8	69	2,340

[1] NA' = Not available.

TABLE 4.23

SEDIMENT DISCHARGE, SUSITNA RIVER AT VEE CANYON

Date	Streamflow (c.f.s.)	Water Temperature (°C)	Suspended Sediment	
			Concentration (mg/l)	Discharge (tons/day)
9/5/80	5,040	5.3	61	827
9/17/80	14,200	5.9	297	11,345
10/18/80	5,000	0.0	5.7	77
1/13/81	5,000	0.1	0.9	12
5/20/81	9,800	6.5	132	3,483
6/18/81	11,600	11.9	316	9,860
6/30/81	13,700	7.9	172	6,339
8/2/81	26,375	8.1	839	59,526
8/3/81	29,420	8.1	755	59,750
8/3/81	28,000	9.8	616	46,400
9/15/81	7,800	5.9	47	985

5 - SUMMARIES OF U.S.G.S. AND R&M DATA

This section contains a compilation of existing U.S. Geological Survey water quality data collected at 5 sites on the Susitna River. Tables 5.1 to 5.7 list the maximum, minimum and mean values for parameters measured at U.S.G.S. stations Denali, Vee Canyon, Gold Creek, Sunshine, and Susitna Station. R&M data have been summarized in a similar format for comparision of values. It should be noted, when comparing values, that the R&M data are collected during specific streamflow events which are of particular importance to fisheries and reservoir studies, and that some values may represent extremes. U.S.G.S. measurements are taken at a fixed time interval at Gold Creek and only periodically at the other stations. Therefore, the number of measurements, timing and specific parameters measured will vary from year to year at any given station.

The R&M Field Data Index, revised in July 1981, identifies data that have been collected by the U.S.G.S. and other agencies on the Susitna River and its tributaries. Names of sites and periods of record are given for locations where water quality, water temperature, and suspended sediment data are available.

TABLE 5.1

WATER QUALITY DATA SUMMARY

SUSITNA RIVER

Agency: U.S. Geological Survey
Station: NR. DENALI - 1957-1981
Elevation: 2440 FT.

	Summer/Winter			
	Maximum	Minimum	Mean	Number Observations
Field Parameters (1)				
Dissolved Oxygen	-	-	-	-
Percent Saturation	-	-	-	-
pH, pH Units	7.8/7.6	7.1/7.1	7.5/7.4	15/4
Conductivity, umhos/cm @ 25°C	205/467	121/194	157/349	18/4
Temperature, °C	10.5/-	0.5/-	5.5/-	50/-
Free Carbon Dioxide	5.8/25	1.5/4.5	3.2/10/8	11/4
Alkalinity, as $CaCO_3$	68/161	42/57	54/116	11/4
Settleable Solids, ml/l	-	-	-	-
Laboratory Parameters (1)				
Ammonia Nitrogen	-	-	-	-
Organic Nitrogen	-	-	-	-
Kjeldahl Nitrogen	-	-	-	-
Nitrate Nitrogen	.09/-	.00/-	.05/-	15/-
Nitrite Nitrogen	-	-	-	-
Total Nitrogen	-	-	-	-
Ortho-Phosphate	-	-	-	-
Total Phosphorus	-	-	-	-
Alkalinity, as $CaCO_3$	-	-	-	-
Chemical Oxygen Demand	-	-	-	-
Chloride	11.0/30.0	2.0/3.8	4.8/19.0	11/4

TABLE 5.1 CONTINUED

Laboratory Parameters (1) (continued)	Summer/Winter Maximum	Minimum	Mean	Number Observations
Conductivity, umhos/cm @ 25°C	-	-	-	-
True Color, Color Units	-	-	-	-
Hardness, as $CaCO_3$	87/181	50/84	64/139	11/4
Sulfate	23/39	9/31	15/36	11/4
Total Dissolved Solids	120/270	72/109	91/204	11/4
Total Suspended Solids	5690/-	5/-	1004/-	58/-
Turbidity, NTU	350/-	20/-	176/-	8/-
Uranium	-	-	-	-
Radioactivity, Gross Alpha, pCi/l	-	-	-	-
Total Organic Carbon	-	-	-	-
Total Inorganic Carbon	-	-	-	-
Organic Chemicals				
Endrin	-	-	-	-
Lindane	-	-	-	-
Methoxychlor	-	-	-	-
Toxaphene	-	-	-	-
2, 4-D	-	-	-	-
2, 4, 5-TP Silvex	-	-	-	-
ICAP Scan				
Ag, Silver	-	-	-	-
Al, Aluminum	-	-	-	-
As, Arsenic	-	-	-	-
Au, Gold	-	-	-	-
B, Boron	-	-	-	-
Ba, Barium	-	-	-	-
Bi, Bismuth	-	-	-	-
Ca, Calcium	29/51	17/23	21/40	11/4
Cd, Cadmium	-	-	-	-
Co, Cobalt	-	-	-	-
Cr, Chromium	-	-	-	-
Cu, Copper	-	-	-	-

TABLE 5.1 CONTINUED

	Summer/Winter			
	Maximum	Minimum	Mean	Number Observations
Laboratory Parameters (1) (continued)				
Fe, Iron	4.0/.06	.03/0	1.0/.02	11/4
Hg, Mercury	-	-	-	-
K, Potassium	3.0/6.6	1.3/3.6	2.5/5.8	11/4
Mg, Magnesium	3.8/16	1.7/6.2	3.1/9.3	11/4
Mn, Manganese	.06/.02	0/0	.009/.01	10/3
Mo, Molybdenum	-	-	-	-
Na, Sodium	10/23	2.1/3.8	4.3/15	11/4
Ni, Nickel	-	-	-	-
Pb, Lead	-	-	-	-
Pt, Platinum	-	-	-	-
Sb, Antimony	-	-	-	-
Se, Selenium	-	-	-	-
Si, Silicon	-	-	-	-
Sn, Tin	-	-	-	-
Sr, Strontium	-	-	-	-
Ti, Titanium	-	-	-	-
W, Tungsten	-	-	-	-
V, Vanadium	-	-	-	-
Zn, Zinc	-	-	-	-
Zr, Zirconium	-	-	-	-

(1) Table values are mg/l unless noted otherwise.

TABLE 5.2

WATER QUALITY DATA SUMMARY
SUSITNA RIVER

Agency: U.S. Geological Survey
Station: VEE CANYON 1962 - 1981
Elevation: 1900 FT.

	Summer Values Only			
	Maximum	Minimum	Mean	Number Observations
Field Parameters (1)				
Dissolved Oxygen	-	-	-	-
Percent Saturation	-	-	-	-
pH, pH Units	8.1	7.2	7.7	10
Conductivity, umhos/cm @ 25°C	168	91	150	25
Temperature, °C	13.0	1.0	7.7	38
Free Carbon Dioxide	6.8	.7	2.6	10
Alkalinity, as $CaCO_3$	59	39	51	10
Settleable Solids, ml/l	-	-	-	-
Laboratory Parameters (1)				
Ammonia Nitrogen	-	-	-	-
Organic Nitrogen	-	-	-	-
Kjeldahl Nitrogen	-	-	-	-
Nitrate Nitrogen	0.88	0.0	.20	10
Nitrite Nitrogen	-	-	-	-
Total Nitrogen	-	-	-	-
Ortho-Phosphate	-	-	-	-
Total Phosphorus	-	-	-	-
Alkalinity, as $CaCO_3$	-	-	-	-
Chemical Oxygen Demand	-	-	-	-
Chloride	9.2	2.1	5.5	10

TABLE 5.2 CONTINUED

Laboratory Parameters (1) (continued)	Summer Values Only			
	Maximum	Minimum	Mean	Number Observations
Conductivity, umhos/cm @ 25°C	-	-	-	-
True Color, Color Units	40	5	14	9
Hardness, as $CaCO_3$	76	42	62	10
Sulfate	18	7.5	14	10
Total Dissolved Solids	110	66	90	10
Total Suspended Solids	2790	34	773	38
Turbidity, NTU	-	-	-	-
Uranium	-	-	-	-
Radioactivity, Gross Alpha, pCi/l	-	-	-	-
Total Organic Carbon	-	-	-	-
Total Inorganic Carbon	-	-	-	-
Organic Chemicals				
Endrin	-	-	-	-
Lindane	-	-	-	-
Methoxychlor	-	-	-	-
Toxaphene	-	-	-	-
2, 4-D	-	-	-	-
2, 4, 5-TP Silvex	-	-	-	-
ICAP Scan				
Ag, Silver	-	-	-	-
Al, Aluminum	-	-	-	-
As, Arsenic	-	-	-	-
Au, Gold	-	-	-	-
B, Boron	-	-	-	-
Ba, Barium	-	-	-	-
Bi, Bismuth	-	-	-	-
Ca, Calcium	27	14	21	10
Cd, Cadmium	-	-	-	-
Co, Cobalt	-	-	-	-
Cr, Chromium	-	-	-	-
Cu, Copper	-	-	-	-

TABLE 5.2 CONTINUED

Laboratory Parameters (1) (continued)	Summer Values Only			
	Maximum	Minimum	Mean	Number Observations
Fe, Iron	12.0	.05	2.9	10
Hg, Mercury	-	-	-	-
K, Potassium	7.3	1.4	3.4	10
Mg, Magnesium	4.4	1.1	2.7	10
Mn, Manganese	.23	0	.12	2
Mo, Molybdenum	-	-	-	-
Na, Sodium	6.3	2.1	3.9	10
Ni, Nickel	-	-	-	-
Pb, Lead	-	-	-	-
Pt, Platinum	-	-	-	-
Sb, Antimony	-	-	-	-
Se, Selenium	-	-	-	-
Si, Silicon	-	-	-	-
Sn, Tin	-	-	-	-
Sr, Strontium	-	-	-	-
Ti, Titanium	-	-	-	-
W, Tungsten	-	-	-	-
V, Vanadium	-	-	-	-
Zn, Zinc	-	-	-	-
Zr, Zirconium	-	-	-	-

(1) Table values are mg/l unless noted otherwise.

TABLE 5.3

WATER QUALITY DATA SUMMARY

SUSITNA RIVER

Agency: R&M CONSULTANTS, INC.

Station: VEE CANYON 1980 - 1981

Elevation: 1900 FT.

NOTE: Not Detectable is abbreviated ND

	Summer/Winter/Break-Up			
	Maximum	Minimum	Mean	Number Observations
Field Parameters (1)				
Dissolved Oxygen	12.6/13.8/10.4	8.7/10.7/10.4	11.5/12.6/10.4	8/3/1
Percent Saturation	110/104/83	82/84/83	99/97/83	8/3/1
pH, pH Units	7.9/7.6/6.6	7.0/7.2/6.6	7.6/7.4/6.6	10/3/1
Conductivity, umhos/cm @ 25°C	171/242/100	103/130/100	129/171/100	9/3/1
Temperature, °C	11.9/0.1/6.5	5.3/-0.1/6.5	7.7/0.0/6.5	10/3/1
Free Carbon Dioxide (2)	4.5/20.0/-	1.7/5.5/-	3.0/10.3/-	7/3/0
Alkalinity, as $CaCO_3$	81/187/-	41/57/-	61/111/-	7/3/0
Settleable Solids, ml/l	1.0/ND/ND	ND/ND/ND	0.27/ND/ND	10/3/1
Laboratory Parameters (1)(3)				
Ammonia Nitrogen	0.27/0.26/0.13	ND/ND/0.13	0.11/0.12/0.13	9/3/1
Organic Nitrogen	0.63/0.85/0.34	ND/0.08/0.34	0.44/0.40/0.34	9/3/1
Kjeldahl Nitrogen	0.79/0.85/0.47	0.26/0.17/0.47	0.60/0.52/0.47	9/3/1
Nitrate Nitrogen	0.19/ND/ND	ND/ND/ND	0.07/ND/ND	10/3/1
Nitrite Nitrogen	ND	ND	ND	9/3/1
Total Nitrogen	0.92/0.85/0.47	0.39/0.17/0.47	0.61/0.52/0.47	9/3/1
Ortho-Phosphate	0.49/0.02/ND	ND/ND/ND	0.06/0.01/ND	10/3/1
Total Phosphorus	0.49/0.07/ND	ND/ND/ND	0.08/0.02/ND	10/3/1
Alkalinity, as $CaCO_3$	60/66/-	40/66/-	48/66/-	4/1/0
Chemical Oxygen Demand	39/12/8	8/6/8	20/9/8	8/3/1
Chloride	11/18/4.5	ND/16/4.5	4.7/17/4.5	10/3/1

susi6/t2

TABLE 5.3 CONTINUED

Laboratory Parameters (1)(3) (continued)	Summer/Winter/Break-Up Maximum	Minimum	Mean	Number of Observations
Conductivity, umhos/cm @ 25°C	-	-	-	-
True Color, Color Units	175/30/15	5/10/15	72/70/15	9/3/1
Hardness, as $CaCO_3$ (4)	76/121/37	51/78/37	58/96/37	10/3/1
Sulfate	9/16/4	2/11/4	6/13/4	10/3/1
Total Dissolved Solids	170/149/100	38/115/100	98/136/100	10/3/1
Total Suspended Solids	1150/14/93	25/0.6/93	398/7.6/93	10/3/1
Turbidity, NTU	120/2.5/25	8.7/0.35/25	68/1.6/25	10/3/1
Uranium	ND	ND	ND	5/2/0
Radioactivity, Gross Alpha, pCi/l	-	-	11.6±0.6/10.3±0.6	1/1/0
Total Organic Carbon	23/23/40	11/23/40	16/23/40	5/1/1
Total Inorganic Carbon	60/106/46	46/21/46	54/64/46	6/2/1
Organic Chemicals				
Endrin	ND	ND	ND	3/1/0
Lindane	ND	ND	ND	3/1/0
Methoxychlor	ND	ND	ND	3/1/0
Toxaphene	ND	ND	ND	3/1/0
2, 4-D	ND	ND	ND	3/1/0
2, 4, 5-TP Silvex	ND	ND	ND	3/1/0
ICAP Scan				
Ag, Silver	ND	ND	ND	10/3/1
Al, Aluminum	2.2/0.18/ND	ND/ND/ND	0.41/0.06/ND	10/3/1
As, Arsenic	ND	ND	ND	10/3/1
Au, Gold	ND	ND	ND	10/3/1
B, Boron	ND	ND	ND	10/3/1
Ba, Barium	0.12/ND/ND	ND/ND/ND	0.07/ND/ND	10/3/1
Bi, Bismuth	0.19/ND/ND	ND/ND/ND	0.02/ND/ND	10/3/1
Ca, Calcium	23/36/13	13/25/13	18/30/13	10/3/1
Cd, Cadmium	ND	ND	ND	10/3/1
Co, Cobalt	ND	ND	ND	10/3/1
Cr, Chromium	ND	ND	ND	10/3/1
Cu, Copper	ND	ND	ND	10/3/1

TABLE 5.3 CONTINUED

Laboratory Parameters (1)(3) (continued)	Summer/Winter/Break-Up Maximum	Minimum	Mean	Number Observations
Fe, Iron	4.0/0.37/0.08	ND/ND/0.08	0.97/0.12/.08	10/3/1
Hg, Mercury	ND	ND	ND	10/3/1
K, Potassium	5.0/9.0/1.6	ND/ND/1.6	2.1/3.7/1.6	10/3/1
Mg, Magnesium	3.4/7.6/1.7	ND/ND/1.7	1.5/3.8/1.7	10/3/1
Mn, Manganese	ND	ND	ND	10/3/1
Mo, Molybdenum	ND	ND	ND	10/3/1
Na, Sodium	5.1/7.2/2.0	2.4/6.3/2.0	3.4/6.7/2.0	10/3/1
Ni, Nickel	ND	ND	ND	10/3/1
Pb, Lead	ND	ND	ND	10/3/1
Pt, Platinum	ND	ND	ND	10/3/1
Sb, Antimony	ND	ND	ND	10/3/1
Se, Selenium	ND	ND	ND	10/3/1
Si, Silicon	6.9/5.0/1.7	2.0/3.7/1.7	3.5/4.3/1.7	10/3/1
Sn, Tin	ND	ND	ND	10/3/1
Sr, Strontium	0.08/0.13/ND	ND/0.06/ND	0.05/0.10/ND	10/3/1
Ti, Titanium	0.24/ND/ND	ND/ND/ND	0.05/ND/ND	10/3/1
W, Tungsten	ND/0.4/ND	ND/ND/ND	ND/0.13/ND	9/3/1
V, Vanadium	ND	ND	ND	10/3/1
Zn, Zinc	0.07/ND/ND	ND/ND/ND	0.01/ND/ND	10/3/1
Zr, Zirconium	ND	ND	ND	10/3/1

(1) Table values are mg/l unless noted otherwise.

(2) All values for free CO_2 determined from nomograph on p. 297 of Standard Method, 14th edition.

(3) Samples for all parameters except chemical oxygen demand, dissolved and suspended solids, and turbidity were filtered.

(4) Hardness calculated by R&M personnel.

TABLE 5.4

WATER QUALITY DATA SUMMARY

SUSITNA RIVER

Agency: U.S. Geological Survey

Station: GOLD CREEK 1949 - 1981

Elevation: 676.5 FT.

	Summer/Winter/Break-Up			
	Maximum	Minimum	Mean	Numbe Obser- vations
Field Parameters (1)				
Dissolved Oxygen	13.3/14.4/-	9.5/11.0/-	11.7/12.7/-	5/2/0
Percent Saturation	106/102/-	83/77/-	98/90/-	5/2/0
pH, pH Units	8.0/8.1/8.0	6.6/7.0/6.5	7.3/7.4/7.1	34/23/9
Conductivity, umhos/cm @ 25°C	227/300/280	90/164/82	161/248/121	63/27/7
Temperature, °C	14.0/0.5/8.0	1.0/0.0/1.0	8.6/0.5/3.4	22/5/7
Free Carbon Dioxide	20/16/24	1.1/1.2/5.6	5.6/6.3/8.0	61/22/5
Alkalinity, as $CaCO_3$	87/88/80	30/49/29	52/70/48	66/23/3
Settleable Solids, ml/l	-	-	-	-
Laboratory Parameters (1)				
Ammonia Nitrogen	.33/.08/-	.01/.03/-	.13/.06/-	4/3/-
Organic Nitrogen	.39/.44/-	.10/.27/-	.27/.36/-	4/3/-
Kjeldahl Nitrogen	-	-	-	-
Nitrate Nitrogen	.36/.32/.29	.02/.05/.05	.13/.14/.17	60/22/3
Nitrite Nitrogen	.03/.01/-	.02/0/-	.02/0/-	2/3/-
Total Nitrogen	.58/.66/-	.25/.51/-	.47/.57/-	4/3/-
Ortho-Phosphate	.03/.03/-	0/.01/-	.01/.02/-	9/2/1
Total Phosphorus	.04/.03/-	0/.03/-	.02/.03/-	5/2/1
Alkalinity, as $CaCO_3$	-	-	-	-
Chemical Oxygen Demand	-	-	-	-
Chloride	15/35/4.5	1.4/9/1.8	5.5/22/3.2	62/25/4

TABLE 5.4 CONTINUED

Laboratory Parameters (1) (continued)	Summer/Winter/Break-Up Maximum	Minimum	Mean	Number Observations
Conductivity, umhos/cm @ 25°C	-	-	-	-
True Color, Color Units	20/5/50	0/0/10	8/3.5/28	52/20/6
Hardness, as $CaCO_3$	107/114/113	35/60/32	61/97/60	60/24/3
Sulfate	28/38/27	1/13/5.5	17/21/16	65/22/2
Total Dissolved Solids	134/167/70	51/102/48	93/149/55	61/26/4
Total Suspended Solids	2620/76/1330	7/1/120	805/18/652	63/8/11
Turbidity, NTU	-	-	-	-
Uranium	-	-	-	-
Radioactivity, Gross Alpha, pCi/l	50/-/-	2.7/-/-	20/-/-	3/1/1
Total Organic Carbon	-	-	5.5/5/1.8	1/1/1
Total Inorganic Carbon	-	-	-	-
Organic Chemicals				
Endrin	-	-	-	-
Lindane	-	-	-	-
Methoxychlor	-	-	-	-
Toxaphene	-	-	-	-
2, 4-D	-	-	-	-
2, 4, 5-TP Silvex	-	-	-	-
ICAP Scan				
Ag, Silver	0/-/-	0/-/-	0/-/-	2/-/-
Al, Aluminum	-	-	-	-
As, Arsenic	-	-	-	-
Au, Gold	-	-	-	-
B, Boron	-	-	-	-
Ba, Barium	0/-/-	0/-/-	0/-/-	2/-/-
Bi, Bismuth	-	-	-	-
Ca, Calcium	37/11/-	37/24/-	19/30/-	60/26/-
Cd, Cadmium	0/-/-	0/-/-	0/-/-	2/-/-
Co, Cobalt	0/-/-	0/-/-	0/-/-	2/-/-
Cr, Chromium	.01/-/-	0/-/-	.005/-/-	2/-/-
Cu, Copper	.005/-/-	.004/-/-	.004/-/-	2/-/-

TABLE 5.4 CONTINUED

Laboratory Parameters (1) (continued)	Summer/Winter/Break-Up Maximum	Minimum	Mean	Number Observations
Fe, Iron	.46/.03/-	0/0/-	.16/.01/-	30/21/0
Hg, Mercury	.002/-/-	0/-/-	.001/-/-	2/-/-
K, Potassium	4.4/5.0/1.7	1.0/1.2/1.3	2.4/2.3/1.6	51/18/3
Mg, Magnesium	6.3/8.3/7.4	1.4/3.6/.3	3.2/5.7/2.5	57/27/4
Mn, Manganese	.18/.0/-	0/0/-	.010/0/-	26/2/0
Mo, Molybdenum	-	-	-	-
Na, Sodium	6.5/17.0/2.9	2.4/5.2/2.8	4.1/11.0/2.9	48/19/2
Ni, Nickel	0/-/-	0/-/-	0/-/-	2/-/-
Pb, Lead	0/-/-	0/-/-	0/-/-	2/-/-
Pt, Platinum	-	-	-	-
Sb, Antimony	-	-	-	-
Se, Selenium	0/-/-	0/-/-	0/-/-	2/-/-
Si, Silicon	-	-	-	-
Sn, Tin	-	-	-	-
Sr, Strontium	-	-	-	-
Ti, Titanium	-	-	-	-
W, Tungsten	-	-	-	-
V, Vanadium	-	-	-	-
Zn, Zinc	.01/-/-	.006/-/-	.008/-/-	2/-/-
Zr, Zirconium	-	-	-	-

(1) Table values are mg/l unless noted otherwise.

TABLE 5.5

WATER QUALITY DATA SUMMARY

SUSITNA RIVER

Agency: R&M CONSULTANTS, INC.

Station: GOLD CREEK 1980 - 1981

Elevation: 676.5 FT.

NOTE: Not Detectable is abbreviated ND

	Summer/Winter/Break-Up			
	Maximum	Minimum	Mean	Number Observations
Field Parameters (1)				
Dissolved Oxygen	13.4/14.1/11.5	8.6/13.3/11.2	12.3/13.8/11.4	6/3/2
Percent Saturation	116/101/102	81/100/101	108/101/102	6/3/2
pH, pH Units	7.8/7.8/6.7	7.0/7.1/6.4	7.4/7.4/6.5	7/3/2
Conductivity, umhos/cm @ 25°C	169/249/106	75/162/105	116/193/106	7/3/2
Temperature, °C	12.8/0.8/10.5	6.8/0.0/10.3	9.4/0.4/10.4	7/3/2
Free Carbon Dioxide (2)	36/23/-	2.1/3.2/0	17/13/-	5/3/-
Alkalinity, as $CaCO_3$	64/144/-	25/46/-	44/88/-	5/3/-
Settleable Solids, ml/l	0.6/ND/ND	ND/ND/ND	0.1/ND/ND	7/3/2
Laboratory Parameters (1)(3)				
Ammonia Nitrogen	0.09/0.52/0.08	ND/ND/ND	.04/0.28/.04	6/3/2
Organic Nitrogen	0.74/0.81/0.34	0.39/0.34/0.27	0.55/0.54/0.31	6/3/2
Kjeldahl Nitrogen	0.74/0.99/ND	0.47/0.66/ND	0.59/0.82/0.34	6/3/2
Nitrate Nitrogen	0.32/0.18/ND	ND/ND/ND	0.15/.06/ND	7/3/2
Nitrite Nitrogen	ND/ND/ND	ND/ND/ND	ND/ND/ND	6/3/2
Total Nitrogen	0.95/0.99/0.35	0.48/0.66/0.34	0.74/0.88/0.35	6/3/2
Ortho-Phosphate	0.10/0.02/ND	ND/ND/ND	0.01/0.01/ND	7/3/2
Total Phosphorus	0.34/ND/0.08	ND/ND/ND	0.08/ND/0.04	7/3/2
Alkalinity, as $CaCO_3$	-	-	-	-
Chemical Oxygen Demand	24/16/11.9	12/2/7.9	18/9/10	7/3/2
Chloride	14/29/10	ND/14/6	5/20/8	7/3/2

TABLE 5.5 CONTINUED

Laboratory Parameters (1)(3) (continued)	Summer/Winter/Break-Up Maximum	Minimum	Mean	Number Observations
Conductivity, umhos/cm @ 25°C	-	-	-	-
True Color, Color Units	110/40/15	5/10/10	50/20/13	7/3/2
Hardness, as $CaCO_3$ (4)	62/121/43	31/68/43	48/88/43	7/3/2
Sulfate	12/16/6	1.5/9.5/5	5.4/11.8/6	7/3/2
Total Dissolved Solids	99/188/90	63/100/87	82/135/89	7/3/2
Total Suspended Solids	1255/7.7/56	57/ND/49	329/5/53	7/3/2
Turbidity, NTU	86/1.2/19	14/0.3/15	43/0.8/17	7/3/2
Uranium	ND	ND	ND	4/2/0
Radioactivity, Gross Alpha, pCi/l	-/2.6/-	-/2.0/-	-/2.3/-	0/2/0
Total Organic Carbon	41/39/25	10/27/15	20/33/20	5/2/2
Total Inorganic Carbon	61/90/44	34/90/41	45/90/43	6/1/2
Organic Chemicals				
Endrin	ND	ND	ND	3/1/0
Lindane	ND	ND	ND	3/1/0
Methoxychlor	ND	ND	ND	3/1/0
Toxaphene	ND	ND	ND	3/1/0
2, 4-D	ND	ND	ND	3/1/0
2, 4, 5-TP Silvex	ND	ND	ND	3/1/0
ICAP Scan				
Ag, Silver	ND	ND	ND	7/3/2
Al, Aluminum	0.70/0.18/ND	ND/ND/ND	0.13/0.06/ND	6/3/2
As, Arsenic	ND	ND	ND	7/3/2
Au, Gold	ND	ND	ND	7/3/2
B, Boron	ND	ND	ND	7/3/2
Ba, Barium	0.11/0.05/0.07	0.06/ND/0.05	0.09/0.02/0.06	7/3/2
Bi, Bismuth	0.19/0.07/ND	ND/ND/ND	0.03/0.02/ND	7/3/2
Ca, Calcium	20/32/14	10/22/14	14/26/14	7/3/2
Cd, Cadmium	ND	ND	ND	7/3/2
Co, Cobalt	ND	ND	ND	7/3/2
Cr, Chromium	ND	ND	ND	7/3/2
Cu, Copper	ND	ND	ND	7/3/2

TABLE 5.5 CONTINUED

Laboratory Parameters (1)(3) (continued)	Summer/Winter/Break-Up Maximum	Minimum	Mean	Number Observations
Fe, Iron	2.3/0.35/0.07	ND/ND/0.05	0.67/0.12/.06	7/3/2
Hg, Mercury	ND	ND	ND	7/3/2
K, Potassium	2.0/2.4/1.9	1.3/2.0/1.8	1.7/2.2/1.9	7/2/2
Mg, Magnesium	2.9/10.0/2.0	1.4/3.2/2.0	2.3/5.6/2.0	7/3/2
Mn, Manganese	ND	ND	ND	7/3/2
Mo, Molybdenum	ND	ND	ND	7/3/2
Na, Sodium	6.2/13.0/4.1	2.8/7.4/3.9	3.9/9.6/4.00	7/3/2
Ni, Nickel	ND	ND	ND	7/3/2
Pb, Lead	ND	ND	ND	7/3/2
Pt, Platinum	ND	ND	ND	7/3/2
Sb, Antimony	ND	ND	ND	7/3/2
Se, Selenium	ND	ND	ND	7/3/2
Si, Silicon	5.9/5.0/2.5	2.6/3.9/2.4	3.5/4.4/2.5	7/3/2
Sn, Tin	ND	ND	ND	7/3/2
Sr, Strontium	0.09/0.19/0.07	ND/0.10/.06	0.05/0.13/0.07	7/3/2
Ti, Titanium	0.14/ND/ND	ND/ND/ND	0.04/ND/ND	7/3/2
W, Tungsten	ND	ND	ND	7/3/2
V, Vanadium	ND	ND	ND	7/3/2
Zn, Zinc	ND	ND	ND	7/3/2
Zr, Zirconium	ND	ND	ND	7/3/2

(1) Table values are mg/l unless noted otherwise.

(2) All values for free CO_2 determined from nomograph on p. 297 of Standard Method, 14th edition.

(3) Samples for all parameters except chemical oxygen demand, dissolved and suspended solids, and turbidity were filtered.

(4) Hardness calculated by R&M personnel.

TABLE 5.6

WATER QUALITY DATA SUMMARY

SUSITNA RIVER

Agency: U.S. Geological Survey
Station: SUNSHINE - 1971-1977
Elevation: 270 FT.

	Summer/Winter			
	Maximum	Minimum	Mean	Number of Observations
Field Parameters (1)				
Dissolved Oxygen	12.8/13	10.6/13	11.8/13	3/1
Percent Saturation	-	-	-/90	0/1
pH, pH Units	7.6/7.2	7.1/7.2	7.4/7.2	3/1
Conductivity, umhos/cm @ 25°C	170/242	100/230	130/236	5/2
Temperature, °C	12/0	3.8/0	8.1/0	5/1
Free Carbon Dioxide	3.9/0	2.1/0	3.1/0	3/0
Alkalinity, as $CaCO_3$	43/71	25/63	37/67	3/2
Settleable Solids, ml/l	-	-	-	-
Laboratory Parameters (1)				
Ammonia Nitrogen	.28/.05	.09/.03	.18/.04	2/2
Organic Nitrogen	.77/.42	.24/.18	.5/.3	2/2
Kjeldahl Nitrogen	-	-	-	-
Nitrate Nitrogen	-	-	-	-
Nitrite Nitrogen	-	-	-	-
Total Nitrogen	2.3/.7	.7/.4	1/.25	2/2
Ortho-Phosphate	.12/.12	0/.12	.06/.12	3/1
Total Phosphorus	.14/.01	.07/.01	.07/.01	2/2
Alkalinity, as $CaCO_3$	-	-	-	-
Chemical Oxygen Demand	-	-	-	-
Chloride	7.3/21	2.2/17	4.2/19	5/2

TABLE 5.6 CONTINUED

Laboratory Parameters (1) (continued)	Summer/Winter Maximum	Minimum	Mean	Number Observations
Conductivity, umhos/cm @ 25°C				
True Color, Color Units	100/0	8/0	44/0	3/1
Hardness, as $CaCO_3$	72/91	37/89	52/90	5/2
Sulfate	13/18	3/17	9/17	5/2
Total Dissolved Solids	-	-	-	-
Total Suspended Solids	-	-	-	-
Turbidity, NTU	250/1.3	200/1.3	225/1.3	2/1
Uranium	-	-	-	-
Radioactivity, Gross Alpha, pCi/l	-	-	-	-
Total Organic Carbon	-	-	-	-
Total Inorganic Carbon	-	-	-	-
Organic Chemicals				
Endrin	-	-	-	-
Lindane	-	-	-	-
Methoxychlor	-	-	-	-
Toxaphene	-	-	-	-
2, 4-D	-	-	-	-
2, 4, 5-TP Silvex	-	-	-	-
ICAP Scan				
Ag, Silver	0/0	0/0	0/0	2/1
Al, Aluminum	-	-	-	-
As, Arsenic	.003/.001	.002/.001	.002/.001	2/1
Au, Gold	-	-	-	-
B, Boron	-	-	-	-
Ba, Barium	.07/.04	0/.04	.04/.04	2/1
Bi, Bismuth	-	-	-	-
Ca, Calcium	23/29	12/29	17/29	5/2
Cd, Cadmium	0/0	0/0	0/0	2/1
Co, Cobalt	0/0	0/0	0/0	2/1
Cr, Chromium	.01/.01	0/.01	.005/.01	2/1
Cu, Copper	.004/.004	.002/.004	.003/.004	2/1

TABLE 5.6 CONTINUED

	Summer/Winter			
	Maximum	Minimum	Mean	Number of Observations
Laboratory Parameters (1) (continued)				
Fe, Iron	.18/.01	.06/.01	.12/.01	2/1
Hg, Mercury	.001/.001	0/.001	.001/.001	2/1
K, Potassium	2.8/2.1	1.1/.19	1.6/2.0	5/2
Mg, Magnesium	3.5/4.5	1.6/4.1	2.5/4.3	5/2
Mn, Manganese	.02/.004	0/0	.009/.002	4/2
Mo, Molybdenum	-	-	-	-
Na, Sodium	4.4/11	1.9/11	2.8/11	5/2
Ni, Nickel	0/.002	.001/.002	.001/.002	2/1
Pb, Lead	0/.008	0/.008	0/.008	2/1
Pt, Platinum	-	-	-	-
Sb, Antimony	-	-	-	-
Se, Selenium	0/0	0/0	0/0	2/1
Si, Silicon	-	-	-	-
Sn, Tin	-	-	-	-
Sr, Strontium	-	-	-	-
Ti, Titanium	-	-	-	-
W, Tungsten	-	-	-	-
V, Vanadium	-	-	-	-
Zn, Zinc	.02/.03	.006/.03	.01/.03	2/1
Zr, Zirconium	-	-	-	-

(1) Table values are mg/l unless noted otherwise.

TABLE 5.7

WATER QUALITY DATA SUMMARY

SUSITNA RIVER

Agency: U.S. Geological Survey
Station: SUSITNA - 1955-1981
Elevation: 40 FT.

	Summer/Winter/Break-Up			
	Maximum	Minimum	Mean	Number Observations
Field Parameters (1)				
Dissolved Oxygen	13/13.9/12.7	10.1/9.9/10.6	11.5/11.5/12.1	12/12/4
Percent Saturation	100/97/100	90/67/95	99/79/98	53/19/11
pH, pH Units	8.3/7.9/7.8	7/6.7/6.5	7.7/7.3/7.3	62/45/18
Conductivity, umhos/cm @ 25°C	168/225/120	90/179/85	120/205/94	21/20/6
Temperature, °C	12.5/0.5/8.0	3.6/0/4.5	8.8/0/6.3	109/52/33
Free Carbon Dioxide	-	-	-	-
Alkalinity, as $CaCO_3$	57/75/39	39/58/30	44/69/34	52/30/6
Settleable Solids, ml/l	-	-	-	-
Laboratory Parameters (1)				
Ammonia Nitrogen	.19/.09/.21	0.0/.01/.01	.04/.04/.08	15/7/3
Organic Nitrogen	1.5/.46/.70	.16/0.0/.16	.60/.27/.43	12/9/2
Kjeldahl Nitrogen	-	-	-	-
Nitrate Nitrogen	-/.19/-	-/.16/-	-/.18/-	0/2/0
Nitrite Nitrogen	-	-	-	-
Total Nitrogen	1.7/.99/1.2	.26/.24/.67	.72/.55/.87	22/17/5
Ortho-Phosphate	-/-/.03	-/-/.03	-/-/.03	0/0/1
Total Phosphorus	-	-	-	-
Alkalinity, as $CaCO_3$	-	-	-	-
Chemical Oxygen Demand	-	-	-	-
Chloride	6.7/18/4.6	1.2/5.7/3.1	2.8/12.9/3.6	23/21/6

susi6/s2

TABLE 5.7 CONTINUED

Laboratory Parameters (1) (continued)	Summer/Winter/Break-Up Maximum	Minimum	Mean	Number Observations
Conductivity, umhos/cm @ 25°C	-	-	-	-
True Color, Color Units	10/5/-	5/0/-	7.5/2.5/-	4/4/0
Hardness, as $CaCO_3$	60/96/48	46/73/36	55/84/40	20/20/6
Sulfate	22/20/7.7	1/10/3.7	13/17/7	23/21/6
Total Dissolved Solids	82/139/65	57/105/52	75/123/55	24/20/6
Total Suspended Solids	2980/12/683	151/2/257	745/4.4/461	67/22/5
Turbidity, NTU	790/3/160	30/1/25	286/2/74	13/10/4
Uranium	-	-	-	-
Radioactivity, Gross Alpha, pCi/l	-	-	-	-
Total Organic Carbon	11/9.3/9.1	2.3/.4/3.8	4.2/2.4/6.0	8/10/4
Total Inorganic Carbon	-	-	-	-
Organic Chemicals				
Endrin	-	-	-	-
Lindane	-	-	-	-
Methoxychlor	-	-	-	-
Toxaphene	-	-	-	-
2, 4-D	-	-	-	-
2, 4, 5-TP Silvex	-	-	-	-
ICAP Scan				
Ag, Silver	.003/0/-	0/0/-	.001/0/-	6/2/0
Al, Aluminum	-	-	-	-
As, Arsenic	.003/.003/.001	.001/0/.001	.017/.013/.001	10/8/5
Au, Gold	-	-	-	-
B, Boron	-	-	-	-
Ba, Barium	2.0/1.0/1.0	.3/.4/.1	.8/.6/.1	7/5/2
Bi, Bismuth	-	-	-	-
Ca, Calcium	22/31/15	14/24/11	18/27/13	23/21/6
Cd, Cadmium	.002/.002/.002	.001/.001/.002	.015/.015/.002	8/4/2
Co, Cobalt	.007/.003/-	.002/.002/-	.003/.003/-	9/6/0
Cr, Chromium	.030/.020/.020	0/0/.005	.014/.008/.013	8/4/2
Cu, Copper	.007/.004/.020	.002/0/.002	.003/.002/.008	10/9/4

TABLE 5.7 CONTINUED

Laboratory Parameters (1) (continued)	Summer/Winter/Break-Up Maximum	Minimum	Mean	Number Observations
Fe, Iron	.460/.160/.170	.010/.060/.110	.091/.091/.144	12/8/5
Hg, Mercury	.0005/.0005/.0005	0/0/.0001	.0003/.0002/.0003	12/8/5
K, Potassium	.0018/.0025/.0011	.001/.0014/.0008	.001/.002/.001	23/21/6
Mg, Magnesium	.003/.005/.003	.002/.004/.002	.003/.004/.002	25/20/5
Mn, Manganese	/020/.030/.070	.004/.010/.008	.009/.022/.010	16/8/5
Mo, Molybdenum	-	-	-	-
Na, Sodium	4.0/8.9/3.2	2.0/6.2/2.4	2.7/7.6/2.9	23/21/6
Ni, Nickel	.004/.003/-	0/.002/-	.001/.003/-	4/2/0
Pb, Lead	.009/.004/.011	.002/0/.002	.003/.002/.005	12/8/4
Pt, Platinum	-	-	-	-
Sb, Antimony	-	-	-	-
Se, Selenium	.001/.001/.001	0/0/.001	.0006/.0009/.001	11/8/5
Si, Silicon	-	-	-	-
Sn, Tin	-	-	-	-
Sr, Strontium	-	-	-	-
Ti, Titanium	-	-	-	-
W, Tungsten	-	-	-	-
V, Vanadium	-	-	-	-
Zn, Zinc	.020/.020/.020	.003/.003/.020	.012/.012/.020	0/7/4
Zr, Zirconium	-	-	-	-

(1) Table values are mg/l unless noted otherwise.

6 - CONTINUOUS WATER QUALITY RECORDER

R&M Consultants installed a continuous water quality monitor at a site located approximately 1 mile downstream of the proposed Watana damsite (Figure 6.1). The monitor records the date, time, temperature, pH, oxidation reduction potential, dissolved oxygen, conductivity and corrected conductivity (at 25°C) every 60 minutes on a magnetic tape cassette. A spent cassette tape is returned monthly to the manufacturer of the recorder (Martek Instruments, Inc.). A computer program has been developed by this company to summarize the data on a daily and monthly basis according to R&M specifications.

The purpose of the continuous recorder is to provide a record of water quality parameters through the winter months when a thick ice cover makes conventional sampling techniques arduous, and during the summer to supplement the water quality data collected at Vee Canyon and Gold Creek.

The percentage of usable data on the summaries received to date has been less than expected. Problems with siltation around the sensors, calibration and equipment damage have prevented a continuous record. Inaccessibility of the sensors in the winter prevents an accurate calibration procedure and maintenance of the sensors is not feasible.

Several problems with the sensors have developed over the span of this program. A design limitation of the pH sensor prevents its use during the winter due to freezing of the gel, and this sensor must be disconnected before freezeup. The stirrer on the dissolved oxygen sensor is likely to be mired in accumulated debris if not periodically cleaned. This problem is evident in the November 1980 summary where the dissolved oxygen values steadily decrease as the month progresses. The electric stirrer motor attracts magnetic particles in the sediment and this eventually jams the stirring paddle so that water is no longer circulated sufficiently about the sensor membrane. Therefore, the pH and D.O. values from November (freezeup) until April could be unreliable.

On April 16, 1981, the sensor assembly was extracted from the ice to prevent damage to the unit during breakup. The unit remained inoperable through May while a damaged cable was repaired and the sensors cleaned and calibrated. The monitor was put back in service on May 21, 1981, and recorded data through June. At this time it was evident that the damage to the cable was more extensive than previously realized and the entire unit was shipped to Martek for repair. The resultant data summaries for May and June contain data believed to be invalid for dissolved oxygen and conductivity. Temperature, pH and oxidation reduction potential

appear to be reasonable values, however, due to the problems experienced with the other parameters, these values could be unreliable as well.

Some temperature values on the May summary have been modified to exclude erroneous readings found on the raw data printout. All the dissolved oxygen values have been lined through and are to be dismissed as inaccurate.

Through the month of July the monitor was out of service while the manufacturers repaired the sensor cables.

The recorder and sensor assembly were reinstalled at the same location on August 5, 1981 and has remained in service since then. All values on the August summary appear to be valid and compare well with periodic measurements made with the YSI portable instruments. The dissolved oxygen values listed on the summary become less accurate towards the end of the month as magnetic sediment particles accumulate around the electric motor shaft. This problem remains unsolved.

The adjustments noted on the summary during August 12 and 13 are due to a period when the instrument was being calibrated, and 14 of the 24 daily readings had to be omitted from the mean values. The last 14 readings on August 12, and the first 14 readings on August 13 had to be disregarded while the instrument stabilized. The values noted on the summary are, therefore, means from only 10 values per day. Tables 6.1 to 6.13 present the summarized data recorded by the monitor.

TABLE 6.1

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

OCTOBER, 1980

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
23	-00.21	-00.04	-00.16	08.09	0332	12.07	2329	12.38	1529	12.15	0125	0237	0144
24	-00.22	00.05	-00.10	08.15	0338	12.03	0729	12.38	2329	12.16	0130	0247	0149
25	00.06	00.18	00.13	08.49	0369	12.39	0129	12.69	2329	12.57	0165	0313	0184
26	00.16	00.26	00.20	08.58	0376	12.66	1829	12.80	1029	12.72	0177	0336	0196
27	00.19	00.27	00.22	08.60	0378	12.60	2129	12.80	1229	12.68	0179	0340	0198
28	00.18	00.24	00.20	08.57	0375	12.47	1829	12.61	1229	12.54	0179	0340	0199
29	00.18	00.21	00.19	08.56	0373	12.53	0029	12.82	1129	12.66	0180	0342	0200
31	00.06	00.16	00.10	08.29	0357	12.90	2329	13.39	1429	13.20	0100	0190	0030
31	-00.22	00.27	00.09	08.41	0362	12.03	0729	13.39	1429	12.58	0154	0292	0162

TABLE 6.2

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

NOVEMMBER, 1980

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
1	00.05	00.20	00.15	08.30	0356	12.47	0729	12.88	0329	12.69	0106	0201	0030
2	00.05	00.23	00.12	08.19	0343	11.74	1629	12.57	0029	12.17	0105	0199	0019
3	-00.02	00.15	00.08	08.18	0341	11.64	1629	12.32	2029	12.06	0110	0209	0018
4	-00.13	-00.04	-00.08	08.13	0334	11.99	0429	12.98	1629	12.45	0103	0195	0012
5	-00.15	-00.10	-00.12	08.08	0328	12.14	1929	12.52	1429	12.30	0096	0182	0008
6	-00.11	-00.02	-00.07	08.13	0334	12.18	2329	12.65	1429	12.35	0090	0171	0012
7	-00.10	-00.05	-00.07	08.14	0334	12.09	0729	12.58	1429	12.30	0088	0167	0013
8	-00.04	00.06	00.01	08.28	0348	12.42	0129	13.17	1429	12.84	0104	0197	0028
9	00.04	00.14	00.08	08.37	0354	13.00	0429	13.47	1529	13.17	0112	0212	0036
10	00.04	00.17	00.10	08.30	0346	10.52	2329	13.14	0029	12.14	0115	0218	0030
11	00.08	00.17	00.12	08.24	0340	09.56	0629	11.97	2329	10.32	0135	0256	0024
12	-00.06	00.14	00.03	08.28	0342	11.83	0329	13.15	1629	12.54	0130	0247	0028
13	-00.12	-00.05	-00.08	08.17	0329	12.97	0929	13.11	2329	13.04	0103	0195	0017
14	-00.05	00.03	-00.01	08.27	0338	13.16	0029	13.41	1429	13.27	0109	0207	0026
15	-00.07	00.00	-00.02	08.25	0338	12.95	2329	13.30	1229	13.19	0106	0201	0023
16	-00.12	-00.06	-00.09	08.17	0329	12.76	0929	12.94	0029	12.81	0097	0184	0016
17	-00.10	-00.05	-00.07	08.18	0330	12.75	0929	12.84	2029	12.79	0099	0188	0018
18	-00.09	-00.03	-00.06	08.21	0331	07.24	1629	12.92	1329	10.70	0101	0191	0020
19	-00.12	-00.06	-00.08	08.17	0328	07.43	0029	08.45	2129	08.10	0097	0184	0017
20	-00.11	-00.06	-00.09	08.17	0327	07.56	2219	08.35	0029	07.97	0096	0182	0017
21	-00.08	-00.04	-00.05	08.21	0330	07.30	1719	07.77	1419	07.55	0099	0188	0021
22	-00.14	-00.05	-00.09	08.17	0325	07.04	0419	08.14	2019	07.63	0096	0182	0016
23	-00.11	-00.07	-00.08	08.18	0325	07.31	1219	07.83	1919	07.53	0096	0182	0017
24	-00.15	-00.08	-00.11	08.13	0321	07.01	2219	07.59	1319	07.35	0091	0172	0012
25	-00.15	-00.11	-00.12	08.12	0319	06.88	1019	07.23	1619	07.06	0090	0171	0011
26	-00.14	-00.10	-00.11	08.13	0320	06.82	1919	07.08	0219	06.93	0090	0171	0012
27	-00.15	-00.10	-00.12	08.12	0319	06.77	2119	06.97	1819	06.88	0088	0167	0012
28	-00.12	-00.06	-00.09	08.17	0322	06.73	1419	07.41	0819	06.91	0091	0172	0016
29	-00.07	00.13	00.04	08.35	0340	07.05	0019	07.39	1819	07.23	0110	0209	0034
30	00.05	00.16	00.11	08.44	0349	07.10	2319	07.32	0119	07.20	0123	0233	0043
30	-00.15	00.23	-00.02	08.20	0334	06.73	1419	13.47	1529	10.38	0102	0193	0020

TABLE 6.3

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

DECEMBER, 1980

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND UMHO	MEAN COND ADJ. UMHO	MEAN MEAS ADJ. UMHO
1	00.02	00.10	00.05	08.35	0340	06.88	1419	07.09	0419	06.97	0116	0220	0035
2	00.08	00.14	00.10	08.42	0346	06.74	0819	07.10	1319	06.92	0124	0235	0041
3	00.09	00.13	00.10	08.42	0345	06.84	0519	07.15	2319	06.97	0126	0239	0042
4	00.08	00.11	00.09	08.42	0345	07.08	0219	10.77	1719	09.61	0125	0237	0041
5	00.08	00.16	00.11	08.44	0347	09.30	1319	10.69	0219	10.17	0125	0237	0043
6	00.06	00.15	00.11	08.44	0347	10.27	1219	11.14	0019	10.65	0125	0237	0043
7	00.14	00.23	00.16	08.52	0353	09.63	1619	10.28	2219	09.98	0132	0250	0050
8	00.16	00.24	00.21	08.57	0359	09.53	0319	10.38	1419	09.96	0138	0262	0055
9	00.18	00.29	00.23	08.61	0362	10.09	0119	10.96	2319	10.46	0142	0269	0058
10	00.19	00.40	00.28	08.68	0369	09.50	1819	10.83	0019	10.02	0149	0283	0066
11	00.29	00.43	00.36	08.78	0378	08.66	2119	09.51	0019	09.14	0160	0304	0075
12	00.24	00.33	00.28	08.68	0367	08.63	0619	09.05	0219	08.85	0150	0285	0065
13	00.04	00.28	00.14	08.50	0348	08.27	1519	08.87	0419	08.57	0133	0252	0046
14	00.02	00.12	00.06	08.40	0338	08.09	0419	08.37	1019	08.24	0123	0233	0036
15	00.13	00.23	00.17	08.55	0353	08.13	0319	08.50	1219	08.28	0139	0264	0052
16	00.23	00.28	00.25	08.65	0362	08.19	0319	08.54	1319	08.39	0148	0281	0061
17	00.13	00.86	00.38	08.80	0378	08.27	1219	09.06	2319	08.58	0165	0313	0077
18	00.90	01.07	01.00	09.55	0454	08.95	0019	09.39	2319	09.22	0243	0461	0154
19	00.98	01.05	01.01	09.56	0454	08.99	2019	09.43	0819	09.23	0244	0463	0155
20	00.98	01.09	01.01	09.56	0455	09.12	1219	09.53	2219	09.25	0244	0463	0154
21	01.04	01.14	01.10	09.66	0465	09.11	2319	09.58	0019	09.39	0254	0482	0165
22	00.90	01.00	00.93	09.46	0445	08.79	2019	09.32	0119	09.00	0233	0442	0146
23	01.01	01.09	01.05	09.59	0458	08.79	2319	09.16	1519	08.96	0247	0469	0159
24	00.85	00.99	00.93	09.46	0444	08.56	2319	08.94	0619	08.79	0234	0444	0145
25	00.85	01.04	00.93	09.46	0444	08.59	2119	08.87	0419	08.68	0234	0444	0145
26	01.06	01.17	01.11	09.66	0465	08.63	2019	08.89	1219	08.78	0255	0484	0166
27	00.94	01.07	00.99	09.52	0451	08.34	2319	08.69	0019	08.51	0242	0459	0152
28	00.95	01.10	01.04	09.58	0456	08.35	0519	08.63	1819	08.50	0248	0471	0158
29	00.72	01.09	00.93	09.44	0443	07.92	2219	08.49	0019	08.29	0235	0446	0145
30	00.52	00.68	00.60	09.05	0403	07.72	1919	07.97	0019	07.84	0194	0368	0104
31	00.12	00.49	00.23	08.62	0360	07.17	1719	07.73	0019	07.35	0152	0288	0061
31	00.02	01.17	00.51	08.94	0394	06.74	0819	11.14	0019	08.82	0179	0340	0093

TABLE 6.4

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

JANUARY, 1981

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
1	-00.23	00.20	-00.01	08.38	0338	06.86	2319	07.38	0019	07.08	0132	0250	0040
2	-00.29	00.18	-00.13	08.30	0332	06.76	0519	07.25	2319	06.94	0127	0241	0034
3	00.21	00.44	00.34	08.80	0379	07.17	2119	07.61	1219	07.38	0173	0328	0082
4	-00.03	00.19	00.04	08.51	0353	06.92	1819	07.30	0019	07.07	0146	0277	0055
5	00.10	00.38	00.26	08.72	0372	07.07	0019	07.42	1219	07.25	0170	0323	0075
6	-00.29	00.27	-00.03	08.43	0346	06.52	2319	07.18	0319	06.83	0140	0266	0049
7	-00.70	-00.28	-00.50	08.00	0310	06.07	1619	06.65	0119	06.30	0104	0197	0012
8	-00.51	-00.16	-00.33	08.15	0323	06.10	0019	06.58	2219	06.34	0115	0218	0025
9	-02.81	-00.12	-01.23	07.41	0261	03.91	1238	06.62	0519	05.44	0058	0110	-0034
10	-01.47	-00.26	-00.73	07.67	0276	05.13	0038	06.33	2138	05.84	0066	0125	-0022
11	-00.27	-00.15	-00.19	08.07	0308	06.24	1138	06.40	1738	06.31	0094	0178	0008
12	-00.16	-00.04	-00.11	08.13	0313	06.23	0338	06.58	1518	06.42	0098	0186	0013
13	-00.12	-00.04	-00.08	08.17	0316	06.37	1218	06.57	0918	06.46	0101	0191	0017
14	-00.16	-00.10	-00.12	08.11	0310	06.31	2318	06.55	0418	06.44	0095	0180	0011
15	-00.19	-00.15	-00.16	08.04	0305	06.26	1518	06.48	0218	06.32	0089	0169	0005
16	-00.16	-00.10	-00.12	08.50	0310	06.23	0318	06.56	2318	06.36	0092	0174	0010
17	-00.14	-00.11	-00.12	08.09	0310	06.38	2318	06.60	1118	06.48	0092	0174	0011
18	-00.14	-00.10	-00.12	08.08	0310	06.29	1518	06.54	1118	06.41	0092	0174	0010
19	-00.13	-00.10	-00.12	08.08	0310	06.27	2018	06.49	0018	06.38	0092	0174	0011
20	-00.08	00.02	-00.04	08.17	0320	06.30	0018	06.76	2118	06.52	0101	0191	0020
21	-00.07	00.04	-00.01	08.20	0324	06.63	1718	06.89	0518	06.75	0105	0199	0025
22	-00.09	-00.03	-00.06	08.13	0316	06.45	1318	06.87	0018	06.72	0098	0186	0018
23	-00.10	-00.05	-00.07	08.10	0314	06.47	2018	06.73	0618	06.60	0096	0182	0015
24	-00.09	-00.03	-00.06	08.12	0316	06.27	1618	06.70	0418	06.49	0099	0188	0017
25	-00.12	-00.07	-00.09	08.07	0312	06.23	0418	06.44	1418	06.33	0096	0182	0014
26	-00.10	-00.06	-00.07	08.11	0316	06.24	0618	06.46	1218	06.34	0101	0191	0018
27	-00.08	00.00	-00.05	08.13	0318	06.26	0118	06.46	1547	06.36	0103	0195	0020
28	00.00	00.12	00.07	08.29	0335	06.43	0047	06.71	1547	06.58	0120	0228	0038
29	-00.07	00.07	00.00	08.18	0325	06.31	2047	06.66	1047	06.54	0110	0209	0028
30	-00.13	-00.05	-00.09	08.05	0312	06.21	1647	06.49	0047	06.36	0098	0186	0015
31	-00.13	-00.09	-00.10	08.04	0311	06.28	0847	06.50	2047	06.40	0096	0182	0014
31	-02.81	00.44	-00.12	08.16	0319	03.91	1238	07.61	1219	06.51	0106	0201	0021

TABLE 6.5

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

FEBRUARY, 1981

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN PH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
1	-00.13	-00.07	-00.10	08.03	0311	06.34	1447	06.53	0347	06.42	0097	0184	0014
2	-00.15	-00.05	-00.11	08.03	0310	06.28	1247	06.58	0447	06.38	0096	0182	0013
3	-00.13	-00.10	-00.11	08.02	0310	06.30	0747	06.45	2347	06.38	0096	0182	0013
4	-00.14	-00.10	-00.12	08.00	0308	06.32	1147	06.45	1447	06.38	0094	0178	0011
5	-00.13	-00.10	-00.11	08.00	0309	06.26	2147	06.51	1247	06.43	0094	0178	0012
6	-00.15	-00.12	-00.13	07.97	0306	06.33	1847	06.46	0947	06.39	0091	0172	0010
7	-00.14	-00.04	-00.07	08.03	0312	06.36	0247	06.54	1647	06.46	0096	0182	0016
8	-00.12	-00.07	-00.09	08.02	0311	06.40	1847	06.56	1047	06.49	0096	0182	0015
9	-00.12	-00.07	-00.09	08.01	0311	06.38	1947	06.56	0447	06.47	0096	0182	0016
10	-00.12	-00.09	-00.10	08.00	0310	06.03	0347	06.51	0447	06.39	0094	0178	0013
11	-00.08	00.00	-00.04	08.07	0316	06.31	1047	06.53	1847	06.44	0102	0193	0021
12	00.00	00.07	00.05	08.18	0329	06.40	0947	06.61	1747	06.52	0114	0216	0034
24	-00.02	00.01	00.00	08.05	0318	10.33	2313	10.37	1813	10.35	0108	0205	0025
25	-00.08	00.00	-00.03	07.99	0312	10.26	1613	10.34	0113	10.29	0103	0195	0019
26	-00.08	00.06	00.00	08.04	0318	10.33	2313	10.47	0713	10.38	0108	0205	0025
27	-00.10	-00.02	-00.05	07.97	0311	10.26	1913	10.38	0613	10.32	0102	0193	0018
28	-00.09	-00.01	-00.05	07.98	0312	10.30	2313	10.39	0813	10.33	0102	0193	0020
28	-00.15	00.07	-00.07	08.02	0312	06.03	0347	10.47	0713	07.57	0099	0188	0017

TABLE 6.6

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

MARCH, 1981

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
1	-00.13	-00.05	-00.09	07.93	0307	10.25	1713	10.36	0313	10.29	0097	0184	0014
2	-00.13	-00.07	-00.11	07.90	0305	10.24	1813	10.29	2313	10.26	0094	0178	0012
3	-00.05	00.02	-00.01	08.02	0317	10.30	0013	10.41	2313	10.35	0107	0203	0025
4	-00.01	00.13	00.04	08.09	0324	10.37	2013	10.53	0813	10.44	0114	0216	0033
5	-00.08	00.00	-00.03	07.97	0313	10.36	2313	10.43	1313	10.39	0103	0195	0022
6	-00.08	00.02	-00.03	07.98	0314	10.33	1613	10.42	2313	10.37	0104	0197	0022
7	-00.05	00.11	00.01	08.04	0321	10.34	1913	10.54	0513	10.43	0111	0210	0029
8	-00.06	00.06	-00.00	08.00	0316	10.35	2213	10.49	0213	10.40	0107	0203	0025
9	-00.10	-00.04	-00.06	07.93	0309	10.28	1813	10.37	0513	10.33	0099	0188	0018
10	-00.08	-00.02	-00.05	07.93	0310	10.35	0013	10.47	1213	10.42	0102	0193	0019
11	-00.14	-00.04	-00.09	07.89	0306	10.29	1813	10.45	0113	10.35	0098	0186	0015
12	-00.12	-00.08	-00.10	07.86	0304	10.26	1913	10.36	0313	10.30	0096	0182	0013
13	-00.08	-00.01	-00.05	07.92	0309	10.35	0413	10.39	2013	10.37	0102	0193	0019
14	-00.12	-00.06	-00.08	07.88	0305	10.31	2213	10.40	0713	10.35	0098	0186	0015
15	-00.09	00.03	-00.03	07.94	0311	10.34	0013	10.48	0713	10.40	0104	0197	0021
16	-00.08	00.07	-00.00	07.97	0315	10.35	1713	10.50	0913	10.42	0108	0205	0025
17	-00.14	-00.07	-00.10	07.84	0302	10.35	0913	10.42	2113	10.38	0095	0180	0012
18	-00.16	-00.11	-00.13	07.80	0298	10.40	0813	10.49	1913	10.44	0091	0172	0008
19	-00.15	-00.08	-00.11	07.82	0301	10.46	1713	10.52	0713	10.49	0094	0178	0011
20	-00.12	-00.02	-00.07	07.87	0306	10.51	0013	10.63	0813	10.58	0099	0188	0016
21	-00.09	00.06	-00.03	07.92	0311	10.60	2013	10.74	0713	10.64	0105	0199	0022
22	-00.07	00.05	-00.02	07.93	0312	10.61	2213	10.74	0813	10.66	0106	0201	0023
23	-00.10	00.00	-00.04	07.90	0309	10.57	2213	10.69	0213	10.62	0102	0193	0020
24	-00.12	-00.07	-00.09	07.83	0303	10.55	1313	10.64	2313	10.57	0097	0184	0014
25	-00.09	00.01	-00.04	07.89	0309	10.59	1413	10.72	0613	10.66	0103	0195	0020
26	-00.14	-00.05	-00.08	07.83	0303	10.59	2011	10.68	0311	10.62	0096	0182	0014
27	-00.14	-00.08	-00.11	07.80	0299	10.55	1111	10.62	2311	10.58	0094	0178	0011
28	-00.12	-00.03	-00.08	07.84	0304	10.57	1911	10.66	0911	10.62	0099	0188	0016
29	-00.09	00.02	-00.05	07.87	0307	10.63	0011	10.77	0811	10.69	0102	0193	0019
30	-00.11	00.05	-00.04	07.88	0309	10.72	2311	10.83	0811	10.76	0103	0195	0020
31	-00.10	-00.03	-00.06	07.84	0305	10.68	1011	10.78	2311	10.72	0100	0190	0017
31	-00.16	00.13	-00.05	07.90	0308	10.24	1813	10.83	0811	10.48	0100	0190	0018

TABLE 6.7

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

APRIL, 1981

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
1	-00.10	-00.02	-00.05	07.86	0307	10.67	2211	10.81	0111	10.72	0102	0193	0019
2	-00.09	-00.04	-00.07	07.83	0304	10.69	0011	10.79	2311	10.73	0099	0188	0016
3	-00.07	00.06	-00.01	07.90	0311	10.79	1411	10.89	0711	10.84	0107	0203	0023
4	-00.06	00.12	00.00	07.94	0316	10.86	1511	11.04	0811	10.93	0110	0209	0027
5	-00.08	00.12	00.00	07.94	0316	10.92	2211	11.11	0711	10.99	0111	0210	0027
6	-00.07	00.06	-00.00	07.91	0312	10.92	0011	11.04	2311	10.97	0108	0205	0025
7	00.11	00.36	00.24	08.24	0346	11.11	0011	11.38	0811	11.28	0142	0269	0059
8	00.22	00.48	00.33	08.31	0356	11.32	2211	11.56	0711	11.42	0153	0290	0069
9	00.22	00.35	00.28	08.25	0350	11.33	0011	11.54	2311	11.44	0147	0279	0063
10	00.28	00.54	00.38	08.37	0362	11.55	1511	11.75	0611	11.63	0160	0304	0076
11	00.21	00.51	00.34	08.31	0356	11.53	1711	11.77	0511	11.62	0154	0292	0070
12	00.21	00.45	00.31	08.28	0353	11.54	1511	11.71	0711	11.61	0151	0286	0066
13	00.25	00.49	00.33	08.30	0355	11.59	1311	11.75	0711	11.64	0154	0292	0069
14	00.28	00.51	00.36	08.34	0359	11.63	1411	11.78	0711	11.69	0159	0302	0074
15	00.25	00.51	00.36	08.33	0358	11.62	1611	11.81	0511	11.70	0158	0300	0073
16	00.26	00.53	00.42	08.41	0366	11.48	1326	11.81	0511	11.70	0166	0315	0081
16	-00.10	00.54	00.19	08.15	0339	10.67	2211	11.81	0511	11.30	0136	0258	0052

TABLE 6.8

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

MAY, 1981

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
21	07.13	08.03	07.49	08.29	0198	11.42	1458	11.76	2358	11.52	0090	0140	0107
22	05.84	08.02	06.99	08.25	0187	11.46	1058	12.41	0458	11.87	0091	0146	0108
23	06.44	09.15	07.76	08.20	0189	11.40	1858	11.97	0558	11.64	0092	0143	0110
24	07.07	09.71	08.52	08.26	0199	11.02	2358	11.74	0558	11.35	0100	0151	0117
25	08.61	11.70	10.02	08.19	0202	10.47	1858	11.23	0658	10.84	0096	0137	0110
26	08.36	10.73	09.79	08.22	0212	02.36	2358	11.21	0658	06.12	0092	0135	0106
27	08.91	10.08	09.41	08.05	0205	01.87	1658	02.34	0258	02.05	0077	0113	0089
28	07.61	08.84	08.02	07.69	0180	00.96	1958	02.02	0358	01.47	0047	0071	0056
29	~~04.57~~5.61	09.73	~~07.84~~8.26	07.77	0194	00.37	0858	02.64	1358	02.00	0057	0089	0070
30	08.70	11.90	10.37	08.16	0231	02.41	0958	02.89	0558	02.59	0102	0145	0116
31	08.57	11.29	09.99	08.10	0228	01.81	1458	05.28	2058	02.98	0108	0158	0125
31	~~04.57~~5.61	11.90	08.74	08.10	0202	00.37	0858	12.41	0458	06.76	0086	0130	0101

TABLE 6.9

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

JUNE, 1981

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
1	08.14	09.79	09.01	08.17	0219	02.76	1958	05.35	0558	03.74	0113	0166	0133
2	08.43	10.62	09.41	08.29	0229	02.13	1758	03.20	0058	02.55	0134	0197	0157
3	08.86	10.70	09.70	08.29	0227	02.12	0958	02.43	0458	02.27	0144	0211	0169
4	08.47	09.99	09.19	08.18	0218	01.73	1124	02.48	0324	02.09	0145	0213	0172
5	07.94	09.13	08.33	07.98	0209	01.41	1724	02.03	0724	01.74	0142	0215	0171
6	06.67	09.22	08.02	07.77	0199	00.11	1024	01.67	2324	01.08	0136	0206	0167
7	07.26	11.16	08.93	07.95	0221	01.04	1024	01.82	2324	01.54	0164	0248	0196
8	08.74	10.27	09.44	08.23	0252	01.02	2224	02.00	0624	01.48	0199	0292	0235
9	06.53	10.72	08.61	07.57	0235	-00.03	1224	01.08	2353	00.83	0138	0209	0167
10	09.05	11.25	10.15	07.17	0255	01.02	0953	01.49	1353	01.18	0093	0132	0105
11	09.36	11.90	10.62	07.13	0260	00.77	1853	01.10	0453	00.92	0092	0131	0104
12	10.12	13.57	11.85	07.10	0266	00.62	1853	00.91	0553	00.74	0093	0129	0103
13	11.64	13.37	12.45	07.11	0274	00.63	1553	00.81	0553	00.70	0098	0132	0107
14	11.26	12.36	11.85	07.10	0277	00.72	0053	00.99	2353	00.81	0098	0136	0108
15	10.97	12.89	11.83	07.06	0276	00.87	2053	01.17	0753	01.00	0095	0131	0105
16	11.02	13.91	12.56	07.07	0277	00.72	2153	00.99	0553	00.83	0097	0131	0106
17	12.12	13.61	12.86	07.08	0279	00.67	1853	00.87	0553	00.75	0102	0137	0111
18	11.68	13.67	12.66	07.10	0289	00.66	1053	01.27	1250	00.99	0106	0143	0115
19	11.73	13.16	12.40	07.15	0303	01.12	1950	01.38	0650	01.23	0111	0150	0121
20	11.50	12.24	11.88	07.18	0305	01.18	0150	01.29	0950	01.23	0114	0158	0125
21	10.99	12.30	11.66	07.14	0300	01.25	1850	01.40	0750	01.31	0110	0152	0123
22	10.43	12.83	11.81	07.13	0305	01.16	1950	01.48	0550	01.29	0113	0156	0125
23	11.26	13.14	12.19	07.07	0303	01.22	1650	01.37	0650	01.29	0111	0150	0123
24	11.36	12.76	12.03	07.02	0304	01.36	0250	01.60	1050	01.51	0083	0112	0091
25	09.40	11.97	10.68	07.07	0316	01.47	2150	01.60	1150	01.53	0058	0082	0064
26	07.22	09.29	08.34	07.07	0315	01.40	1750	01.60	0850	01.50	0066	0100	0077
27	06.39	07.28	06.78	06.96	0307	01.38	1550	01.57	2350	01.59	0079	0127	0096
28	06.15	07.27	06.72	06.78	0285	01.39	2150	02.14	0450	01.80	0069	0111	0085
29	06.64	07.99	07.19	06.69	0283	00.56	1350	01.45	0050	00.95	0068	0106	0084
30	06.74	09.13	07.82	06.54	0273	-00.07	1050	00.83	0050	00.38	0054	0084	0067
30	06.15	13.91	010.23	07.34	0269	-00.07	1050	05.35	0558	01.36	0107	0155	0124

TABLE 6.10

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

AUGUST, 1981

JD	DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
217	5	10.64	11.20	10.94	07.13	0098	10.73	2129	12.43	1429	11.26	0096	0137	0133
	6	10.03	10.84	10.42	07.17	0089	09.88	2129	11.95	1629	10.91	0103	0147	0142
	7	09.46	10.24	09.70	07.19	0092	09.52	1529	11.87	0129	10.72	0105	0154	0146
	8	08.66	09.36	08.97	07.17	0090	10.84	0829	13.08	2029	11.88	0099	0150	0141
	9	08.34	09.16	08.73	07.29	0091	12.07	2229	12.89	1129	12.46	0096	0145	0136
222	10	08.26	08.98	08.65	07.29	0094	11.77	0629	12.96	2129	12.48	0095	0143	0136
	11	07.86	09.07	08.41	07.24	0098	12.18	1829	13.61	1029	12.69	0097	0146	0138
	12	~~02.77~~ 08.24	08.87✓	~~05.23~~ 8.52	~~08.26~~ 7.24	~~0095~~ 104	~~11.36~~ 12.15	~~1848~~ 0029	12.97✓	0929✓	~~12.24~~ 12.60	~~0123~~ 101	~~0205~~ 144	~~0154~~ 144
	13	~~02.75~~ 07.49	07.80✓	~~05.54~~ 7.70	~~08.30~~ 7.74	~~0128~~ 144	~~10.68~~ 10.88	~~1449~~ 1449	~~12.49~~ 11.50	~~0848~~ 2049	~~11.64~~ 11.29	~~0127~~ 110	~~0211~~ 161	~~0171~~ 167
	14	06.95	07.51	07.22	07.72	0157	11.32	2349	12.08	0449	11.63	0110	0171	0168
227	15	06.17	07.14	06.53	07.68	0164	11.07	0049	12.41	0549	11.67	0110	0177	0168
	16	05.45	06.14	05.77	07.64	0167	11.52	0149	12.27	0949	11.78	0110	0183	0170
	17	04.76	06.40	05.52	07.61	0165	10.40	2249	12.64	0249	11.59	0111	0185	0175
	18	05.90	07.43	06.60	07.51	0158	09.48	2249	11.07	0449	10.33	0110	0177	0174
	19	07.03	07.81	07.35	07.43	0155	09.39	1849	10.08	0549	09.22	0110	0171	0173
232	20	06.83	07.36	07.02	07.37	0152	09.20	0349	10.83	2049	10.07	0102	0159	0162
	21	06.26	07.58	06.94	07.29	0149	09.95	1449	11.64	0949	10.62	0086	0138	0142
	22	07.51	07.60	07.56	07.29	0157	09.74	2249	11.21	0349	10.35	0088	0137	0141
	23	06.94	07.81	07.38	07.21	0154	09.46	1549	10.66	0749	10.12	0085	0132	0140
	24	06.67	08.38	07.48	07.24	0161	09.14	2149	10.92	0749	09.86	0091	0142	0148
237	25	07.75	09.65	08.50	07.17	0168	07.10	1749	09.56	0049	08.52	0094	0142	0150
	26	08.84	10.83	09.68	07.12	0178	07.02	1249	08.98	0349	07.92	0098	0144	0153
	27	09.86	11.61	10.66	07.17	0189	06.25	1449	08.37	0749	07.36	0105	0150	0158
	28	10.46	11.58	11.01	07.20	0200	06.64	1649	08.22	0849	07.33	0106	0147	0157
	29	09.57	10.86	10.04	07.31	0215	06.75	1249	08.06	0649	07.41	0109	0155	0164
	30	09.60	10.24	09.93	07.32	0207	06.23	1349	08.27	2049	07.49	0106	0155	0161
243	31	09.04	10.04	09.47	07.42	0212	06.03	1449	08.21	0349	07.31	0113	0166	0171
	31	~~02.75~~ 04.76	11.61✓	~~08.19~~ 08.40	~~07.39~~ 07.34	~~0147~~ 0148	06.03✓	1449✓	13.61✓	1029✓	10.25✓	~~0103~~ 0102	~~0156~~ 0154	~~0154~~ 0154

TABLE 6.11

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

SEPTEMBER, 1981

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
1	07.59	09.16	08.34	07.70	0230	07.11	1949	08.69	0649	07.73	0136	0206	0203
2	07.05	08.05	07.41	07.71	0238	07.07	1949	09.39	0049	07.77	0139	0217	0213
3	06.75	07.97	07.29	07.52	0207	06.71	1249	12.55	2038	09.00	0122	0190	0190
4	07.22	08.13	07.60	07.42	0162	09.53	1338	12.29	0238	10.77	0102	0159	0154
5	07.23	08.32	07.70	07.40	0165	09.25	2038	11.77	1038	10.65	0100	0156	0152
6	06.92	07.80	07.39	07.41	0171	09.53	1738	11.38	0038	10.52	0099	0154	0150
7	06.30	07.35	06.69	07.43	0183	09.94	2038	11.82	0838	10.88	0100	0161	0153
8	05.69	06.81	06.28	07.40	0196	09.98	1738	11.82	0738	10.82	0094	0151	0147
9	05.61	06.60	06.10	07.47	0225	10.00	1838	11.68	0438	10.77	0100	0161	0154
10	06.14	07.05	06.57	07.38	0231	09.14	2138	11.69	0738	10.02	0096	0154	0150
11	05.72	06.67	06.14	07.37	0238	09.02	0038	11.68	0738	09.99	0095	0153	0149
12	05.61	06.49	06.08	07.27	0234	08.83	0038	11.79	1138	09.81	0087	0140	0140
13	05.15	06.37	05.72	07.37	0246	08.87	2338	11.07	2038	09.88	0094	0156	0149
14	04.59	06.07	05.21	07.38	0249	08.71	1638	12.06	1238	10.27	0096	0160	0153
15	05.01	06.02	05.48	07.33	0246	08.63	1930	11.69	1338	09.87	0093	0155	0149
16	05.63	07.19	06.36	07.40	0224	09.40	1130	11.54	0830	10.23	0102	0164	0159
17	06.00	07.20	06.67	07.48	0205	09.38	2128	10.54	0328	10.05	0107	0172	0165
18	06.29	06.93	06.60	07.51	0228	09.36	2328	10.13	1228	09.71	0108	0174	0167
19	06.37	06.81	06.51	07.51	0244	09.28	1928	09.95	1128	09.54	0109	0175	0168
20	05.86	06.36	06.14	07.48	0249	08.91	2328	10.01	2128	09.28	0104	0167	0162
21	05.42	06.31	05.77	07.51	0256	08.83	1828	09.93	0628	09.19	0106	0176	0164
22	04.62	05.56	05.06	07.53	0261	08.91	1928	09.65	0828	09.23	0107	0178	0166
23	03.96	04.98	04.30	07.56	0266	09.16	0028	09.57	0828	09.37	0109	0187	0171
24	02.70	04.16	03.26	07.58	0271	09.32	0128	09.72	0828	09.51	0110	0196	0175
25	02.15	03.18	02.72	07.60	0274	09.57	0128	10.08	2328	09.78	0113	0209	0181
26	00.50	01.95	01.02	07.73	0289	10.22	0028	10.92	0928	10.60	0122	0234	0194
27	00.30	00.84	00.46	07.77	0295	10.24	0828	11.07	2028	10.60	0127	0254	0203
28	00.28	00.44	00.36	07.67	0283	09.58	1228	10.80	2328	10.25	0118	0236	0194
29	00.28	00.48	00.37	07.70	0286	09.63	1628	10.84	0128	10.22	0122	0244	0200
30	00.23	00.42	00.32	07.64	0280	09.85	0628	10.70	2228	10.19	0117	0234	0195
30	00.23	09.16	05.19	07.50	0237	06.71	1249	12.55	2038	09.88	0107	0178	0169

NOTE : DISSOLVED OXYGEN DATA SHOULD BE DISMISSED DUE TO SENSOR MALFUNCTION

TABLE 6.12

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

OCTOBER, 1981

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
1	00.27	00.45	00.36	07.66	0281	09.93	0728	10.98	1728	10.43	0119	0238	0198
2	00.32	00.57	00.43	07.77	0291	09.92	0428	10.98	0028	10.30	0131	0262	0212
3	00.32	00.58	00.45	07.79	0296	10.12	0028	10.85	1028	10.47	0137	0274	0219
4	00.31	00.33	00.32	07.66	0282	10.15	1028	10.25	0028	10.20	0123	0246	0205
5	-00.26	-00.23	-00.23	06.54	0239	10.64	2345	12.32	1045	11.45	0064	0128	0143
6	-00.22	-00.14	-00.18	06.55	0242	10.45	1945	10.98	2245	10.58	0067	0134	0146
7	-00.22	-00.10	-00.15	06.61	0250	10.62	0045	11.84	0945	11.23	0072	0144	0151
8	-00.21	00.19	-00.09	06.56	0246	10.84	1145	13.34	1958	11.83	0071	0142	0151
9	00.06	00.46	00.22	06.53	0245	12.20	2058	13.36	0158	12.78	0071	0142	0154
10	00.06	00.41	00.23	06.51	0245	12.34	1958	12.90	1258	12.54	0069	0138	0152
11	00.04	00.12	00.08	06.52	0248	12.34	1958	13.22	1058	12.62	0071	0142	0155
12	00.04	00.87	00.33	06.47	0246	11.93	2258	13.14	1158	12.31	0067	0134	0149
13	00.70	01.39	01.06	06.46	0247	11.92	2158	12.96	0258	12.07	0066	0126	0146
14	01.29	02.08	01.68	06.46	0247	11.77	1858	12.69	1258	11.98	0067	0128	0144
15	01.23	02.12	01.69	06.47	0248	11.76	1958	12.35	1058	11.98	0067	0128	0143
16	01.13	01.98	01.62	06.48	0247	11.87	2058	12.63	1758	12.11	0069	0132	0146
17	01.23	01.79	01.57	06.47	0244	11.74	2058	12.12	0958	11.93	0068	0130	0146
18	01.36	01.60	01.51	06.47	0246	11.76	0058	12.02	0358	11.89	0070	0134	0147
18	-00.26	02.12	00.60	06.77	0255	09.92	0428	13.36	0158	11.59	0081	0162	0161

NOTE: DISSOLVED OXYGEN VALUES ARE LOW

UNIT MALFUNCTION ON 10/18/81

NO DATA AVAILABLE THROUGH 11/2/81

TABLE 6.13

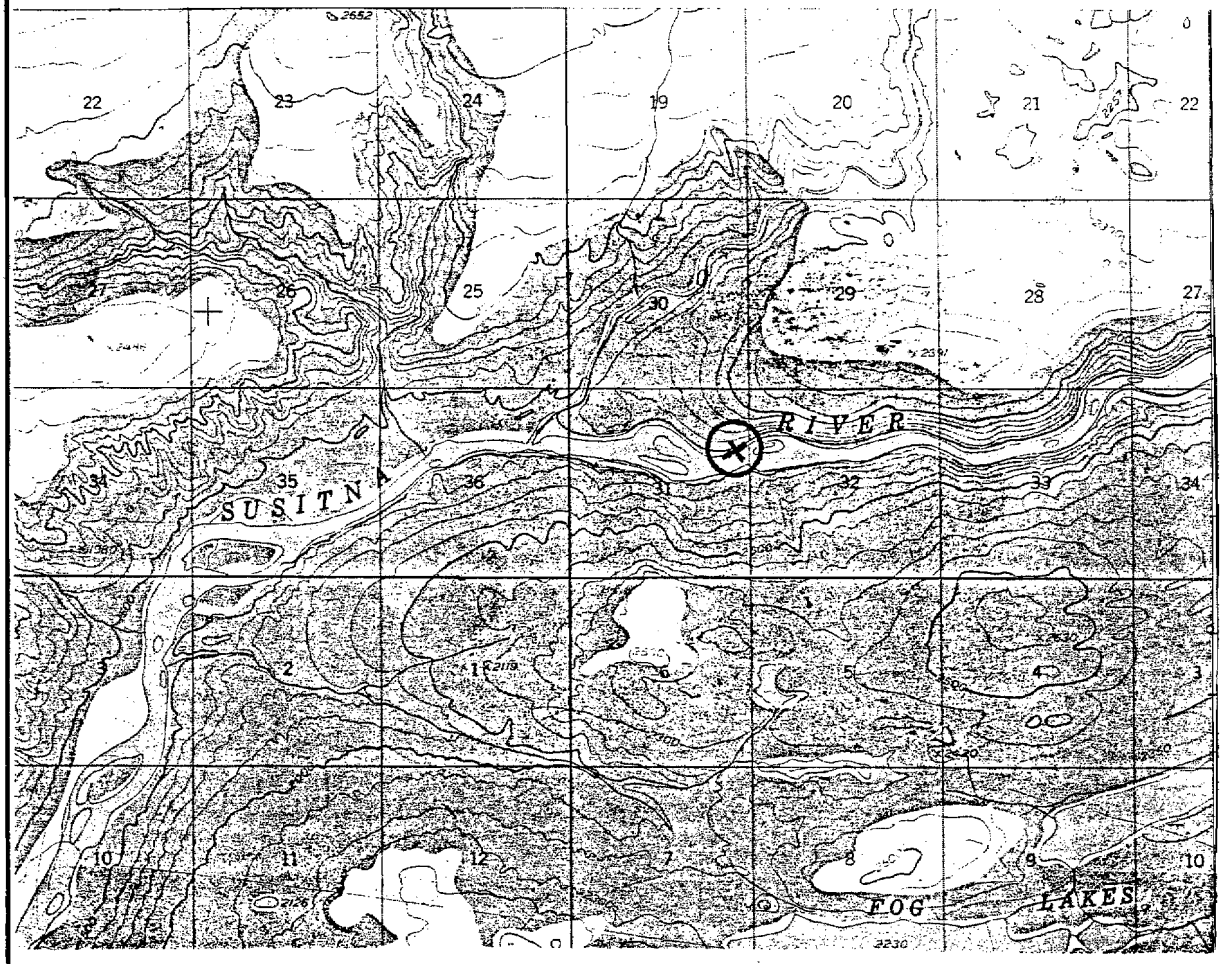
R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

NOVEMBER, 1981

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
3	00.20	00.25	00.22	06.64	0240	12.92	1005	13.53	1605	13.21	0117	0234	0222
4	00.13	00.23	00.16	06.56	0238	12.55	1105	12.95	0005	12.70	0108	0216	0212
5	00.16	00.27	00.21	06.63	0247	12.61	0005	13.15	1605	12.88	0110	0220	0211
6	00.18	00.34	00.26	06.72	0261	12.97	0505	13.60	1605	13.25	0121	0242	0223
7	00.12	00.28	00.19	06.62	0258	13.07	2305	13.37	0005	13.19	0113	0226	0216
8	00.11	00.22	00.16	06.58	0256	12.84	2205	13.11	0305	12.98	0107	0214	0209
9	00.11	00.21	00.15	06.56	0258	12.84	2305	13.29	1505	13.01	0104	0208	0204
10	00.05	00.16	00.09	06.47	0250	12.47	2205	13.09	1305	12.75	0089	0178	0184
11	00.05	00.17	00.09	06.47	0250	12.45	0105	13.05	1405	12.66	0086	0172	0179
12	00.04	00.17	00.10	06.48	0252	12.53	0205	13.23	1405	12.80	0088	0176	0182
13	00.14	00.29	00.23	06.68	0274	12.89	0105	13.50	1405	13.18	0111	0222	0207
14	00.23	00.32	00.25	06.71	0278	13.22	0105	13.72	1405	13.51	0119	0238	0219
15	00.26	00.35	00.29	06.76	0283	13.56	0305	13.96	1405	13.71	0129	0258	0235
16	00.22	00.31	00.25	06.72	0279	13.61	0505	13.84	2305	13.74	0132	0264	0242
17	00.22	00.37	00.28	06.77	0283	13.79	2205	14.00	1105	13.88	0138	0276	0248
18	00.22	00.32	00.26	06.75	0282	13.78	0205	13.97	1405	13.86	0138	0276	0250
19	00.25	00.38	00.31	06.82	0291	13.72	1705	13.90	0805	13.82	0146	0292	0261
20	00.28	00.38	00.31	06.81	0292	13.71	0605	13.84	0005	13.76	0148	0296	0264
21	00.27	00.42	00.35	06.86	0295	13.60	2205	13.86	0305	13.73	0154	0308	0271
22	00.24	00.32	00.27	06.74	0282	13.50	0905	13.95	1505	13.65	0149	0298	0272
23	00.12	00.26	00.18	06.63	0273	13.19	1305	13.49	0105	13.34	0134	0268	0254
24	00.09	00.21	00.13	06.57	0268	09.64	2305	12.60	0005	10.02	0126	0252	0245
25	00.09	00.24	00.13	06.56	0269	07.93	2305	10.05	0005	09.01	0122	0244	0237
26	00.06	00.22	00.11	06.53	0267	06.60	2005	08.04	0905	07.30	0115	0230	0227
27	00.05	00.10	00.07	06.47	0264	09.73	2305	10.55	0705	10.21	0103	0206	0209
28	00.05	00.11	00.07	06.48	0264	07.89	0805	09.69	1505	08.93	0100	0200	0203
29	00.08	00.17	00.12	06.56	0272	08.69	2105	09.73	1405	09.32	0105	0210	0205
30	00.08	00.16	00.11	06.54	0271	08.31	1405	09.61	0805	09.01	0101	0202	0201
30	00.04	00.42	00.20	06.63	0268	06.60	2005	14.00	1105	12.26	0118	0237	0225



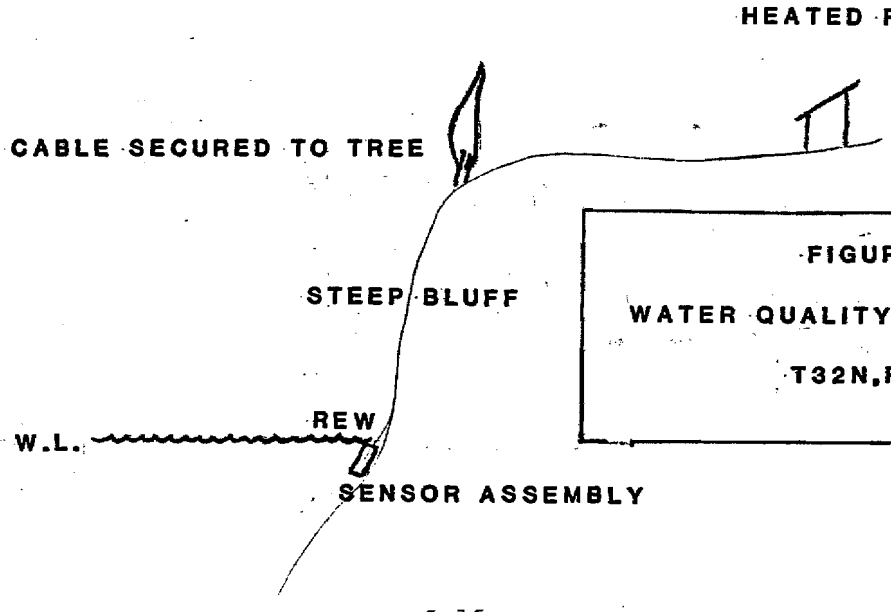


FIGURE 6.1

WATER QUALITY MONITOR SITE

T32N,R5E,S31

Prepared by: R&M CONSULTANTS, INC.

Prepared for: ACRES

ATTACHMENT A

HISTORICAL WATER TEMPERATURE DATA

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY PROCESS DATE IS 02-13-80

STATION NUMBER 15292000 SUSITNA RIVER AT GOLD CREEK AK STREAM SOURCE AGENCY USGS
LATITUDE 624604 LONGITUDE 1494128 DRAINAGE AREA 6160.00 DATUM 676.50 STATE 02 COUNTY 170

TEMPERATURE (DEG. C) OF WATER, WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
1							---	---	12.5	10.0	10.5	10.5
2							---	---	12.0	10.0	10.5	10.0
3							---	---	11.0	10.0	10.5	9.5
4							---	---	13.0	10.0	10.0	9.0
5							---	---	13.5	10.0	9.0	8.0
6							---	---	13.0	10.0	8.0	7.5
7							---	---	11.5	11.0	8.0	7.0
8							---	---	11.5	10.0	8.0	7.0
9							---	---	11.0	9.5	8.0	7.0
10							---	---	11.0	9.0	8.0	7.5
11							---	---	11.5	10.0	8.0	7.5
12							---	---	10.5	9.5	8.0	6.5
13							---	---	11.0	9.5	8.5	8.0
14							---	---	12.5	10.0	8.5	8.0
15							---	---	13.5	11.5	8.5	8.0
16							---	---	13.5	11.5	8.0	8.0
17							---	---	12.5	11.5	8.0	7.5
18							---	---	12.5	10.5	8.0	7.0
19							---	---	11.5	9.5	7.5	7.5
20							---	---	10.5	8.5	7.5	7.5
21							---	---	10.0	8.0	7.5	7.5
22							---	---	9.0	7.0	7.5	7.5
23							---	---	8.0	5.5	7.5	7.0
24							---	---	8.0	6.0	7.0	7.0
25							---	---	8.0	7.0	7.5	7.0
26							---	---	8.0	7.5	7.0	7.0
27							---	---	8.0	7.5	7.0	6.5
28							---	---	9.5	8.0	6.5	6.0
29							---	---	10.0	9.5	6.0	5.5
30							14.5	12.5	10.5	9.5	6.0	6.0
31							13.0	10.0	10.5	10.0	---	---
MONTH							14.5	10.0	13.5	5.5	10.5	5.5
YEAR	14.5	5.5										

NOTE: NUMBER OF MISSING DAYS OF RECORD EXCEEDED 20% OF YEAR

STATION NUMBER 15292000 SUSITNA RIVER AT GOLD CREEK AK STREAM SOURCE AGENCY USGS
LONGITUDE 1494128 DRAINAGE AREA 6160.00 DATUM 676.50 STATE 02 COUNTY 170

STATION NUMBER 15292000 SUSITNA RIVER AT GOLD CREEK AK STREAM SOURCE AGENCY USGS
LATITUDE 624604 LONGITUDE 1494128 DRAINAGE AREA 6160.00 DATUM 676.50 STATE 02 COUNTY 170

TEMPERATURE (DEG. C) OF WATER, WATER YEAR OCTOBER 1974 TO SEPTEMBER 1975

DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
	OCTOBER		NOVEMBER		DECEMBER		JANUARY		FEBRUARY		MARCH	
1	6.0	5.5	2.5	2.0								
2	6.5	6.0	2.5	2.0								
3	6.0	5.0	2.5	1.5								
4	5.0	4.5	2.0	1.0								
5	5.5	5.0	1.0	1.0								
6	6.5	5.5	1.0	1.0								
7	6.5	6.0	1.0	.5								
8	6.5	6.0	1.0	1.0								
9	6.0	5.5	1.0	.5								
10	6.0	5.5	1.0	.5								
11	5.5	5.0	1.0	1.0								
12	5.0	4.5	1.5	1.0								
13	5.0	4.5	1.5	1.0								
14	5.5	5.0	1.0	1.0								
15	5.5	4.5	1.0	1.0								
16	5.0	4.5	1.5	1.0								
17	5.0	4.0	1.0	1.0								
18	4.0	3.5	---	---								
19	4.0	3.5	---	---								
20	3.5	3.0	---	---								
21	3.0	3.0	---	---								
22	3.0	1.0	---	---								
23	3.5	2.5	---	---								
24	4.0	3.5	---	---								
25	3.5	2.5	---	---								
26	2.5	2.0	---	---								
27	2.0	2.0	---	---								
28	2.0	1.5	---	---								
29	1.5	1.5	---	---								
30	2.5	1.5	---	---								
31	2.0	1.5	---	---								
MONTH	6.5	1.0	2.5	.5								

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY PROCESS DATE IS 02-13-80

STATION NUMBER 15292000 SUSITNA RIVER AT GOLD CREEK AK STREAM SOURCE AGENCY USGS
LATITUDE 624604 LONGITUDE 1494128 DRAINAGE AREA 6160.00 DATUM 676.50 STATE 02 COUNTY 170

TEMPERATURE (DEG. C) OF WATER, WATER YEAR OCTOBER 1974 TO SEPTEMBER 1975

DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
1			---	---					---	---	9.0	7.0
2			---	---					---	---	9.0	7.5
3			---	---					---	---	9.5	7.5
4			---	---					---	---	9.0	7.5
5			---	---					---	---	7.5	6.0
6			---	---					---	---	7.0	6.0
7			---	---					---	---	7.0	6.0
8			---	---					---	---	6.5	5.0
9			---	---					---	---	6.5	5.5
10			---	---					---	---	6.0	5.0
11			---	---					---	---	6.0	5.5
12			---	---					---	---	6.0	5.0
13			---	---					---	---	5.5	4.5
14			---	---					---	---	6.0	4.0
15			---	---					---	---	6.0	4.5
16			---	---					---	---	6.0	5.5
17			---	---					---	---	6.0	5.5
18			---	---					---	---	6.5	6.0
19			2.0	1.5					---	---	6.0	3.5
20			3.5	1.0					---	---	6.0	5.0
21			4.0	1.5					---	---	6.0	5.5
22			2.5	1.5					---	---	6.0	5.0
23			4.0	1.5					---	---	6.0	4.0
24			4.0	1.5					---	---	6.0	5.0
25			4.0	2.5					10.5	9.5	5.5	5.5
26			6.0	2.0					9.5	8.5	---	---
27			5.0	3.5					10.0	7.5	---	---
28			5.0	3.5					8.5	6.5	---	---
29			5.0	3.5					9.0	6.0	---	---
30			---	---					8.0	7.0	---	---
31			---	---					8.5	7.0	---	---
MONTH			6.0	1.0					10.5	6.0	9.5	3.5

YEAR 10.5 .5

NOTE: NUMBER OF MISSING DAYS OF RECORD EXCEEDED 20% OF YEAR

STREAM SOURCE AGENCY USGS
STATE 02 COUNTY 170

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY PROCESS DATE IS 02-13-80

STATION NUMBER 15292000 SUSITNA RIVER AT GOLD CREEK AK STREAM SOURCE AGENCY USGS
LATITUDE 624604 LONGITUDE 1494128 DRAINAGE AREA 6160.00 DATUM 676.50 STATE 02 COUNTY 170

TEMPERATURE (DEG. C) OF WATER, WATER YEAR OCTOBER 1975 TO SEPTEMBER 1976

DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
1			---	---	6.5	2.5	9.5	8.0	---	---	---	---
2			---	---	6.0	2.5	10.0	8.0	---	---	---	---
3			---	---	6.0	3.0	9.5	8.0	---	---	---	---
4			---	---	6.0	3.0	8.5	6.5	---	12.0	10.5	8.0
5			---	---	4.5	3.5	7.5	6.0	13.0	12.5	11.0	7.5
6			---	---	5.0	3.5	---	---	---	11.5	11.0	8.0
7			---	---	5.5	3.5	12.0	11.0	---	11.0	10.5	8.0
8			---	---	5.5	3.0	13.5	10.0	11.5	10.5	11.0	9.5
9			---	---	5.5	3.5	13.0	9.5	10.5	9.5	11.5	9.0
10			---	---	6.0	3.5	13.5	10.0	---	9.5	11.0	9.5
11			1.0	.5	6.5	3.5	13.5	10.5	---	10.5	10.5	8.5
12			1.0	.5	7.0	3.5	11.5	10.5	---	---	10.5	9.5
13			1.0	.5	7.5	4.0	11.5	10.5	---	10.5	---	7.0
14			1.5	.5	8.0	5.0	11.0	10.5	---	---	---	---
15			2.0	.5	8.5	5.5	12.0	10.5	---	12.0	---	---
16			2.0	.5	7.5	4.0	12.5	9.5	---	9.5	---	---
17			2.5	.5	6.5	5.0	13.0	9.5	---	9.5	---	---
18			2.5	1.5	7.5	4.5	---	9.5	---	---	---	---
19			2.5	1.0	8.5	5.0	---	11.0	11.0	9.5	---	---
20			3.5	1.5	8.5	5.0	---	10.5	---	7.5	---	---
21			3.5	2.5	9.5	4.0	---	10.0	---	---	---	---
22			4.0	2.5	7.5	6.0	13.5	10.0	---	---	---	---
23			3.0	2.5	9.0	6.5	12.0	10.5	---	---	---	---
24			4.0	2.0	10.5	6.5	11.5	10.0	---	---	---	---
25			5.0	2.0	10.5	7.5	---	10.0	---	---	---	---
26			5.0	3.5	12.0	8.0	---	10.5	---	---	---	---
27			4.5	3.0	12.0	8.5	---	10.0	---	---	---	---
28			5.5	3.5	11.5	9.0	---	---	---	---	---	---
29			6.0	3.0	12.0	9.5	---	10.5	---	---	---	---
30			6.0	3.5	12.5	9.0	---	11.5	---	---	---	---
31			7.0	2.5	---	---	---	11.0	---	---	---	---
MONTH			7.0	.5	12.5	2.5	13.5	6.0	13.0	7.5	11.5	7.0
YEAR	13.5	.5										

NOTE: NUMBER OF MISSING DAYS OF RECORD EXCEEDED 20% OF YEAR

STATION NUMBER 15292000 ... DRAINAGE AREA 6160.00 DATUM 676.50 STATE 02 COUNTY 170

15292000 SUSITNA RIVER AT GOLD CREEK --Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1976 TO SEPTEMBER 1977

DATE	TOTAL MOLYB-DENUM (MO) (UG/L)	TOTAL NICKEL (NI) (UG/L)	TOTAL SELE-NIUM (SE) (UG/L)	TOTAL SILVER (AG) (UG/L)	TOTAL ZINC (ZN) (UG/L)	SUS-PENDED SEDI-MENT (MG/L)	SUS-PENDED SEDI-MENT DIS-CHARGE (T/DAY)	SUS. SED. FALL DIAM. % FINER THAN .002 MM	SUS. SED. FALL DIAM. % FINER THAN .004 MM	SUS. SED. FALL DIAM. % FINER THAN .008 MM	SUS. SED. FALL DIAM. % FINER THAN .016 MM	SUS. SED. FALL DIAM. % FINER THAN .031 MM
OCT												
01...	--	--	--	--	--	10	144	--	--	--	--	--
MAY												
10...	--	--	--	--	--	120	1220	--	--	--	--	--
18...	--	--	--	--	--	1110	42600	7	9	17	27	44
JUN												
14...	1	50	0	<10	80	915	128000	2	4	6	11	22
JUL												
28...	--	--	--	--	--	394	22300	14	19	29	44	54
AUG												
10...	0	<50	1	<10	80	656	35400	13	19	27	39	52

DATE	SUS. SED. FALL DIAM. % FINER THAN .062 MM	SUS. SED. FALL DIAM. % FINER THAN .125 MM	SUS. SED. FALL DIAM. % FINER THAN .250 MM	SUS. SED. FALL DIAM. % FINER THAN .500 MM	SUS. SED. FALL DIAM. % FINER THAN 1.00 MM	SUS. SED. SIEVE DIAM. % FINER THAN .062 MM	SUS. SED. SIEVE DIAM. % FINER THAN .125 MM	SUS. SED. SIEVE DIAM. % FINER THAN .250 MM	SUS. SED. SIEVE DIAM. % FINER THAN .500 MM	SUS. SED. SIEVE DIAM. % FINER THAN 1.00 MM	SUS. SED. SIEVE DIAM. % FINER THAN 2.00 MM
OCT											
01...	--	--	--	--	--	--	--	--	--	--	--
MAY											
10...	--	--	--	--	--	44	64	87	99	100	--
18...	--	--	--	--	--	63	76	90	99	100	--
JUN											
14...	40	62	84	97	100	--	--	--	--	--	--
JUL											
28...	--	--	--	--	--	70	80	92	99	100	--
AUG											
10...	--	--	--	--	--	65	74	86	95	98	99

TEMPERATURE (DEG. C) OF WATER, WATER YEAR OCTOBER 1976 TO SEPTEMBER 1977

DAY	APRIL MAX	APRIL MIN	MAY MAX	MAY MIN	JUNE MAX	JUNE MIN	JULY MAX	JULY MIN	AUGUST MAX	AUGUST MIN	SEPTEMBER MAX	SEPTEMBER MIN
1			---	---	6.5	3.5	9.5	7.5				
2			---	---	6.5	3.5	10.0	7.5				
3			---	---	7.0	4.0	9.0	7.0				
4			---	---	5.0	3.5	9.0	7.0				
5			---	---	5.0	3.0	9.0	7.0				
6			---	---	5.5	3.5	10.5	7.5				
7			---	---	6.0	4.0	11.5	8.5				
8			---	---	6.0	3.5	12.0	9.0				
9			---	---	5.5	4.0	---	---				
10			---	---	6.0	4.0	---	---				
11			---	---	5.0	3.5	---	---				
12			---	---	4.0	3.0	---	---				
13			---	---	5.5	3.0	---	---				
14			---	---	5.5	3.5	---	---				
15			---	---	5.0	4.0	---	---				
16			---	---	6.0	4.5	---	---				
17			---	---	6.5	4.5	---	---				
18			---	---	5.0	4.0	---	---				
19			---	---	6.5	4.0	---	---				
20			---	---	7.5	4.5	---	---				
21			---	---	7.5	5.0	---	---				
22			---	---	6.5	5.0	---	---				
23			---	---	7.0	5.5	---	---				
24			5.0	3.5	8.5	6.0	---	---				
25			6.0	2.5	9.0	7.0	---	---				
26			7.0	3.0	9.0	7.0	---	---				
27			7.0	4.0	9.0	6.0	---	---				
28			7.0	4.0	10.0	7.5	---	---				
29			5.5	4.0	9.5	8.0	---	---				
30			5.5	3.5	9.5	7.5	---	---				
31			6.5	4.0	---	---	---	---				
MONTH			7.0	2.5	10.0	3.0	12.0	7.0				

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY PROCESS DATE IS 02-13-80

STATION NUMBER 15292000 SUSITNA RIVER AT GOLD CREEK AK STREAM SOURCE AGENCY USGS
LATITUDE 624604 LONGITUDE 1494128 DRAINAGE AREA 6160.00 DATUM 676.50 STATE 02 COUNTY 170

TEMPERATURE (DEG. C) OF WATER, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

PROVISIONAL DATA

DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
1					---	---	10.5	9.5	---	---	11.5	10.5
2					---	---	11.0	10.0	---	---	12.0	10.0
3					---	---	11.0	10.0	---	---	12.0	10.5
4					---	---	11.5	10.5	---	---	11.5	10.0
5					---	---	12.0	11.5	---	---	10.5	9.5
6					---	---	11.5	10.5	---	---	10.5	9.0
7					---	---	12.0	10.5	---	---	9.5	8.5
8					---	---	12.5	10.5	---	---	10.0	8.5
9					---	---	11.5	10.5	---	---	9.5	9.0
10					---	---	---	---	---	---	9.5	9.0
11					---	---	---	---	---	---	10.0	9.0
12					---	---	---	---	---	---	9.5	9.0
13					---	---	---	---	---	---	9.0	8.0
14					---	---	---	---	11.5	11.0	8.5	7.5
15					10.0	9.5	---	---	12.5	11.0	8.5	7.5
16					9.5	8.5	---	---	12.0	11.5	9.0	7.5
17					8.5	7.5	---	---	12.5	11.0	8.5	7.5
18					7.5	7.5	---	---	12.0	10.5	8.5	7.5
19					8.5	7.5	---	---	12.0	11.0	8.0	7.0
20					10.0	7.5	---	---	11.5	10.5	7.5	7.0
21					10.5	8.0	---	---	11.5	10.5	7.0	6.0
22					10.0	9.0	---	---	11.0	9.5	6.5	5.5
23					9.5	8.5	---	---	11.0	9.5	6.0	5.0
24					9.0	8.0	---	---	12.0	10.0	5.0	4.5
25					8.5	8.0	---	---	11.5	9.5	5.5	4.5
26					9.0	8.0	---	---	11.5	9.5	6.5	5.0
27					10.0	8.0	---	---	11.0	9.5	7.0	6.0
28					10.0	8.5	---	---	11.0	9.5	7.5	6.0
29					11.0	10.0	---	---	11.5	10.0	6.0	4.5
30					11.0	9.5	---	---	11.0	10.0	5.0	3.5
31					---	---	---	---	11.0	9.5	---	---
MONTH					11.0	7.5	12.5	9.5	12.5	9.5	12.0	3.5

YEAR 12.5 3.5

NOTE: NUMBER OF MISSING DAYS OF RECORD EXCEEDED 20% OF YEAR

15292000 SUSITNA RIVER AT GOLD CREEK--Continued

TEMPERATURE (DEG. C) OF WATER, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
	OCTOBER		NOVEMBER		DECEMBER		JANUARY		FEBRUARY		MARCH	
1	4.5	3.5	1.5	.0	.0	.0						
2	4.0	3.0	.5	.0	.5	.0						
3	3.0	2.5	.0	.0	.5	.0						
4	3.0	2.0	.0	.0	.5	.0						
5	3.5	3.0	1.0	.0	.5	.0						
6	4.5	3.5	1.0	.5	.5	.0						
7	4.0	3.5	1.0	.0	.5	.5						
8	4.5	4.0	.5	.0	.5	.5						
9	4.5	4.0	.0	.0	.5	.5						
10	4.0	3.0	.5	.0	.5	.5						
11	3.5	3.0	.5	.0	.5	.0						
12	3.0	1.5	.5	.0	.0	.0						
13	2.5	2.0	.5	.0	.0	.0						
14	2.5	1.5	.0	.0	.0	.0						
15	1.5	.5	.0	.0	.0	.0						
16	.5	.5	.0	.0	---	---						
17	1.0	.5	.0	.0	---	---						
18	2.0	.5	.0	.0	---	---						
19	1.5	1.0	.0	.0	---	---						
20	2.0	1.0	.0	.0	---	---						
21	1.5	.5	.0	.0	---	---						
22	1.0	.5	.0	.0	---	---						
23	1.5	.5	.0	.0	---	---						
24	1.5	.5	.0	.0	---	---						
25	1.5	.5	.0	.0	---	---						
26	2.5	1.0	.0	.0	---	---						
27	1.0	.5	.5	.0	---	---						
28	1.0	.5	.5	.5	---	---						
29	1.5	.5	.5	.0	---	---						
30	1.0	.5	.5	---	---	---						
31	1.0	.5	---	---	---	---						
MONTH	4.5	.5	1.5	.0	.5	.0						

DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
1			---	---	7.0	4.5	13.0	10.0	13.0	11.5	9.0	6.5
2			---	---	6.5	5.0	14.0	11.5	13.0	11.0	10.0	7.5
3			---	---	6.5	5.0	15.0	13.0	13.5	11.5	9.5	7.0
4			---	---	7.0	5.5	15.0	13.5	13.5	12.0	9.0	7.0
5			---	---	7.5	5.5	13.5	10.5	12.5	12.0	9.0	7.0
6			---	---	6.5	5.5	10.5	9.5	12.0	11.0	9.0	7.0
7			---	---	7.0	5.5	10.5	9.0	11.5	11.0	9.0	7.0
8			---	---	8.0	6.0	10.5	9.0	12.0	10.5	9.5	7.0
9			---	---	8.5	6.5	11.5	10.0	11.5	10.5	9.5	7.5
10			---	---	8.0	7.5	---	---	11.5	10.5	9.5	7.5
11			---	---	8.5	7.0	---	---	12.0	10.5	9.5	7.5
12			---	---	9.0	7.0	---	---	12.5	10.5	9.5	7.5
13			---	---	8.0	7.5	---	---	12.5	10.5	9.0	8.0
14			---	---	8.5	7.0	---	---	12.0	11.0	9.0	8.0
15			---	---	9.0	7.0	---	---	11.0	10.5	8.5	8.0
16			---	---	8.5	8.0	---	---	11.5	10.5	8.5	7.5
17			---	---	9.5	8.0	---	---	11.0	10.0	8.0	7.5
18			---	---	9.5	8.0	---	---	11.0	9.5	7.5	7.0
19			---	---	9.5	9.0	---	---	11.0	10.0	7.5	7.0
20			---	---	11.0	9.0	---	---	11.0	10.5	7.5	7.0
21			---	---	11.5	9.5	---	---	11.5	10.0	7.0	6.5
22			7.0	4.5	12.5	10.0	---	---	11.0	9.5	7.0	6.5
23			7.0	5.5	13.5	11.0	---	---	12.0	9.5	7.0	6.5
24			7.0	5.0	12.0	10.5	---	---	12.5	10.0	6.5	6.0
25			8.0	5.0	10.5	8.0	---	---	12.5	10.5	6.5	5.0
26			8.0	6.0	8.0	7.5	---	---	13.0	11.5	6.0	4.5
27			7.5	5.0	8.0	7.0	---	---	12.5	11.0	5.0	4.0
28			7.5	5.0	8.5	7.0	---	---	11.5	10.0	5.0	4.0
29			6.5	5.0	9.0	7.5	---	---	10.0	8.5	4.5	3.5
30			6.0	4.5	10.5	8.0	---	---	9.0	8.5	4.5	3.5
31			7.0	4.5	---	---	---	---	8.5	7.5	---	---
MONTH			8.0		13.5	4.5			13.5	7.5	10.0	3.5
YEAR	15.0	.0										

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY PROCESS DATE IS 06-05-81

STATION NUMBER 15292000 SUSITNA RIVER AT GOLD CREEK AK STREAM SOURCE AGENCY USGS
LATITUDE 624604 LONGITUDE 1494128 DRAINAGE AREA 6160.00 DATUM 676.50 STATE 02 COUNTY 170

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

PROVISIONAL DATA

DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
	OCTOBER		NOVEMBER		DECEMBER		JANUARY		FEBRUARY		MARCH	
1	5.0	4.0	1.5	.5								
2	5.0	4.0	2.5	.5								
3	5.0	4.0	2.5	1.5								
4	5.0	4.5	2.0	1.0								
5	5.0	4.5	2.5	1.0								
6	5.0	4.0	2.5	1.5								
7	5.0	4.0	2.5	1.5								
8	4.0	3.5	2.5	.5								
9	4.5	3.5	2.5	.5								
10	5.0	4.0	2.0	1.0								
11	4.5	4.0	2.0	1.0								
12	4.5	3.5	2.0	.5								
13	3.5	2.5	1.0	.5								
14	3.0	2.5	2.5	1.0								
15	3.0	2.5	2.0	.5								
16	3.0	2.5	1.5	.5								
17	2.5	2.0	2.0	1.0								
18	2.0	1.5	2.0	1.0								
19	2.5	.5	2.5	1.0								
20	3.0	1.0	3.0	2.0								
21	2.5	.5	2.0	1.0								
22	2.5	1.0	2.0	1.0								
23	3.0	1.0	1.5	1.5								
24	3.0	1.0	1.5	1.0								
25	3.0	1.0	1.5	1.0								
26	3.0	1.0	2.0	1.0								
27	3.0	1.0	2.0	1.0								
28	3.0	1.5	2.0	1.5								
29	3.0	1.0	1.5	1.0								
30	2.5	.5	1.5	1.0								
31	2.0	1.0	---	---								
MONTH	5.0	.5	3.0	.5								

PROVISIONAL RECORDS
SUBJECT TO REVISION

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY

STATION NUMBER 15292000 SUSITNA RIVER AT GOLD CREEK AK STREAM SOURCE AGENCY USGS
LATITUDE 624604 LONGITUDE 1494128 DRAINAGE AREA 6160.00 DATUM 676.50 STATE 02 COUNTY 170

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

ISIONAL DATA

DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
1			---	---	6.0	4.0	8.0	6.5	8.0	8.0	6.0	5.5
2			---	---	6.0	4.5	9.5	7.0	8.0	8.0	5.5	5.0
3			---	---	6.5	4.0	9.0	8.0	8.0	7.5	5.0	4.5
4			---	---	7.5	4.5	9.0	7.5	8.0	7.5	4.5	4.0
5			---	---	7.0	4.5	9.0	7.0	8.0	7.5	4.5	4.0
6			---	---	6.5	5.5	10.0	8.0	8.0	8.0	4.5	4.5
7			---	---	5.5	5.0	10.0	8.5	8.0	8.0	4.5	4.5
8			---	---	7.0	5.0	10.0	8.5	8.0	7.5	4.5	4.5
9			---	---	7.0	5.0	10.0	8.5	7.5	7.5	5.0	4.5
10			---	---	6.0	4.5	9.5	8.5	8.0	7.5	5.0	4.5
11			---	---	6.0	5.0	9.0	7.5	8.0	7.5	5.0	4.5
12			---	---	6.0	4.5	9.0	8.0	8.0	8.0	4.5	4.5
13			---	---	7.0	5.0	9.5	8.0	8.0	8.0	4.5	4.5
14			4.5	3.5	7.5	4.5	10.5	9.0	8.0	7.5	4.5	4.5
15			5.0	2.5	7.0	5.5	10.5	9.0	7.5	7.0	5.5	5.0
16			5.5	2.5	8.5	5.5	10.0	9.0	7.0	7.0	6.0	5.5
17			5.5	3.5	7.0	5.5	10.0	9.0	7.0	7.0	6.0	5.5
18			4.5	3.5	6.0	5.0	11.5	9.0	7.0	6.5	5.5	5.0
19			6.5	3.0	5.0	4.5	11.5	9.5	6.5	6.5	5.0	4.5
20			5.0	4.0	5.5	4.5	12.5	10.0	6.5	6.5	4.5	4.5
21			4.5	3.5	6.0	4.5	12.5	10.0	6.5	6.5	4.5	4.5
22			6.0	3.5	7.5	5.0	13.0	10.5	6.5	6.0	4.5	4.5
23			6.5	4.0	8.5	5.5	13.5	10.5	6.0	6.0	5.0	4.5
24			6.0	4.5	8.0	6.0	13.0	11.5	6.0	6.0	5.0	5.0
25			7.0	4.0	7.5	6.5	12.5	11.0	6.0	6.0	5.0	4.5
26			7.5	4.0	8.5	6.5	12.0	10.0	6.0	6.0	5.0	5.0
27			7.0	4.5	9.0	7.0	11.0	8.5	6.0	6.0	5.0	5.0
28			6.0	5.0	8.5	7.5	8.5	8.0	6.0	6.0	5.0	4.5
29			7.0	4.5	8.0	7.0	8.0	8.0	6.0	6.0	5.0	4.5
30			5.0	4.0	7.5	6.0	8.0	7.5	6.0	6.0	5.0	4.5
31			5.0	4.0	---	---	8.0	8.0	6.0	6.0	---	---
MONTH			7.5	2.5	9.0	4.0	13.5	6.5	8.0	6.0	6.0	4.0

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - WATER RESOURCES DIVISION DIST 02
PRIMARY COMPUTATIONS OF QUALITY OF WATER DIGITAL MONITOR RECORDS
DATA PROCESSED 03-11-81 RT NO 76 TEST DIFF 10

15292000
SUSITNA RIVER AT GOLD CREEK AK
WATER TEMP (DEG C)

PARAMETER CODE 00010 STORE STATISTICS 00001,00002, ,

PROVISIONAL DATA FOR WATER YEAR ENDING SEPT. 30, 1981

DATE	MAX	MIN	MEAN		VALUES AT INDICATED HOURS 1	2	3	4	5	6	7	8	9	10	11	12
10-01	4.8	4.6	4.6	AM	4.8	4.8	4.8	4.7	4.7	4.7	4.7	4.7	4.6	4.6	4.6	4.6
				PM	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
10-02	4.6	4.3	4.4	AM	4.5	4.5	4.5	4.5	4.5	4.4	4.4	4.4	4.4	4.4	4.4	4.4
				PM	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.3
10-03	4.3	3.9	4.0	AM	4.3	4.3	4.2	4.2	4.2	4.1	4.1	4.0	4.0	4.0	3.9	3.9
				PM	3.9	3.9	3.9	3.9	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
10-04	4.0	3.9	3.9	AM	4.0	4.0	4.0	4.0	4.0	4.0	3.9	3.9	3.9	3.9	3.9	3.9
				PM	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
10-05	3.9	3.8	3.8	AM	3.9	3.9	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
				PM	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
10-06	3.9	3.8	3.8	AM	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
				PM	3.8	3.8	3.8	3.8	3.8	3.9	3.9	3.9	3.9	3.9	3.9	3.9
10-07	4.0	3.9	3.9*	AM	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
				PM	4.0											
PERIOD	4.8	3.8														

NOTE.- SYMBOLS USED ABOVE HAVE THE FOLLOWING MEANINGS
A - SUCCESSIVE RECORDED PUNCH READINGS DIFFER BY MORE THAN THE SPECIFIED ALLOWABLE TEST DIFFERENCE
R - ONE OR MORE INPUT VALUE IS OUTSIDE THE RANGE OF THE CONVERSION TABLE FOR THAT ITEM
* - DAILY SUMMARY IS FOR AN INCOMPLETE DAY
% - UNIT VALUES RECORD WRITTEN

1981 WATER TEMPERATURE DATA

GOLD CREEK			VEE CANYON		
SAMPLING DATE	TIME	TEMP. (°C)	SAMPLING DATE	TIME	TEMP (°C)
MAY 27	~3 PM	10.3	MAY 20	1 PM	6.5
JUNE 17	~3 PM	12.8	JUNE 18	~1 PM	12.0
JUNE 23	—	12.6 (USGS)	—		
JUNE 30	~10 AM	7.3	JUNE 30	4 PM	7.9
JULY 1	12:40 PM	8.6	—		
AUGUST 2	~12:00(PM)	9.3	AUGUST 2	~5 PM	8.3
AUGUST 3	~NOON	9.2	AUGUST 3	~9 AM	7.5
			AUGUST 3	~3 PM	9.1

• All water temperature data collected by R&M Consultants except where noted.

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY PROCESS DATE IS 03-12-81

STATION NUMBER 15291500 SUSITNA R NR CANTWELL AK STREAM SOURCE AGENCY USGS
LATITUDE 624157 LONGITUDE 1473240 DRAINAGE AREA 4140.00 DATUM 1900.00 STATE 02 COUNTY 290

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DAY	APRIL MAX	APRIL MIN	MAY MAX	MAY MIN	JUNE MAX	JUNE MIN	JULY MAX	JULY MIN	AUGUST MAX	AUGUST MIN	SEPTEMBER MAX	SEPTEMBER MIN
1			---	---	7.0	6.0	9.5	7.0	11.0	9.0	7.0	5.0
2			---	---	7.0	6.5	12.0	9.5	10.5	9.0	5.0	3.0
3			---	---	9.0	7.0	12.0	10.0	9.5	8.0	3.0	2.5
4			---	---	11.5	7.0	11.0	8.5	11.0	9.0	3.5	2.5
5			---	---	12.5	9.0	11.5	10.5	11.5	10.0	4.0	2.5
6			---	---	12.5	9.0	11.5	11.0	12.5	11.0	5.0	3.5
7			---	---	10.5	8.5	11.5	9.5	12.5	9.5	5.5	4.0
8			---	---	10.0	8.5	9.5	9.0	9.5	8.0	6.5	5.5
9			---	---	10.0	8.0	9.5	9.0	9.0	8.0	6.0	5.0
10			---	---	10.0	9.0	9.5	9.0	10.5	8.5	7.0	5.0
11			---	---	9.5	7.0	9.5	9.0	12.0	10.5	6.0	4.5
12			---	---	7.0	6.0	9.5	9.0	12.0	10.5	5.5	4.0
13			---	---	9.0	7.0	9.5	8.5	11.5	9.0	4.5	4.0
14			---	---	9.0	8.0	10.0	8.5	9.0	7.5	4.5	4.0
15			---	---	9.5	8.5	10.5	10.0	8.0	7.5	5.5	4.5
16			---	---	10.5	8.5	10.0	9.0	8.0	7.5	6.5	6.0
17			---	---	10.5	7.5	9.5	8.0	8.5	8.0	6.5	4.5
18			---	---	7.5	4.0	10.5	8.0	8.5	8.0	5.0	4.0
19			---	---	4.5	3.5	11.5	10.0	8.5	8.0	4.0	3.5
20			---	---	5.0	4.5	12.5	10.5	8.5	8.0	4.0	3.5
21			---	---	6.5	5.0	12.5	10.5	8.0	7.5	4.0	3.5
22			---	---	9.5	6.5	12.5	10.5	7.5	7.0	4.0	3.5
23			---	---	10.5	9.5	13.0	10.5	8.5	7.5	5.0	4.0
24			---	---	11.0	10.0	12.5	11.5	9.5	8.0	4.5	4.5
25			---	---	11.0	9.5	12.5	11.0	10.0	9.0	4.5	4.0
26			---	---	11.0	9.0	11.0	9.5	9.0	8.0	4.5	4.0
27			---	---	12.0	11.0	10.5	9.0	8.5	7.5	5.0	4.5
28			---	---	12.0	10.5	9.0	7.5	8.5	7.5	5.0	4.5
29			---	---	11.0	8.5	8.0	7.5	8.5	8.0	4.5	4.0
30			7.0	6.0	8.5	7.0	9.0	8.0	8.0	7.0	4.5	4.0
31			6.0	5.0	---	---	10.0	9.0	7.0	7.0	---	---
MONTH												

15294350 Susitna River at Susitna Station--Continued
(National stream-quality accounting network station)

WATER QUALITY DATA, WATER YEAR OCTOBER 1974 TO SEPTEMBER 1975--Continued

DATE	TOTAL MERCURY (HG) (UG/L)	SUS-PENDED MERCURY (HG) (UG/L)	DIS-SOLVED MERCURY (HG) (UG/L)	TOTAL SELE-NIUM (SE) (UG/L)	SUS-PENDED SELE-NIUM (SE) (UG/L)	DIS-SOLVED SELE-NIUM (SE) (UG/L)	TOTAL ZINC (ZN) (UG/L)	SUS-PENDED ZINC (ZN) (UG/L)	DIS-SOLVED ZINC (ZN) (UG/L)
JAN. 20...	.0	.0	.0	1	1	0	30	20	10
MAY 23...	.0	.0	.0	0	0	0	60	40	20
AUG. 27...	.0	.0	.0	0	0	0	90	90	0

TEMPERATURE (DEG. C) OF WATER, WATER YEAR OCTOBER 1974 TO SEPTEMBER 1975

	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1			---	---	9.0	8.5	10.5	10.0	10.5	10.0	---	---
2			---	---	9.0	8.0	10.5	10.0	11.5	10.0	---	---
3			---	---	8.0	7.0	10.0	10.0	12.0	11.0	---	---
4			---	---	8.0	6.5	10.5	10.0	12.0	11.5	9.0	9.0
5			---	---	8.0	6.5	10.5	10.5	11.5	11.5	9.0	9.0
6			---	---	8.0	7.0	11.5	10.5	11.5	11.5	9.0	8.5
7			---	---	8.5	7.0	11.5	11.5	11.5	11.0	8.5	8.0
8			---	---	9.0	8.0	12.0	12.0	11.0	11.0	8.0	8.0
9			---	---	9.0	8.5	12.0	12.0	11.0	10.5	8.0	8.0
10			---	---	10.5	8.5	12.5	12.0	11.0	10.5	8.0	8.0
11			---	---	10.0	9.0	13.0	12.5	11.0	10.5	8.0	7.5
12			---	---	9.5	9.0	13.0	12.5	11.0	10.5	7.5	7.5
13			---	---	9.5	9.0	12.5	11.5	10.5	10.5	7.5	7.5
14			---	---	9.5	9.0	11.5	11.0	10.5	10.5	7.5	6.5
15			---	---	9.5	9.0	11.0	11.0	11.0	10.5	7.5	6.5
16			---	---	10.5	9.5	11.0	10.5	11.0	11.0	7.5	7.0
17			---	---	10.5	10.0	10.5	10.5	11.0	11.0	7.0	7.0
18			---	---	10.0	9.5	11.0	10.5	11.0	10.5	7.5	7.0
19			---	---	9.5	9.5	11.0	10.5	10.5	10.5	7.5	7.0
20			---	---	9.5	9.0	10.5	10.0	10.5	10.5	7.0	7.0
21			---	---	9.0	9.0	10.0	10.0	10.5	10.5	7.0	6.5
22			---	---	9.0	9.0	10.0	10.0	10.5	10.0	7.5	7.0
23			7.0	6.5	9.0	8.5	10.0	10.0	10.0	10.0	7.5	6.5
24			7.0	6.0	9.0	8.5	10.0	10.0	10.5	10.0	7.0	6.5
25			7.0	6.0	10.5	9.0	10.0	10.0	10.5	10.0	7.0	6.5
26			7.0	5.0	12.0	10.0	10.0	10.0	10.0	10.0	8.0	7.0
27			8.0	7.0	13.0	11.5	10.0	10.0	10.0	10.0	8.0	7.5
28			8.0	7.0	14.0	12.0	10.5	10.0	---	---	7.5	7.0
29			8.5	7.5	14.0	12.0	10.5	10.5	---	---	7.0	7.0
30			8.5	7.0	12.5	10.5	10.5	10.5	---	---	7.0	6.5
31			9.0	7.0	---	---	10.5	10.5	---	---	---	---
MONTH			---	---	14.0	6.5	13.0	10.0	12.0	10.0	9.0	6.5

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

TEMPERATURE (DEG. C) OF WATER, WATER YEAR OCTOBER 1975 TO SEPTEMBER 1976

	OCTOBER		NOVEMBER		DECEMBER		JANUARY		FEBRUARY		MARCH	
DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	6.5	6.0	0.5	0.5	0.0	0.0						
2	6.0	5.5	0.5	0.5	0.0	0.0						
3	5.5	4.5	0.5	0.5	0.0	0.0						
4	4.5	4.0	0.5	0.5	0.0	0.0						
5	4.5	4.5	0.5	0.5	0.0	0.0						
6	4.5	4.5	0.5	0.5	0.0	0.0						
7	4.5	3.5	0.5	0.5	---	---						
8	3.5	3.0	0.5	0.5	---	---						
9	3.0	2.5	0.5	0.5	---	---						
10	2.5	1.5	0.5	0.5	---	---						
11	1.5	1.5	0.5	0.5	---	---						
12	2.0	1.5	0.5	0.5	---	---						
13	2.5	2.0	0.5	0.5	---	---						
14	2.5	2.5	0.5	0.5	---	---						
15	3.0	2.5	0.5	0.5	---	---						
16	3.0	3.0	0.5	0.5	---	---						
17	2.5	2.5	0.5	0.5	---	---						
18	2.5	2.0	0.5	0.5	---	---						
19	2.0	1.5	0.5	0.5	---	---						
20	1.5	1.0	0.5	0.5	---	---						
21	1.0	1.0	0.5	0.5	---	---						
22	1.0	1.0	0.5	0.5	---	---						
23	1.0	1.0	0.5	0.5	---	---						
24	1.0	1.0	0.5	0.0	---	---						
25	1.0	1.0	0.5	0.5	---	---						
26	1.0	1.0	0.5	0.5	---	---						
27	1.0	0.5	0.5	0.0	---	---						
28	0.5	0.5	0.0	0.0	---	---						
29	0.5	0.5	0.0	0.0	---	---						
30	0.5	0.5	0.0	0.0	---	---						
31	0.5	0.5	---	---	---	---						
MONTH	6.5	0.5	0.5	0.0	---	---						

	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	---	---	0.5	0.5	11.0	8.0	15.0	13.0	11.5	10.5	8.5	8.5
2	---	---	0.5	0.5	11.0	8.0	12.5	10.5	12.0	11.5	8.5	8.5
3	---	---	0.5	0.5	10.5	8.0	11.5	9.5	12.0	11.5	8.5	8.0
4	---	---	0.5	0.5	11.0	8.5	11.5	8.5	11.5	11.5	8.0	8.0
5	---	---	0.5	0.5	10.5	8.0	8.5	7.5	12.0	11.5	8.0	8.0
6	---	---	0.5	0.5	8.0	6.5	11.0	7.0	12.0	11.5	8.0	7.5
7	---	---	0.5	0.5	8.0	6.5	15.0	10.5	11.5	10.5	7.5	7.5
8	---	---	0.5	0.5	9.0	7.0	15.5	13.5	10.5	10.5	7.5	7.0
9	---	---	0.5	0.5	9.0	7.5	16.5	14.0	10.5	10.0	7.0	7.0
10	---	---	1.0	0.5	10.0	7.5	16.0	14.0	10.5	9.5	7.0	7.0
11	---	---	1.0	0.5	12.5	9.0	15.5	13.5	11.5	10.5	7.0	7.0
12	0.5	0.5	1.5	1.0	13.0	9.5	15.0	13.5	11.5	11.0	7.0	7.0
13	0.5	0.0	1.5	1.0	12.5	10.0	13.5	12.0	11.0	10.0	7.0	7.0
14	0.5	0.0	1.0	1.0	13.5	10.0	12.0	11.5	10.0	10.0	7.0	7.0
15	0.5	0.5	1.5	1.0	13.5	11.5	11.5	11.5	10.0	10.0	7.0	7.0
16	0.5	0.5	2.0	1.5	13.5	10.5	12.0	11.0	10.0	9.5	7.0	7.0
17	0.5	0.5	2.5	2.0	10.5	9.0	13.0	11.5	9.5	9.5	7.0	7.0
18	0.5	0.5	3.0	3.0	11.0	8.0	13.5	11.5	9.5	9.0	7.0	7.0
19	0.5	0.5	3.0	2.5	13.0	9.5	13.5	12.0	9.0	9.0	7.0	6.5
20	0.5	0.5	3.0	2.5	13.5	10.5	12.5	12.0	9.0	9.0	6.5	6.5
21	0.5	0.5	4.5	3.0	13.5	11.0	12.5	12.0	9.0	9.0	6.5	6.5
22	0.5	0.5	5.0	4.5	13.0	11.5	13.0	12.5	9.0	9.0	6.5	6.5
23	0.5	0.5	5.0	4.0	12.0	10.0	13.0	12.0	9.5	9.0	6.5	6.5
24	0.5	0.5	5.0	3.5	14.5	11.0	13.0	11.5	9.5	9.5	6.5	6.5
25	0.5	0.5	6.5	4.0	15.0	13.0	12.0	11.5	9.5	9.5	6.5	6.0
26	0.5	0.5	6.5	5.5	15.5	13.5	11.5	11.5	9.5	9.5	6.0	6.0
27	0.5	0.5	7.0	6.0	15.0	14.0	11.5	11.5	9.5	9.5	6.0	6.0
28	0.5	0.5	6.5	5.5	15.0	13.5	11.5	11.0	9.5	9.0	6.0	6.0
29	0.5	0.5	7.0	5.5	14.5	13.5	11.0	10.5	9.0	9.0	6.0	6.0
30	0.5	0.5	9.0	6.5	16.0	14.0	10.5	10.5	9.0	8.5	6.0	5.5
31	---	---	10.0	7.0	---	---	10.5	10.5	8.5	8.5	---	---
MONTH	---	---	10.0	0.5	16.0	6.5	16.5	7.0	12.0	8.5	8.5	5.5
YEAR	16.5	0.0										

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

TEMPERATURE (DEG. C) OF WATER, WATER YEAR OCTOBER 1976 TO SEPTEMBER 1977

DAY	OCTOBER 1977 MAX	MIN	MEAN	DAY	MAY 1977 MAX	MIN	MEAN	DAY	MAY 1977 MAX	MIN	MEAN
1	5.5	5.5	5.5	20	5.0	3.0	4.0	26	9.0	6.5	7.5
2	5.5	5.0	5.0	21	5.5	4.0	5.0	27	10.0	7.5	8.5
3	5.0	4.5	5.0	22	6.5	5.0	5.5	28	10.0	8.0	9.0
4	4.5	4.5	4.5	23	6.5	5.5	6.0	29	9.5	8.5	8.5
5	4.5	4.5	4.5	24	6.0	5.5	5.5	30	8.0	6.5	7.5
6	4.5	4.5	4.5	25	7.5	5.0	6.0	31	9.5	7.0	8.0

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		JUNE			JULY			AUGUST			SEPTEMBER	
1	10.0	8.0	9.0	13.0	11.5	12.0	12.0	11.0	11.5	11.0	9.5	10.0
2	11.0	8.5	9.5	13.0	12.0	12.0	11.5	10.5	11.0	11.0	9.5	10.0
3	11.0	9.0	10.0	12.5	11.0	11.5	12.5	10.5	11.5	11.5	10.0	11.0
4	10.5	8.0	9.0	12.5	11.5	12.0	12.5	12.0	12.0	11.5	10.0	11.0
5	8.5	7.0	7.5	12.5	11.0	11.5	12.0	11.5	12.0	11.0	9.5	10.0
6	8.5	7.0	7.5	12.5	11.0	11.5	12.5	11.5	12.0	10.5	8.5	9.0
7	9.5	8.0	8.5	13.0	11.5	12.0	12.5	12.0	12.0	8.5	7.5	8.0
8	10.5	8.5	9.5	13.5	12.0	13.0	12.0	11.0	11.5	8.5	7.0	8.0
9	11.0	9.5	10.0	14.0	12.5	13.5	12.0	11.5	11.5	9.0	8.5	8.5
10	11.5	10.0	10.5	14.0	13.0	13.5	12.5	11.5	12.0	9.0	8.5	9.0
11	12.5	10.5	11.5	14.5	13.0	14.0	12.5	11.5	12.0	9.5	9.0	9.0
12	12.0	10.0	11.0	14.5	13.5	14.0	12.0	11.5	11.5	9.5	8.5	9.0
13	11.5	10.0	10.5	14.0	13.0	13.5	12.5	11.0	11.5	9.0	7.5	8.0
14	11.5	9.5	10.5	13.5	12.5	13.0	12.0	11.5	11.5	8.5	8.0	8.0
15	11.5	10.0	10.5	12.5	11.5	12.0	12.0	11.0	11.5	8.5	7.0	7.5
16	11.0	9.5	10.0	13.0	11.5	12.5	12.0	11.5	11.5	7.5	6.5	7.0
17	10.5	9.5	10.0	13.0	12.0	12.5	12.0	11.0	11.5	7.5	6.5	7.0
18	10.5	10.0	10.0	13.5	12.0	12.5	11.5	10.5	11.0	7.5	7.0	7.0
19	11.0	9.0	10.0	13.0	12.5	12.5	12.0	11.0	11.5	7.0	6.0	6.5
20	12.0	10.5	11.0	12.5	12.0	12.5	12.5	11.0	11.5	7.0	6.0	6.5
21	12.0	11.0	11.5	12.5	11.5	12.0	12.5	11.5	12.0	6.0	5.5	6.0
22	12.5	11.5	12.0	13.0	11.5	12.5	12.5	11.5	12.0	7.0	5.5	6.0
23	12.5	10.0	11.0	13.0	12.0	12.5	12.5	11.5	12.0	7.0	6.0	6.5
24	12.5	11.0	12.0	12.5	11.5	12.0	12.5	11.5	12.0	6.0	5.0	5.5
25	13.0	12.0	12.5	13.0	12.0	12.5	11.5	11.0	11.5	6.0	5.0	5.5
26	13.0	11.5	12.5	13.0	12.0	12.5	11.5	10.5	11.0	5.5	5.0	5.5
27	13.0	12.0	12.5	12.5	11.5	12.0	11.0	9.5	10.0	6.0	5.5	5.5
28	13.0	11.5	12.0	13.0	12.0	12.5	11.0	10.0	10.5	6.0	5.5	6.0
29	13.0	12.0	12.5	13.0	12.5	13.0	11.0	9.5	10.0	5.5	4.5	5.0
30	12.5	11.5	12.0	13.0	13.0	13.0	11.0	9.0	10.0	4.5	3.5	4.0
31	---	---	---	13.0	12.0	12.5	10.5	9.5	10.0	---	---	---
MONTH	13.0	7.0	10.5	14.5	11.0	12.5	12.5	9.0	11.5	11.5	3.5	7.5

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

TEMPERATURE (DEG. C) OF WATER, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

DAY	OCTOBER 1977 MAX	MIN	MEAN	DAY	MAY 1978 MAX	MIN	MEAN	DAY	MAY 1978 MAX	MIN	MEAN
1	3.5	3.0	3.5	24	9.0	8.0	8.5	28	10.0	9.0	9.5
2	3.5	2.5	3.0	25	10.0	8.5	9.0	29	10.5	9.0	9.5
				26	10.0	9.0	9.0	30	10.5	9.5	10.0
16	1.0	1.0	1.0	27	10.0	8.0	9.0	31	10.5	9.5	10.0

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		JUNE			JULY			AUGUST			SEPTEMBER	
1	11.0	9.5	10.5	11.5	10.5	11.0	15.5	14.0	15.0	11.5	10.0	10.5
2	11.5	10.0	11.0	12.5	11.0	11.5	15.5	14.0	15.0	11.5	10.5	11.0
3	12.0	10.0	11.0	12.5	11.5	12.0	15.5	14.0	14.5	11.5	10.5	11.0
4	12.0	11.0	11.5	12.0	11.0	11.5	15.0	13.0	13.5	11.5	10.5	11.0
5	12.0	10.5	11.0	12.0	12.0	12.0	13.5	12.5	13.0	11.0	10.0	10.0
6	11.0	9.5	10.5	12.5	11.5	12.0	13.0	11.5	12.0	10.0	9.0	9.5
7	13.5	10.5	11.5	13.0	11.5	12.0	12.5	11.5	12.0	10.0	9.5	10.0
8	13.5	12.0	12.5	13.5	11.5	12.5	12.5	11.5	12.0	10.0	9.0	9.5
9	12.5	11.0	12.0	13.5	12.5	13.0	13.5	12.0	12.5	9.5	9.5	9.5
10	14.0	11.5	13.0	13.5	12.0	12.5	13.5	11.5	12.5	9.5	8.5	9.0
11	14.5	13.0	13.5	13.5	12.0	12.5	13.5	12.0	13.0	9.5	8.5	9.0
12	14.5	13.0	14.0	13.0	12.0	12.5	13.5	12.0	12.5	9.5	9.0	9.5
13	14.0	11.5	12.5	13.0	12.0	12.5	12.0	11.0	11.5	10.0	9.0	9.5
14	11.5	10.0	10.5	13.0	11.0	11.5	11.5	10.5	11.0	10.0	9.0	9.0
15	10.0	9.5	10.0	11.0	10.0	10.5	12.5	10.5	11.5	9.0	8.0	8.5
16	10.5	9.0	9.5	11.0	10.0	10.5	12.5	11.5	12.0	9.0	8.0	8.5
17	10.0	9.0	9.5	11.0	9.5	10.0	12.0	10.5	11.0	9.0	8.0	8.5
18	9.0	8.5	9.0	12.5	10.5	11.5	13.0	11.5	12.0	9.0	8.5	8.5
19	9.0	8.5	8.5	12.5	11.0	11.5	13.0	11.0	12.0	8.5	8.0	8.5
20	11.5	8.5	10.0	11.5	10.5	11.0	12.0	10.5	11.5	8.0	7.5	8.0
21	12.5	10.5	11.5	10.5	10.0	10.5	12.0	10.5	11.5	8.0	8.0	8.0
22	12.5	11.0	11.5	11.0	10.0	10.5	12.0	10.0	11.0	8.0	6.5	7.0
23	11.0	10.5	10.5	12.0	10.0	10.5	11.5	10.5	11.0	6.5	5.5	6.0
24	10.5	9.5	10.0	13.0	11.5	12.0	11.5	10.0	11.0	8.0	5.0	6.5
25	9.5	9.5	9.5	13.5	12.0	12.5	12.0	10.5	11.0	9.5	6.5	7.5
26	10.5	9.0	9.5	13.5	12.0	12.5	12.0	10.5	11.0	---	6.0	---
27	10.5	10.0	10.0	14.5	12.5	13.5	11.5	10.0	11.0	---	5.0	---
28	12.0	10.0	11.0	14.5	12.5	13.5	11.5	10.0	10.5	---	---	---
29	12.5	11.0	12.0	14.5	12.0	13.0	10.5	9.0	9.5	---	---	---
30	12.0	11.0	11.5	15.0	13.0	14.0	10.5	9.5	10.0	---	---	---
31	---	---	---	15.5	13.5	14.5	10.5	9.5	10.0	---	---	---
MONTH	14.5	8.5	11.0	15.5	9.5	12.0	15.5	9.0	12.0	11.5	5.0	9.0
YEAR	15.5	1.0	10.5									

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

TEMPERATURE (DEG. C) OF WATER, MAY TO SEPTEMBER 1979

MAY 1979

DAY	MAX	MIN	MEAN	DAY	MAX	MIN	MEAN	DAY	MAX	MIN	MEAN
15	6.5	5.0	5.5	21	9.0	7.5	8.0	27	11.5	10.0	11.0
16	6.5	6.0	6.0	22	9.0	8.0	8.5	28	11.5	10.0	10.5
17	7.5	6.0	6.5	23	9.0	8.0	8.5	29	11.5	10.0	10.5
18	8.0	6.5	7.0	24	9.5	8.0	8.5	30	10.5	8.5	9.5
19	8.0	6.5	7.5	25	10.5	8.5	9.5	31	10.5	8.5	9.0
20	8.5	7.0	8.0	26	11.0	9.5	10.0				
								MONTH	11.5		

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		JUNE			JULY			AUGUST			SEPTEMBER	
1	10.5	9.5	10.0	14.0	11.5	12.5	13.5	11.5	12.0	10.0	9.0	9.5
2	10.5	9.5	10.0	15.5	13.0	14.0	14.5	12.5	13.0	10.0	8.5	9.5
3	10.5	8.5	9.5	16.5	14.5	15.0	14.0	12.5	13.5	10.0	9.0	9.5
4	10.0	9.5	9.5	16.5	14.5	15.0	14.5	12.5	13.5	9.5	8.5	9.0
5	11.5	9.0	10.0	14.5	12.0	13.0	14.0	12.5	13.0	9.0	8.0	8.5
6	11.0	10.0	10.5	12.0	10.5	11.0	12.5	11.5	11.5	9.5	8.5	9.0
7	10.5	9.0	9.5	11.5	9.5	10.5	11.5	11.0	11.0	10.0	8.5	9.0
8	10.5	9.0	9.5	12.5	11.0	12.0	12.0	11.0	11.5	10.0	9.0	9.5
9	12.5	10.0	11.0	13.0	11.0	11.5	12.0	11.5	12.0	10.0	9.0	9.5
10	12.5	11.0	12.0	14.0	12.0	13.0	11.5	11.0	11.0	10.0	9.5	10.0
11	12.5	11.0	11.5	14.5	13.0	13.5	11.0	10.5	11.0	10.0	8.5	9.5
12	12.0	10.5	11.5	14.5	12.5	13.0	12.0	10.5	11.0	10.0	9.0	9.5
13	11.5	10.5	10.5	14.5	12.0	13.0	12.5	11.5	12.0	9.5	9.0	9.0
14	11.5	9.5	10.5	14.0	12.5	13.0	12.0	11.0	11.5	9.5	9.0	9.0
15	11.5	10.5	11.0	12.5	11.0	11.5	11.0	10.5	10.5	9.5	8.5	9.0
16	11.5	10.0	10.5	11.0	10.0	10.5	10.5	9.5	10.0	8.5	7.5	8.0
17	11.0	10.0	10.5	13.0	10.5	11.0	11.5	10.0	10.5	8.5	8.0	8.0
18	12.5	10.0	11.0	13.5	12.5	13.0	11.5	10.0	10.5	8.5	8.5	8.5
19	12.5	11.0	11.5	14.0	12.0	13.0	11.0	10.5	10.5	8.5	7.5	8.0
20	11.5	10.5	11.0	14.0	12.5	13.0	11.5	10.5	11.0	8.0	7.5	7.5
21	13.0	10.5	11.5	13.5	12.5	13.0	11.5	10.0	10.5	7.5	7.0	7.5
22	14.5	12.0	13.0	12.5	11.5	12.0	12.0	10.5	11.5	7.5	7.0	7.0
23	15.0	13.0	14.0	12.0	11.0	11.0	12.5	11.0	11.5	7.5	7.0	7.0
24	14.5	12.5	13.0	11.5	11.0	11.5	12.5	11.0	11.5	7.5	7.0	7.5
25	12.5	10.0	11.0	11.5	11.0	11.0	12.5	11.0	12.0	7.5	6.5	7.0
26	10.0	8.5	9.0	12.5	10.5	11.0	12.5	11.0	12.0	6.5	6.0	6.5
27	9.0	8.0	8.5	13.0	11.5	12.0	12.5	11.5	12.0	6.5	6.0	6.0
28	10.0	8.5	9.0	14.0	11.5	12.0	12.0	11.0	11.5	6.0	5.5	6.0
29	11.5	9.0	10.0	13.5	12.0	13.0	11.5	10.0	10.5	6.0	5.0	5.5
30	12.5	10.5	11.5	13.5	12.5	13.0	9.5	8.5	9.0	5.5	5.0	5.5
31	---	---	---	13.5	12.0	12.5	10.0	8.5	9.5	---	---	---
MONTH	15.0	8.0	10.5	16.5	9.5	12.5	14.5	8.5	11.5	10.0	5.0	8.0

ATTACHMENT B

R&M CONSULTANTS PROCEDURES MANUAL FOR WATER QUALITY DATA COLLECTION (REVISED)

INTRODUCTION

Since the inception of the R&M water quality data collection program, several changes and alternatives to the procedures have been recommended. These have been incorporated into the data collection procedures. Therefore, a revision of the R&M Procedures Manual describing the latest methods used in sample collection follows.

This manual describes the methods employed by R&M Consultants for collecting water samples and measuring various parameters in the field. Included also are procedures for filtering, processing and handling samples for quantitative analysis in a laboratory.

PROCEDURES

At the sampling cross-section a tag line must be strung across the channel to mark the sampling locations. If possible the tag line should be left up for the duration of the season so the same sampling locations can be used in subsequent operations. Three sites are marked on the tag line for water quality sampling. The locations should be equally spaced with one site at mid-channel and the remaining two at an equal distance between mid-channel and the left and right bank. Ten sites will be required for suspended sediment sampling. All locations must be clearly marked with flagging or paint on the tag line.

All water samples are collected with a U.S. P-61-A1 Point Integrating sampler, except during the winter when frazil ice will clog this device. Then the van Dorn sampling bottle is used. Refer to the section entitled "Suspended Sediment Sampling" for a detailed description of the P-61 operation. The van Dorn sampler makes use of a "grab" sampling method. The sampler is opened and held underwater at a depth not less than one foot. Care should be taken to avoid creating turbulence around the sampler. When filled, the release button is pressed which closes both ends simultaneously, entrapping the water sample.

Prepare a level surface and set up the YSI model 51B Dissolved Oxygen meter, the YSI model 33 S-C-T meter and the VWR Scientific Model 55 pH meter. The Imhoff cones are placed in the rack built onto the equipment box. Carefully rinse out all containers used for the handling of samples.

Conductivity

Conductivity is measured with a YSI Model 33 Salinity - Conductivity-Temperature meter. Before an actual measurement, the sensor probe should be cooled to the temperature of the

sample. This can be done by submerging the probe in a container of river water about 15 minutes prior to measurement.

To measure conductivity the sensor probe is placed in the sample to be tested. Momentary agitation should free any air bubbles trapped in the sensor. These air bubbles must be eliminated for an accurate measurement. The instrument is standardized by adjusting the needle to coincide with the red line on the scale. The temperature of the sample is read and recorded. The temperature compensating dial on the meter is adjusted to that water temperature. The conductivity is measured using the lowest scale on the meter. All data are recorded on the field log or a field notebook. Temperature-corrected conductivity (for a standard 25°C) is determined by applying one of the following conversion factors, where °C is the temperature of the sample. Conductivity is reported in micromhos/cm @ 25°C.

Temp °C	CF	Temp °C	CF	Temp °C	CF
0	1.80	7	1.49	14	1.25
1	1.74	8	1.45	15	1.22
2	1.69	9	1.41	16	1.20
3	1.65	10	1.38	17	1.17
4	1.61	11	1.35	18	1.15
5	1.57	12	1.32	19	1.13
6	1.53	13	1.29	20	1.10

pH

The VWR Scientific Model 55 pH meter is very sensitive to cold water temperatures and moisture within the housing. Cold water temperatures affect the gel within the sensor so that the meter will require a long time to stabliize, about 15 - 20 minutes per reading. The meter should only be calibrated just prior to pH measurements. The buffer solutions and sensor should be cooled to sample temperature before calibrating. Submerging the bottled buffer solutions in a container filled with river water is adequate for cooling.

The pH meter is calibrated by placing the sensor probe in the pH 7 buffer solution. Assuming the buffer solution is the same temperature as the water sample, set the TEMPERATURE dial on the meter to the temperature of the water sample. Turn the meter on and depress the push-button on the left side to illuminate the digital display. Adjust the meter to pH 7.00 with the dial labelled CALIBRATE. Rinse the sensor in distilled water, then place in the pH 4 buffer. Adjust the TEMPERATURE dial until the meter reads 4.00. Measurements of the water sample should be taken

immediately after calibration. Carefully rinse the sensor in distilled water and place in the sample. The meter reacts slowly so a sufficient amount of time must be allowed for stabilization. The meter reading will "step" up slowly until stabilized. The most accurate pH reading is when the meter has stopped stepping up. In cold weather this may take as long as 25 minutes. Under these conditions it might be advantageous to take the pH of the "composite" instead of each individual sample.

Dissolved Oxygen

Since the dissolved oxygen is measured from the boat, this meter should be calibrated first upon arrival at the site. The YSI model 51B Dissolved Oxygen meter is standardized by two methods found to be efficient in the field. For the most accurate readings the meter should not be moved once it is calibrated. Therefore, these procedures are best carried out on the boat with the meter in the same operating position as when the measurements are taken.

Adjust the meter pointer to zero with the instrument turned off, using the screw in the center of the plexiglass panel. Position switch to ZERO and again adjust pointer to zero but this time with the zero control knob. Position switch to FULL SCALE and adjust to the "15" mark on the P.P.M. scale using the full scale control knob. Allow instrument to stablize for 10 - 15 minutes, without turning it off. Shake a bottle, 2/3 full of distilled water, to saturate with air. Then wait until no more bubbles rise to the surface, about 10 minutes. Remove the end cap from the sensor and submerge the probe in the bottle. Set switch to READ TEMP and set the OXYGEN SOLUBILITY FACTOR to correspond with the water temperature reading. Read the actual (not adjusted to sea level) barometric pressure from the barometer and record. Select the appropriate saturated water oxygen value from Figure 1. Place the sensor probe in the sample and stir (stirring is accomplished by moving the probe vertically at approximately 1-foot per second). Position switch to READ 0_2 and adjust the CALIB knob so that the pointer indicates the value obtained from Figure 1. The meter is now calibrated.

As a check to verify the accuracy of the calibration a second method is used. Position the switch to CALIB. With the probe in the protective bottle (insure that the cloth inside the bottle is moist) to provide humid air around the membrane, the pointer should set at the mark for the local elevation.

If the water saturation procedure was carried out correctly, then no adjustment of the CALIB knob is necessary. If the pointer does not correspond to the local elevation, then adjust by turning the CALIB knob. Then repeat the water saturation method.

The instrument can easily go out of calibration if it is moved or jarred.

Measure dissolved oxygen by positioning the boat at one of the three predetermined locations across the channel. It is important not to create a turbulent flow around the sensor probe, so for accurate readings the boat should be positioned upstream of the marked site and allowed to drift while the measurement is taken. Check the instrument setting of ZERO and FULL SCALE. Remove the protective bottle and suspend the probe over the side of the boat. Set switch to READ TEMP and adjust the OXYGEN SOLUBILITY dial to the temperature of the water indicated by the meter. Record the water temperature on the field data form. Agitate the sensor vertically at a constant rate. Position switch to READ O_2 and the pointer will indicate dissolved oxygen in p.p.m. Repeat this procedure at the two remaining sampling locations.

Percent saturation is computed by dividing the measured dissolved oxygen value by the saturated water oxygen value from Figure 1.

Sampling

After the measurement of water temperature and dissolved oxygen the water samples can be collected. This is done at the same three sites as used in dissolved oxygen measurement. Using the P-61 sampler, a depth-integrated water sample can be obtained. For some parameters, this method produces a more representative sample, as opposed to the grab sampling technique which can only sample at a fixed depth.

To insure an adequate supply of water for field and laboratory analysis, a 3-liter container should be filled at each site. Since the P-61 can only hold 1 liter, this requires that three samples be taken at each site and combined in a 3-liter container. Care should be taken not to aerate the water when combining these samples. When all the locations across the channel have been sampled, the remaining field parameters can be measured upon return to the bank.

The pH and conductivity meters should be standardized just prior to making measurements. After calibration, the conductivity sensor and the pH sensor can be inserted directly into the first of the 3-liter containers. Depending on the temperature, a period of time should be allowed for sensor stabilization. The colder the temperature the longer the time required for an accurate measurement. Measure conductivity first since the pH sensor usually requires a longer stabilization period.

Insure the proper setting of the red line on the conductivity meter and adjust the temperature compensating dial to correspond with the water temperature. Read the conductivity with the switch set on the lowest scale. Record the value on the field data form.

The pH meter needs no further temperature adjustment if the buffer solutions were cooled to sample temperature before calibration. Read the pH directly. An effort should be made to insure that the meter reading is stable and not slowly stepping up in value. Record the pH on the field data form.

Transfer both sensor probes to the next 3-liter sample and repeat the measurement procedures.

Stir the sample in each of the 3-liter containers so that all sediment is in suspension, then quickly transfer 1 liter of the sample to an Imhoff cone for determination of settleable solids. Note the time of the transfer to the cone. After 45 minues the sample in the Imhoff cone should be stirred to loosen any material adherring to the side of the cone. One revolution of a stirring rod or the thermometer held against the side of the cone should be sufficient. Care should be taken not to disturb the sediment already settled to the bottom of the cone. Total settleable solids can be read after an additional 15 minutes from the time the sample was stirred. Read the settleable solids from the graduations on the Imhoff cones and report in ml/l.

The sample remaining in each 3-liter container can be mixed together in a large clean bucket. After the Imhoff cone have been read, they can also be drained into the bucket with the other water quality samples. The water in the bucket now constitutes the "composite" sample.

Filtering and Preservation.

Prepare the filter assembly by rinsing out the container carefully and inserting a 0.45-micron membrane filter in the depression on the bottom plate. Lay the coarse fiber filter on top of the membrane filter with the rough side up. Mix the composite sample in the bucket thoroughly and pour into the filter. Using the air pump, pressurize the filter only enough to produce a slight stream of filtered water from the nozzle in the bottom plate. If, during the filtering process, the filters should break, any water already collected will be contaminated and should be discarded or filtered again.

Recent quality control analysis has revealed a possible contamination fo the filtered samples by certain metals. Consultation with laboratory technicians resulted in a procedure to prepare the filters. These procedures have not been incorporated

to date, however are recommended for future sample handling, even if only for a comparative analysis.

The filter papers (membrane and fiber) are to be rinsed with distilled water and then be allowed to soak in more distilled water for 24 hours prior to sample collection. An alternate method is to prepare a "blank" sample. Prepare the filter assembly with dry filter papers and run 1 quart of distilled water through it. Submit this as a sample to the laboratory for analysis along with the other water samples.

The filtered water should be collected in clean, 1-quart bottles supplied by the laboratory. These bottles must be marked well in reference to their contents to avoid later confusion. Table 1 lists as a guideline how each bottle should be prepared, labelled and for which parameters each will be analyzed. Preservatives are supplied by the laboratory in glass or plastic vials. After the lab bottles are filled, the acid preservatives, either H_2S0_4 (sulfuric) or HNO_3 (nitric), are added to the appropriate bottles.

All samples for quantitative analyses are kept in a cooler full of ice during shipment to the laboratory. The water temperature should be kept below 4°C.

Table 2 lists the detection limits and methods used for parameter measurements in the field and laboratory. The references on Table 2 and on the following page should be consulted for specific descriptions of procedures.

Alkalinity

Alkalinity should be determined on-site in the field to avoid effects of storage and air mixing with the sample. However, if this isn't feasible, then it would be acceptable to delay this measurement until return to camp. A separate unfiltered sample is obtained from the composite sample. The sample container must be filled to the top and tightly capped to prevent any mixture with air. Keep the sample cool along with the other water quality samples and transport to camp. Alkalinity is measured using a potentiometric titration to an end point pH. The end point pH is determined by the expected alkalinity concentrations as follows.

Alkalinity (mg/l of $CaCO_3$)	1st End Point (C)	2nd End Point (D)
30	5.1	4.8
150	4.8	4.5
500	4.5	4.2

TABLE 1
R&M CONSULTANTS
WATER SAMPLE PREPARATION

Container	Field Preparation and Label	Parameters
Plastic 1 quart	HNO_3 Filtered	ICAP Scan Uranium Radioactivity, Gross Alpha
Plastic 1 quart	No Preservative Filtered	Total Phosphorus Ortho - phosphate Chloride True Color Sulfate
Plastic 1 quart	H_2SO_4 Filtered	Total Nitrogen Ammonia Nitrogen Organic Nitrogen Nitrate Nitrogen Nitrite Nitrogen
Plastic 1 quart	H_2SO_4 Unfiltered	Total Organic Carbon Chemical Oxygen Demand
Plastic 1 quart	No Preservative Unfiltered	Turbidity Total Dissolved Solids Total Suspended Solids
Glass (freon rinsed) 1 quart	No Preservative Unfiltered	Organic Chemicals

Calibrate the pH meter (see pH meter section). Obtain a 100 ml. sample in a graduated cylinder and transfer into a beaker. Fill the buret with 0.02 Normal sulfuric acid and record the volume as indicated by graduations on the buret (read at bottom of meniscus). Determine the initial pH of the sample and record. Titrate to the appropriate end points.

> Example: Initial pH of a 100 ml sample was measured at 6.64. The buret was filled with 0.02 N sulfuric acid to 0.36 ml as read from the graduations on the buret. The sample was obtained from the Susitna River and alkalinity was expected to be between 30 and 150 mg/l of $CaCO_3$. The end points to titrate to are therefore, 5.1 and 4.8. Acid is added to the 100 ml sample until a pH of 5.1 is reached. At this point a reading is obtained from the buret. The volume of acid is now 6.74 ml, therefore 6.38 ml (6.74 - 0.36) of acid have been used to reduce the pH from 6.64 to 5.10. Titration continues until the pH drops to 4.8. The buret now reads 6.93, indicating that a total of 6.57 ml. of acid was required to reduce the pH to 4.8.

Alkalinity is calculated as follows:

$$\text{Alkalinity} = \frac{(2C-D) \times 0.02 \times 50{,}000}{100} = 10\,(2C-D)$$

where C = ml titrant to the 1st end point.
where D = ml titrant to the 2nd end point.

Thus, alkalinity in example = 10 [2 (6.38) - 6.57] = 61.9, or 62

Note: If initial pH exceeds 8.3, record the ml titrant used to reduce the pH to 8.3 and proceed as above. See page 253 in Standard Methods, 15th edition, for alkalinity relationships to determine the concentrations of bicarbonate, carbonate and hydroxide alkalinity.

After receiving the quantitative analysis results from the laboratory, free carbon dioxide and hardness can be determined.

Free Carbon Dioxide

Using the temperature, pH and alkalinity data obtained in the field and the lab values for total dissolved solids, the free CO_2 can be determined by the nomographic method (Figure 2).

TABLE 2

WATER QUALITY PARAMETERS ANALYSED
FROM VEE CANYON AND GOLD CREEK
BY R&M CONSULTANTS, INC.[1]

	Method[2]	Detection Limit[3]	Data Available from the U.S.G.S.[4]
Field Parameters			
Dissolved Oxygen	SM 421F	0.1	GC
Percent Saturation, %	C	1	GC
pH, pH units	EPA p239	±0.01	GC, VC
Conductivity, umhos/cm	EPA p275	1	GC, VC
Temperature, °C	SM 212	0.1	GC, VC
Carbon Dioxide	SM 407A	1	GC, VC
Alkalinity as $CaCO_3$	EPA p3	2	GC, VC
Settleable Solids, ml/l	EPA p273	0.1	-
Laboratory Parameters			
Ammonia Nitrogen	EPA p159	0.05	GC
Organic Nitrogen	Kjeldahl	0.1	GC
Kjeldahl Nitrogen	EPA p175	0.1	-
Nitrate Nitrogen	EPA p197	0.1	GC, VC
Nitrite Nitrogen	EPA p215	0.01	GC
Total Nitrogen	EPA p175	0.1	GC
Ortho-Phosphate	EPA p249	0.01	GC
Total Phosphorus	EPA p249	0.01	GC
Chemical Oxygen Demand	EPA p20	1	-

TABLE 2 - CONTINUED

	Method[2]	Detection Limit[3]	Data Available from the U.S.G.S.[4]
Laboratory Parameters (Cont'd)			
Chloride	EPA p29	0.2	GC, VC
Color	EPA p36	1	GC, VC
Hardness	C	1	GC, VC
Sulfate	EPA p277	1	GC, VC
Total Dissolved Solids[5]	EPA p266	1	GC, VC
Total Suspended Solids[6]	EPA p268	1	GC, VC
Turbidity	EPA p295	0.05	-
Uranium	Fluorescence	0.075	-
Gross Alpha picocurie/liter	EPA p264	3	GC
Total Organic Carbon	EPA p415	1.0	GC
Total Inorganic Carbon	EPA p415	1.0	-
Organic Chemicals			
Endrin	SM 509A	0.0002	-
Lindane	SM 509A	0.004	-
Methoxychlor	SM 509A	0.1	-
Toxaphene	SM 509A	0.005	-
2, 4-D	SM 509B	0.1	-
2, 4, 5-TP Silvex	SM 509B	0.01	-
ICAP SCAN[7]			
Ag, Silver		0.05	GC
Al, Aluminum		0.05	-
As, Arsenic		0.10	-
Au, Gold		0.05	-
B, Boron		0.05	-
Ba, Barium		0.05	GC

TABLE 2 - CONTINUED

	Method(2)	Detection Limit(3)	Data Available from the U.S.G.S.(4)
Laboratory Parameters (Cont'd)			
ICAP SCAN - (Cont'd)			
Bi, Bismuth		0.05	-
Ca, Calcium		0.05	GC, VC
Cd, Cadmium		0.01	GC
Co, Cobalt		0.05	GC
Cr, Chromium		0.05	GC
Cu, Copper		0.05	GC
Fe, Iron		0.05	GC, VC
Hg, Mercury		0.1	GC
K, Potassium		0.05	GC, VC
Mg, Magnesium		0.05	GC, VC
Mn, Manganese		0.05	GC, VC
Mo, Molybdenum		0.05	-
Na, Sodium		0.05	GC, VC
Ni, Nickel		0.05	GC
Pb, Lead		0.05	GC
Pt, Platinum		0.05	-
Sb, Antimony		0.10	-
Se, Selenium		0.10	GC
Si, Silicon		0.05	-
Sn, Tin		0.10	-
Sr, Strontium		0.05	-
Ti, Titanium		0.05	-
W, Tungsten		1.0	-
V, Vanadium		0.05	-

TABLE 2 - CONTINUED

	Method(2)	Detection Limit(3)	Data Available from the U.S.G.S.(4)
Laboratory Parameters (Cont'd)			
ICAP SCAN - (Cont'd)			
Zn, Zinc		0.05	GC
Zr, Zirconium		0.05	-

(1) Chemical & Geological Laboratories of Alaska, Inc., has been contracted to provide laboratory analyses. They are one of two private labs in Alaska certified by the Alaska Department of Environmental Conservation to provide water quality analyses.

(2) SM - Standard Methods for the Examination of Water and Wastewater, 15th edition, 1980.

EPA - Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020.

C - Value computed by R&M Consultants, Inc.

Kjeldahl - SM 420

Fluorescence - Following the accepted method outlined by G.K. Turner Associates.

(3) All values are expressed in mg/l unless otherwise noted.

(4) GC - Parameters measured by the U.S. Geological Survey at Gold Creek.

VC - Parameters measured by the U.S. Geological Survey at Vee Canyon (near Cantwell site), summer only.

(5) TDS - (filterable) material that passes through a standard glass fiber filter and remains after evaporation (SM p93).

(6) TSS - (nonfilterable) material retained on a standard glass fiber filter after filtration of a well-mixed sample.

(7) ICAP SCAN - thirty two (32) element computerized scan in parts/million (Ag, Al, As, Au, B, Ba, Bi, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Mo, Na, Ni, Pb, Pt, Sb, Se, Si, Sn, Sr, Ti, V, W, Zn, Zr)

Hardness

Hardness is calculated using element concentrations determined by the ICAP scan. Applying a conversion factor to these concentrations results in a hardness value attributed to each respective element. The sum of these individual values results in the total hardness for the sample. The following elements are used for hardness calculations.

Element (mg/l)	Conversion Factor
Calcium	2.497
Magnesium	4.116
Strontium	1.142
Iron	1.792
Aluminum	1.564
Zinc	1.531
Manganese	1.822

Data Tabulation

All field data will be presented on a form similar to Figure 3. Final data presentation will follow the format on Table 2. Data will be compiled to provide a range and mean for each parameter for three seasons. The seasons and their respective definitions are breakup - from the time ice begins to break up until recession of spring runoff, summer - from the end of breakup until the water temperature drops to essentially 0°C in the fall, and winter - from the end of summer until breakup begins.

Suspended Sediment Sampling

Ten sampling locations are identified across the channel on the tag line. These should be evenly spaced and marked well with flagging so that a given position can easily be maintained by boat.

Using the P-61 sampler, fill a 1 liter bottle between 60 - 90% full. Make note of the sample number, distance from the left bank, depth of bottom and total channel width.

The P-61 sampler is attached to the cable with a pin and strain relief clamp. The wire from the nose of the sampler connects to the internal wire in the cable. The depth gauge on the winch/reel

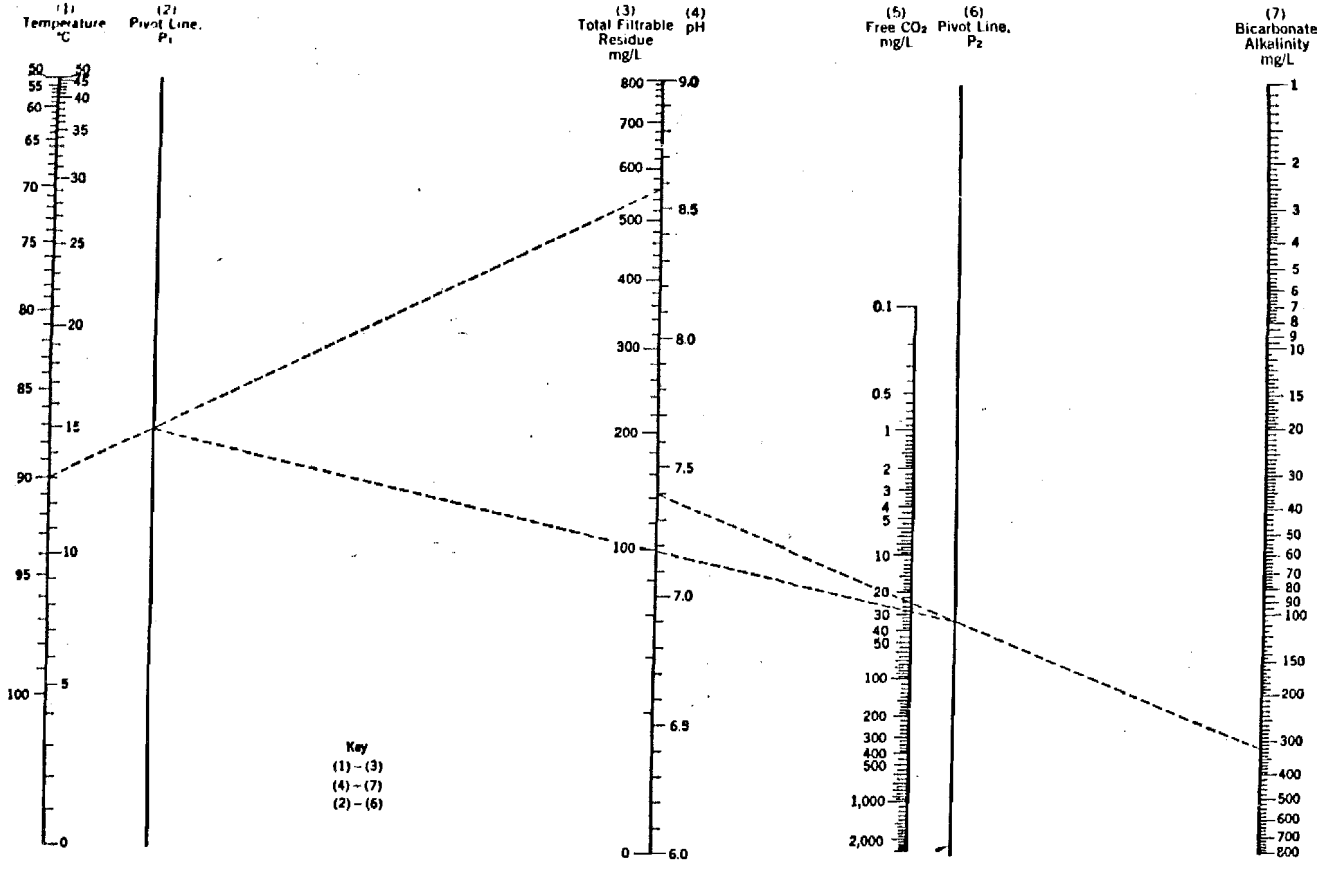


Figure 406:4. Nomograph for evaluation of free carbon dioxide content.† To use: align temperature (Scale 1) and total filtrable residue (Scale 3), which determines Point P_1 on Line 2; align pH (Scale 4) and bicarbonate alkalinity (Scale 7), which determines Point P_2 on Line 6; align P_1 with P_2 and read free carbon dioxide on Scale 5. (Example: For 13 C temperature, 560 mg total filtrable residue/L, pH 7.4, and 320 mg alkalinity/L, the free carbon dioxide content is found to be 28 mg/L.)

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Figure - 2

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SOLUBILITY OF OXYGEN IN WATER (Saturated with Air) IN PPM AT VARIOUS TEMPERATURES AND PRESSURES

TEMPERATURE IN DEGREES CENTIGRADE	P mm	775	760	750	725	700	675	650	625
	P Inches	30.51	29.92	29.53	28.54	27.56	26.57	25.59	24.61
	0	14.9	14.6	14.4	13.9	13 5	12.9	12.5	12.0
	1	14.5	14.2	14.1	13.8	13 1	12 6	12.2	11.7
	2	14.1	13.9	13.7	13.2	12.9	12 3	11 8	11.4
	3	13.8	13.5	13.3	12.9	12.4	12 0	11 5	11.1
	4	13.4	13.2	13.0	12.5	12 1	11.7	11 2	10.8
	5	13.1	12.8	12.6	12.2	11 8	11.4	10 9	10.5
	6	12.7	12.5	12.3	11.9	11 5	11 1	10.7	10.3
	7	12.4	12.2	12.0	11.6	11 2	10.8	10.4	10.0
	8	12.1	11.9	11.7	11.3	10 9	10.5	10 1	9.8
	9	11.8	11.6	11.5	11.1	10 7	10 3	9 9	9.5
	10	11.6	11.3	11.2	10.8	10 4	10 1	9.7	9.3
	11	11.3	11.1	10.9	10 6	10 2	9 8	9 5	9.1
	12	11.1	10.8	10.7	10 3	10 0	9 6	9.2	8 9
	13	10.8	10.6	10.5	10.1	9 8	9 4	9.1	8.7
	14	10.6	10 4	10 2	9 9	9 5	9 2	8.9	8 5
	15	10 4	10 2	10 0	9.7	9 3	9 0	8 7	8.3
	16	10 1	9 9	9 8	9 5	9 1	8 8	8 5	8.1
	17	9 9	9 7	9 6	9 3	9 0	8 6	8 3	8.0
	18	9 7	9 5	9 4	9.1	8.8	8 4	8.1	7.8
	19	9 5	9 3	9 2	8 9	8 6	8 3	8.0	7.6
	20	9 3	9 2	9 1	8 7	8 4	8.1	7.8	7.5
	21	9 2	9 0	8 9	8 6	8 3	8 0	7.7	7.4
	22	9 0	8 8	8 7	8 4	8.1	7.8	7.5	7.2
	23	8 8	8 7	8.5	8.2	8.0	7.7	7.4	7.1
	24	8 7	8.5	8.4	8.1	7.8	7.5	7.2	7.0
	25	8.5	8 4	8.3	8.0	7.7	7.4	7.1	6.8
	26	8.4	8.2	8.1	7.8	7.6	7.3	7.0	6.7
	27	8.2	8.1	8.0	7.7	7.4	7.1	6.9	6.6
	28	8.1	7.9	7.8	7.6	7.3	7.0	6.7	6.5
	29	7.9	7.8	7.7	7.4	7.2	6.9	6.6	6.4
	30	7.8	7.7	7.6	7.3	7.0	6.8	6.5	6.2
	31	7.7	7.5	7.4	7.2	6.9	6.7	6.4	6.1
	32	7.6	7.4	7.3	7.0	6.8	6.6	6.3	6.0
	33	7.4	7.3	7.2	6.9	6.7	6.4	6.2	5.9
	34	7.3	7.2	7.1	6.8	6.6	6.3	6.1	5.8
	35	7.2	7.1	7.0	6.7	6.5	6.2	6.0	5.7
	36	7.1	7.0	6.9	6.6	6.4	6.1	5.9	5.6
	37	7.0	6.8	6.7	6.5	6.3	6.0	5.8	5.6
	38	6.9	6.7	6.6	6.4	6.2	5.9	5.7	5.5
	39	6.8	6.6	6.5	6.3	6.1	5.8	5.6	5.4
	40	6.7	6.5	6.4	6.2	6.0	5.7	5.5	5.3
	41	6.6	6.4	6.3	6.1	5.9	5.6	5.4	5.2
	42	6.5	6.3	6.2	6.0	5.8	5.6	5.3	5.1
	43	6.4	6.2	6.1	5.9	5.7	5.5	5.2	5.0
	44	6.3	6.1	6.0	5.8	5.6	5.4	5.2	4.9
	45	6.2	6.0	5.9	5.7	5.5	5.3	5.1	4.8
	46	6.1	5.9	5.9	5.6	5.4	5.2	5.0	4.8
	47	6.0	5.9	5.8	5.6	5.3	5.1	4.9	4.7
	48	5.9	5.8	5.7	5.5	5.3	5.0	4.8	4.6
	49	5.8	5.7	5.6	5.4	5.2	5.0	4.7	4.5
	50	5.7	5.6	5.5	5.3	5.1	4.9	4.7	4.4

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Figure - 1

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DATE: _____

WQ ANALYSIS - FIELD PARAMETERS

SITE:

River Stage Before

River Stage After

PARAMETER	LB	C	RB	MEAN
Dissolved Oxygen (ppm)				
Percent Saturation				
pH				
Conductivity (umhos/cm) Adjusted to 25°C				
Temperature (°C)				
Free CO_2 (mg/l)				
Alkalinity (mg/l as $CaCO_3$)				
Settleable Solids (ml/l)				
Barometric Pressure				
Air Temperature				

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should be zeroed when the bottom of the sampler is at water surface. From the two terminals on the winch/reel a wire is connected, leading to the green capacitor box. The capacitor is hooked up to a 40 volt battery or two 22 volt batteries in series. The switch on the green box is positioned on CHARGE until ready to sample. At that time the switch is moved to SAMPLE and must be held in that position for the duration of the sampling time. Once the P-61 has broken the surface after sampling, the switch can be moved back to CHARGE in order to charge the capacitor for the next sampling run. The meter on the box will indicate the charge of the capacitor when the red button on the box is depressed. Before sampling begins the P-61 should be tested for proper operation. An audible "click" within the sampler will be heard when the capacitor is discharged.

To obtain a sample, load the P-61 with a bottle and lower to the bottom. Record the depth of bottom and distance from the starting station. To insure a totally depth-integrated sample, the P-61 must be slowly brought to the surface at a constant rate. If the sampler is brought up too fast, then the bottle will not fill to the minimum 60% level. If it is brought up too slowly the bottle may overfill.

Each bottle must be properly labelled with respect to stationing, location, date, etc.

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