STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF LAND AND WATER MANAGEMENT

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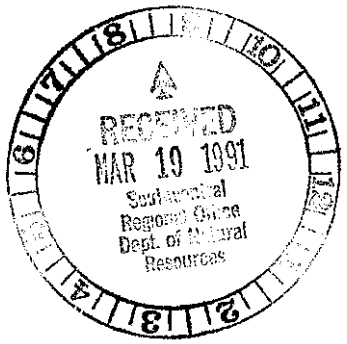

LAS 13222

Northcentral District
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230 S. Franklin, Room 407
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APPLICATION FOR RESERVATION OF WATER

INSTRUCTIONS: This is an application to reserve a specific instream flow or level of water under AS 46.15.145 and 11 AAC 93.141-147. This application must be filled out completely and all requested attachments submitted with it. Failure to complete all parts of the application may result in return of the application. Attach extra pages to fully answer questions. If a report is attached as part of this application, indicate appropriate page numbers following each question. Submit this application to the district in which the proposed reservation is located (identified above). Please type or print in ink.

1. Full legal name of applicant(s): ALASKA DEPARTMENT OF FISH AND GAME 124286

2. Mailing Address: P.O. BOX 3-2000

   City: JUNEAU State: AK Zip: 99802-2000

   Business Phone: 907-465-4100 Home Phone: _____

3. Name of the stream or water body in which water is proposed to be reserved:

   SOUTH FORK CAMPBELL CREEK

4. Location of the proposed reservation of water:

   (a) List ALL sections, townships, ranges and meridians from the beginning to the end of the stream segment and for all parts of the lake or waterbody in which water is requested to be reserved. (Attach extra pages if needed.)

   SEE ATTACHED APPENDIX A

(b) Describe the location of the point or points defining the boundary of the proposed reservation of water by river mile index, river mile, geographical or cultural landmark, etc., on the stream of water body. (Attach extra pages if needed.)

SEE ATTACHED APPENDIX A

(c) ATTACH a U.S. Geological Survey map at 1:63,360 scale, or 1:250,000 scale if 1:63,360 scale is unavailable for the area, clearly identifying the following for the proposed reservation of water:

SEE ATTACHED APPENDIX A

(1) Sections, townships, ranges and meridians

(2) The stream or water body in which the reservation of water is proposed

(3) Specific point or points defining the boundary of the proposed reservation of water

(4) Permanent, temporary or planned locations of water measurement devices (such as gaging stations, weirs, staff gages)

(5) Permanent, temporary or planned bench marks

5. (a) Identify the purpose(s) of the proposed reservation of water by checking the appropriate box(es).

[X] protection of fish and wildlife habitat, migration, and propagation

[ ] recreation and park purposes

[ ] navigation and transportation purposes

[ ] sanitary and water quality purposes

(b) Describe in detail the purpose(s) of the proposed reservation, including, when appropriate; species and life stage, type of recreation, vehicle, or water quality parameter, or other relevant information. (Attach extra page if needed.)

SEE ATTACHED APPENDIX A

6. Is the water currently being used for the purpose(s) applied for?

[X] Yes.

[ ] No. If no, when will use for this purpose begin? Specify approximate date.

_____

7. (a) Water requested to be reserved (check one):

[X] to maintain a specific instream flow rate, measured in cubic feet per second

[ ] to maintain a specific level of surface water, measured in cubic feet or acre feet

[ ] to maintain a specific surface water elevation, measured in relation to a permanent benchmark.

(b) Quantify the specific amount of water requested to be reserved: Identify and quantify, as appropriate; flow rates, quantities, surface water elevations, depths, etc., as they relate to the daily durations and months of the year during which the reservation is proposed. Include any flow release schedules from projects upstream of the proposed reservation that would apply. (Attach extra pages if needed.)

SEE ATTACHED APPENDIX A

8. Attach and submit with this application documentation or reports showing facts to support the following:

_____

(a) The need for the proposed reservation of water, including reasons why this reservation is being requested. **SEE ATTACHED APPENDIX A**

(b) Identify and describe the methodology, data, and data analysis used to substantiate the need for and the quantity of water requested for the proposed reservation of water, including:

SEE ATTACHED APPENDICES A, B, C, D

(1) Name and description of method used,

(2) Who conducted the study and analysis,

(3) Schedule of when data collection and analysis occurred,

(4) Type(s) of instrument(s) used to collect and analyze data,

(5) Description of data and how the data was collected, including when applicable, (A) selection of stream reach, study site and transect selection, (B) flow, survey, elevation, and depth measurements, (C) pertinent physical, biological, water chemistry and socio-economic data,

(6) Description of how data was analyzed, and

(7) Maps, photos, aerial photos, calculations, and any other documents supporting this application.

9. If there are provisions for monitoring this proposed reservation of water, include the following:

SEE ATTACHED APPENDIX A

(a) Description of monitoring equipment (such as gaging stations, staff gages, weirs)

(b) Location of monitoring equipment

(c) Provisions for payment of monitoring

(d) Reporting system.

Statements contained in this application are true and correct to the best of my knowledge.

Signed **FOR THE ALASKA DEPARTMENT OF FISH AND GAME**
Applicant(s) Full Legal Name(s)

Date 8/15/91

4. (a) South Fork of Campbell Creek

Township 12 North, Range 2 West, Sections 2, 3, Seward Meridian

Township 13 North, Range 2 West, Sections 31, 32, Seward Meridian

Township 13 North, Range 3 West, Sections 33, 34, 35, Seward Meridian

Ref: U.S. Geological Survey (USGS) Topographic Map, Anchorage A-7, A-8, 1:63,360 (Figures 1, 2).

(b) This reservation applies to stream flows within the South Fork of Campbell Creek and its floodplain from the mouth of the South Fork of Campbell Creek to approximately RM 5 of this fork. This reach of Campbell Creek has been specified as important to anadromous fish under AS16.05.870(a), as stream #247-60-10340-2020 (ADF&G 1987).

(c) Figure 1

(1) see 4 (a)

(2) The portion of the South Fork of Campbell Creek subject to reservation is marked on the attached map (Figure 1).

(3) See 4 (b).

(4) Continuous flow records have been recorded at a USGS station (#15274000) within this reach from 1947 to 1971. Its coordinates are: Lat 61°09'57", long 149°46'15".

(5) N/A

5. (b) The primary purpose of the proposed reservation for the South Fork of Campbell Creek is to protect fish production in the Campbell Creek drainage (Figure 3). Campbell Creek originates in the Chugach Mountains in the area surrounded by Tanaina Peak, Mount Williwaw, The Ramp, The Wedge, Powerline Pass, and Flattop Mountain. Campbell Creek flows in a meandering path westward through the Anchorage bowl (Figure 1). The North and South Forks of Campbell Creek join to form the mainstem at a point that is approximately eight miles from the mouth. Little Campbell Creek joins Campbell Creek approximately five miles from the mouth. Campbell Creek flows from Chugach State Park across the southern end of

Fort Richardson Military Reservation, through the city of Anchorage, and into Turnagain Arm of Cook Inlet. The North and South Fork flow approximately 13.0 and 13.5 miles respectively, from headwaters in the Chugach Mountains to the junction of the North and South forks. The overall length, of the creek, measuring from the headwaters of either fork, is approximately 21.0 miles. These measurements are approximated from the Anchorage USGS topographic maps 1:25,000 (A-8) NE and NW; 1:63,360 Anchorage (A-8) and the 1:63,360 Anchorage (A-7).(United States Geological Service)

This stream has been specified for protection, under AS16.05.870(a), as important to anadromous fish. The Atlas to the Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes indicates chinook (Oncorhynchus tshawytsha), coho (O. kisutch), and pink (O. gorbuscha) salmon have been observed and that chinook, coho, and pink salmon spawn and rear in the South Fork of Campbell Creek (ADFG 1984, Map Anchorage (A-8)). Pink salmon rear part of the year in the Campbell Creek drainage and chinook, and coho salmon rear on a year around basis in the Campbell Creek drainage.

Passage by chinook salmon, from saltwater to their spawning areas, occurs from approximately the second week in May and extends through approximately the last week in July. The period for chinook salmon spawning occurs from approximately the first week in July through the last week in August. Incubation for chinook occurs from approximately the first week in July through the last week in April. Rearing of chinook in the South Fork of Campbell Creek occurs on a year round basis (Pers. Comm. K. Delaney, K. Hepler, K. Roth 1988).

Passage by coho salmon, from saltwater to their spawning areas, occurs from approximately the first week in July and extends through approximately the second week in October. The period for coho salmon spawning occurs from approximately the first week in August through the last week in October. Incubation for coho occurs from approximately the first week in August through the second week in May. Rearing of coho in the South Fork of Campbell Creek occurs on a year round basis (Pers. Comm. K. Delaney, K. Hepler, K. Roth).

Passage of pink salmon to their spawning areas occurs from approximately the first week in July through approximately the first week in September. Most of the spawning by pink salmon occurs from the first week in July through the first week in September. Pink salmon incubation occurs from approximately the first week in July through the last week in April. Rearing of pinks in

the stream occurs in a period that approximately encompasses April and May. After this short fresh water rearing period the young pink salmon outmigrate to the ocean (Pers. Comm. K. Hepler, K. Roth).

A small number of chum (O. keta) salmon have been observed in Campbell Lake and are thought to use Campbell Creek for spawning. None, however have been observed in this reach of the Campbell Creek drainage. It is thought that chum salmon passage to their spawning areas is, approximately, from the third week in June through the second week in September. Spawning and incubation start in about the third week in July and extend through the end of September and the second week in May, respectively. The rearing period is considered to encompass the period from the third week in April through the first week in June (Pers. Comm. K. Hepler, K. Roth).

Most of the rainbow trout (O. mykiss) in this and other portions of Campbell Creek are not indigenous. Although some natural reproduction occurs, most of the population occurs through hatchery enhancement.

Rainbow trout begin spawning in about the third week in April and continue through about the second week in June, with incubation occurring from the third week of April through approximately the second week in August. Rainbow trout rear year around in Campbell Creek (Pers. Comm. K. Hepler, K. Roth).

A three year stocking program for steelhead (O. mykiss), sea-run rainbow trout, has been discontinued. It is thought that a perpetuating run of steelhead was not established. Steelhead that have been observed in Campbell Creek pass from saltwater into the creek in September and October. Spawning is from approximately the beginning of May through the end of June. The incubation period includes the period from the first of May through the end of July. Steelhead rear year around (Pers. Comm. K. Hepler, K. Roth).

Dolly Varden (Salvelinus malma) are found in this reach and throughout the drainage. Limited information is available about the timing of Dolly Varden life phases in this stream. From the information that is available it is thought that Dolly Varden spawning occupies the period from the third week in September through the second week in November, with incubation being from the second week in September through the middle of May. Dolly Varden rear in this stream on a year around basis. Dolly Varden have been observed within this entire reach.

Burbot (Lota lota) are not thought to be present in Campbell Creek (Pers. Comm. K. Hepler, K. Roth). Arctic grayling are not thought to be present, although they were stocked in 1968 (ADFG 1985).

In 1987, a total of 893 anglers made 2,001 fishing trips to Campbell Creek and fished 1,485 days. Anglers also harvested 408 rainbow trout and 104 Dolly Varden or Arctic char (Mills 1987, p. 58).

Substantial human development has occurred along Campbell Creek. The South Fork and other reaches of Campbell Creek are focal points for increasing recreational activities (e.g., fishing, floating, jogging, bicycling, hiking, and cross-country skiing) because of the associated qualities of the Creek, the adjacent green belt, Campbell Tract and its location within the heart of Anchorage.

Maintaining adequate instream flows within this reach of the South Fork of Campbell Creek is essential to preserving the fish and wildlife and other associated values of this system as is protecting its water quality.

Five years ago, the citizens of Anchorage expressed their support for the important values they placed on the quality of this creek by approving the sale of bonds to improve the water quality of this system.

7. (b)

MONTH	FLOW (cfs)
January	8
February	8
March	7
April	8
May	19
June	38
July	38
August	38
September	38
October	38
November	23
December	8

8. (a) The instream flow reservation is needed to protect and maintain fish production within the South Fork of Campbell Creek. The analyses that follow indicate that a reduction in flow will reduce the quality of habitat in this stream.

(b) An instream flow analysis is dependent upon determining the hydrological (and/or hydraulic) characteristics of a system and evaluating the effects that changes in those characteristics will have on the species that depend upon them.

The Tennant Method (Tennant 1975) was selected as an appropriate procedure for evaluating instream flow requirements for fish in the South Fork of Campbell Creek based upon the limited availability of hydrological and biological data, and financial and personnel resources.

This technique has been tested successfully in court, has been successfully used to quantify instream flows for other instream flow reservations in Alaska, requires minimal expenditures of resources and can be used with limited or extensive hydrological and fishery data bases. The selection of the Tennant Method to quantify instream flows for this and other Alaskan streams is also supported by the results of a research project conducted to evaluate and compare applications of different instream flow methods to the same stream reach (Estes 1984; Estes and Orsborn 1986). The evaluation was sponsored by the U.S. Soil Conservation Service, Alaska Department of Fish and Game (ADF&G), Alaska Department of Natural Resources (ADNR), U.S. Geological Survey, and Washington State University. The results of that study indicated that the Tennant, and other instream flow techniques, can be applied to Alaskan streams to quantify instream flow requirements if adapted to local hydrological and biological characteristics and considerations.

The Tennant Method (also referred to as the Montana Method in earlier literature) is considered one of the simplest, yet reliable techniques, for selecting or qualitatively evaluating instream flows for fish and wildlife. Tennant established eight flow classifications by analyzing a series of field measurements and observations. Each is assigned a percentage range of the average annual flow (QAA). Seven of the classifications characterize habitat quality for fish and wildlife and the eighth provides for a short term flushing flow to maintain channel substrate characteristics for suitable fish spawning and incubation and benthic invertebrate production. The percentages of QAA for habitat quality range from <10 percent (Severe Degradation) to 60-100% (Optimum Range). The flushing flow recommendation is 200% of the QAA (Tennant 1975). Estes (1984) suggests the flushing value should be increased to 400% or more over a three to seven day period.

The Tennant Method requires that a QAA be calculated from an existing or synthesized data base. A flow recommendation is established by selecting the desired qualitative habitat classification and multiplying the QAA by the corresponding percentage or percentage range assigned to that classification.

A USGS gaging station (#15274000) was located within this reach. An evaluation of the morphology of South Fork of Campbell Creek, other watershed characteristics, fish distribution within this gaged reach and recommendations from the U.S. Geological Survey were used to define the boundaries of the reach.

To determine the recommended instream flow requirements for the reach specified in this application, discharge records from the USGS station #15274000 were summarized. Duration values and monthly flow statistics were among the data calculated.

Reservation flows were derived by calculating Tennant flow values using the long-term QAA and comparing them with mean monthly flow, duration analysis values,.and fish periodicity (fish life phase timing). This approach to derive the required instream flow reservation values should prevent the allocation of more water than occurs in Campbell Creek.

Although important to the fishery, a flushing flow was not specified and requested within this application because this river is not regulated. However, if it were determined that future applications for water withdrawals or diversions would prevent the occurrence of the equivalent of the one in two year flood flow (QF2P) and the three to seven days of flows associated with this event, a provision will be requestedd to insure these flows will not be eliminated (see Estes 1984).

One of the limitations of the Tennant Method is that channel configuration or seasonal variability may require that the percentages associated with the qualitative habitat ratings be adjusted in quantity and/or for the season/month they apply. In the case of South Fork of Campbell Creek, an evaluation of the results of these analyses was considered reasonable when compared with the duration analysis and other hydrological information for Campbell Creek.

9. USGS station 15274000 should be reactivated; otherwise there are no flow recording devices within this reach of river.

LITERATURE CITED

Alaska Administrative Code. Chapter 5 Section 61.001-050.

Alaska Department of Fish and Game (ADF&G). 1984. An atlas to the catalog of waters important for spawning, rearing or migration of anadromous fishes. Revised 1987. Southcentral Region, Resource Management Region II. Habitat Division, Juneau, Alaska. Map numbers Anchorage (A-7), and (A-8).

ADF&G. 1985. Alaska habitat management guide. Southcentral region volume II: Distribution, abundance, and human use of fish and wildlife. Habitat Division, Juneau, Alaska.

ADF&G. 1987. Catalog of waters important for spawning, rearing, or migration of anadromous fishes. ADF&G. Habitat Division. Juneau, Alaska.

Delaney, K. J. 1988. Personal communication. ADFG Fishery Biologist. Sport Fish Division, Region II. Anchorage, Alaska.

Estes, C. C. 1984. Evaluation of methods for recommending instream flows to support spawning by salmon. M.S. Thesis. Washington State University. Pullman, Washington.

Estes, C. C. 1987. Instream flow. ADF&G. Division of Sport Fish. Federal Aid in Sport Fish Restoration, Annual Performance Report, 1986-1987. Project F-10-2, Job No. RT-7. Juneau, Alaska.

Estes, C. C., and J. F. Orsborn. 1986. Review and analysis of methods for quantifying instream flow requirements. Water Resources Bulletin. 22(3):389-398.

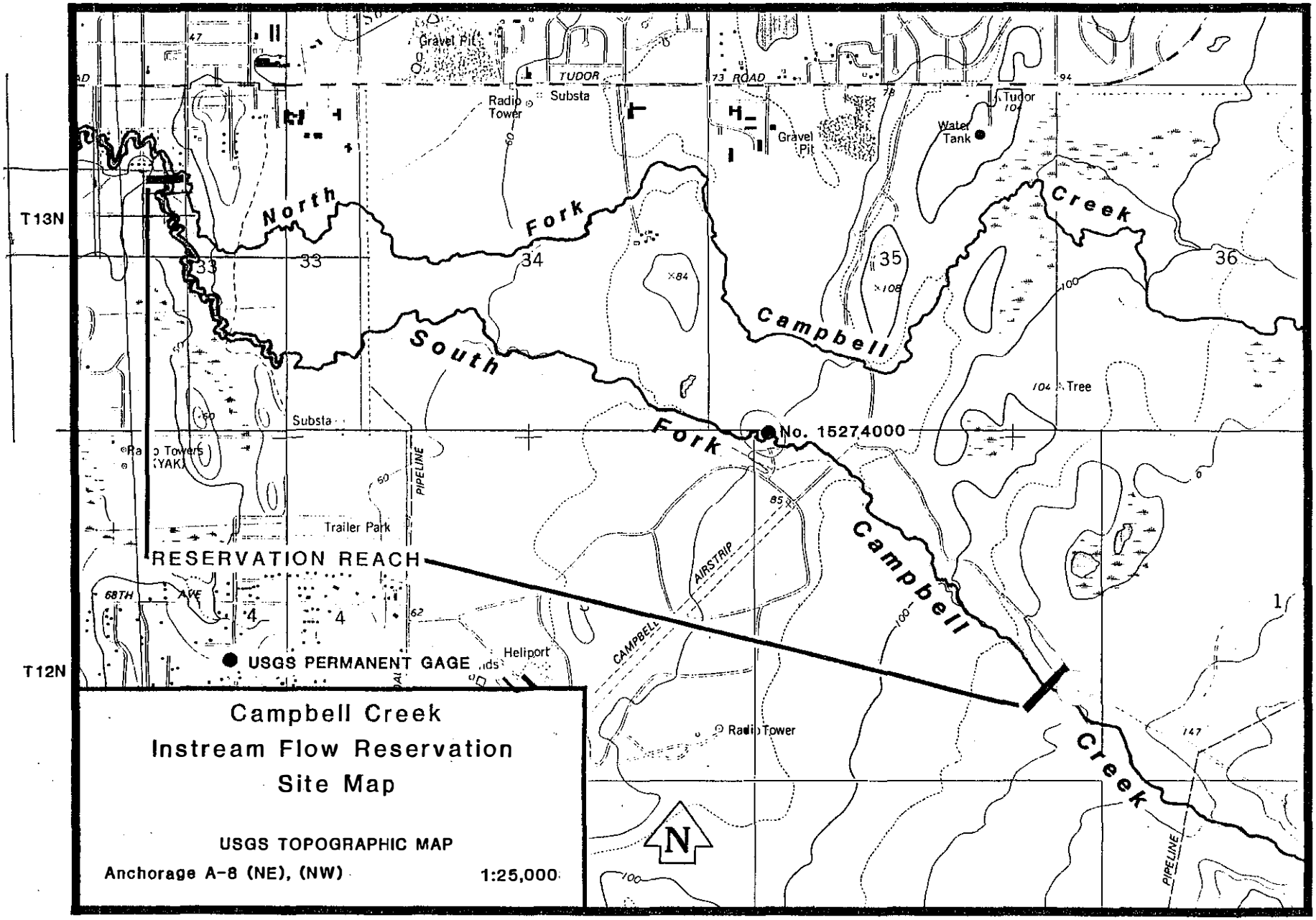
Hepler, K. R. 1988. Personal communication. ADFG Fishery Biologist. Sport Fish Division, Region II. Anchorage, Alaska.

Mills, M. J. 1987. Alaska statewide sport fisheries harvest report. Fishery data series number 2. Alaska Department of Fish and Game. Juneau, Alaska. 141 pp.

Roth, K. J. 1988. Personal communication. ADFG Fishery Biologist. Sport Fish Division, Region II. Anchorage, Alaska.

Tennant, D. L. 1975. Instream flow regimes for fish, wildlife, recreation, and related environmental resources. U.S. Fish and Wildlife Service. Billings, Montana.

Tennant, D. L. 1976. Instream flow regimes for fish, wildlife, recreation, and related environmental resources. In: Instream Flow Needs, Volume II, J. F. Orsborn and C. H. Allman (Editors), American Fisheries Society, Bethesda, Maryland, pp. 359-373.

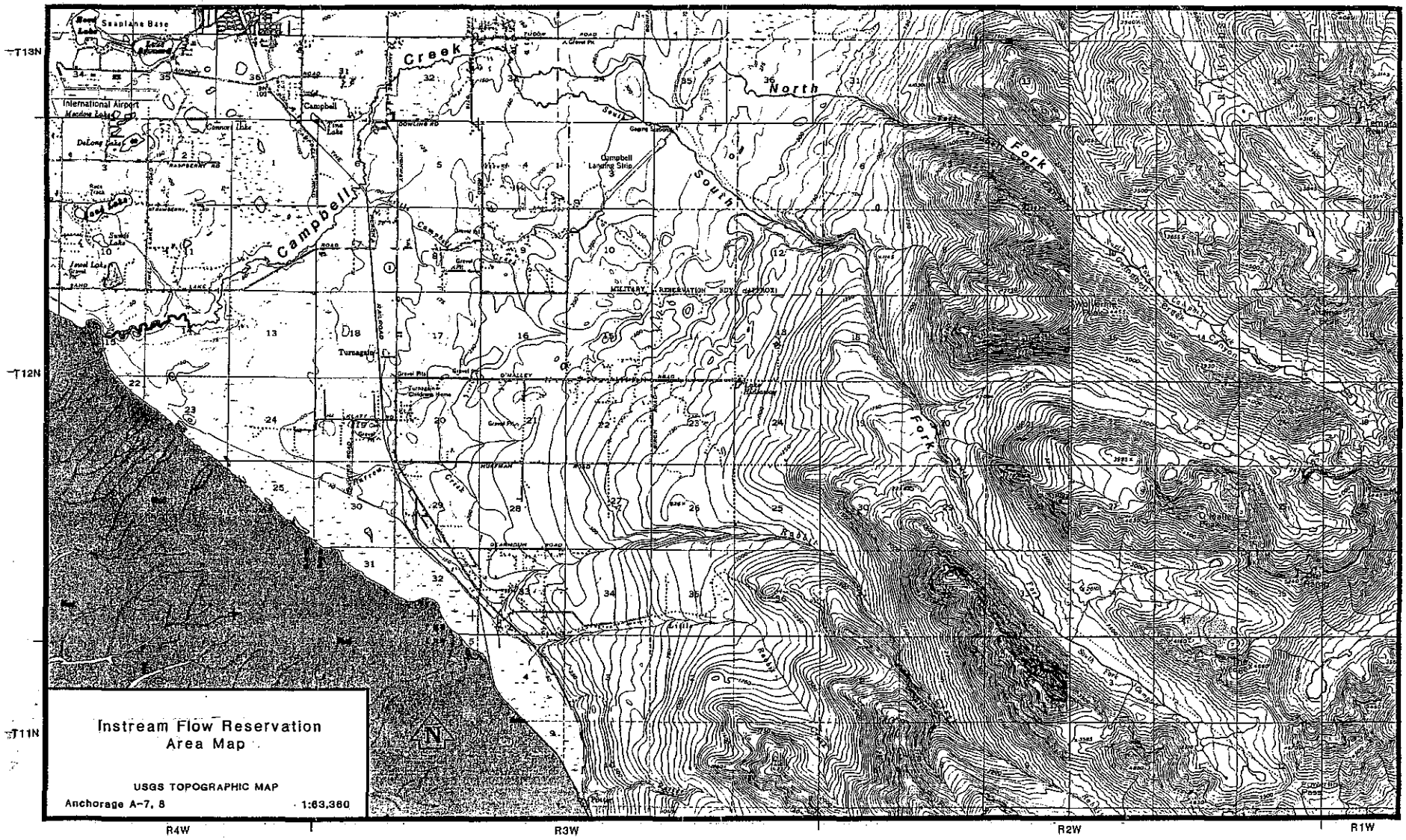


Campbell Creek Instream Flow Reservation Site Map

USGS TOPOGRAPHIC MAP

Anchorage A-8 (NE), (NW) **1:25,000**

Appendix A, Figure 2,



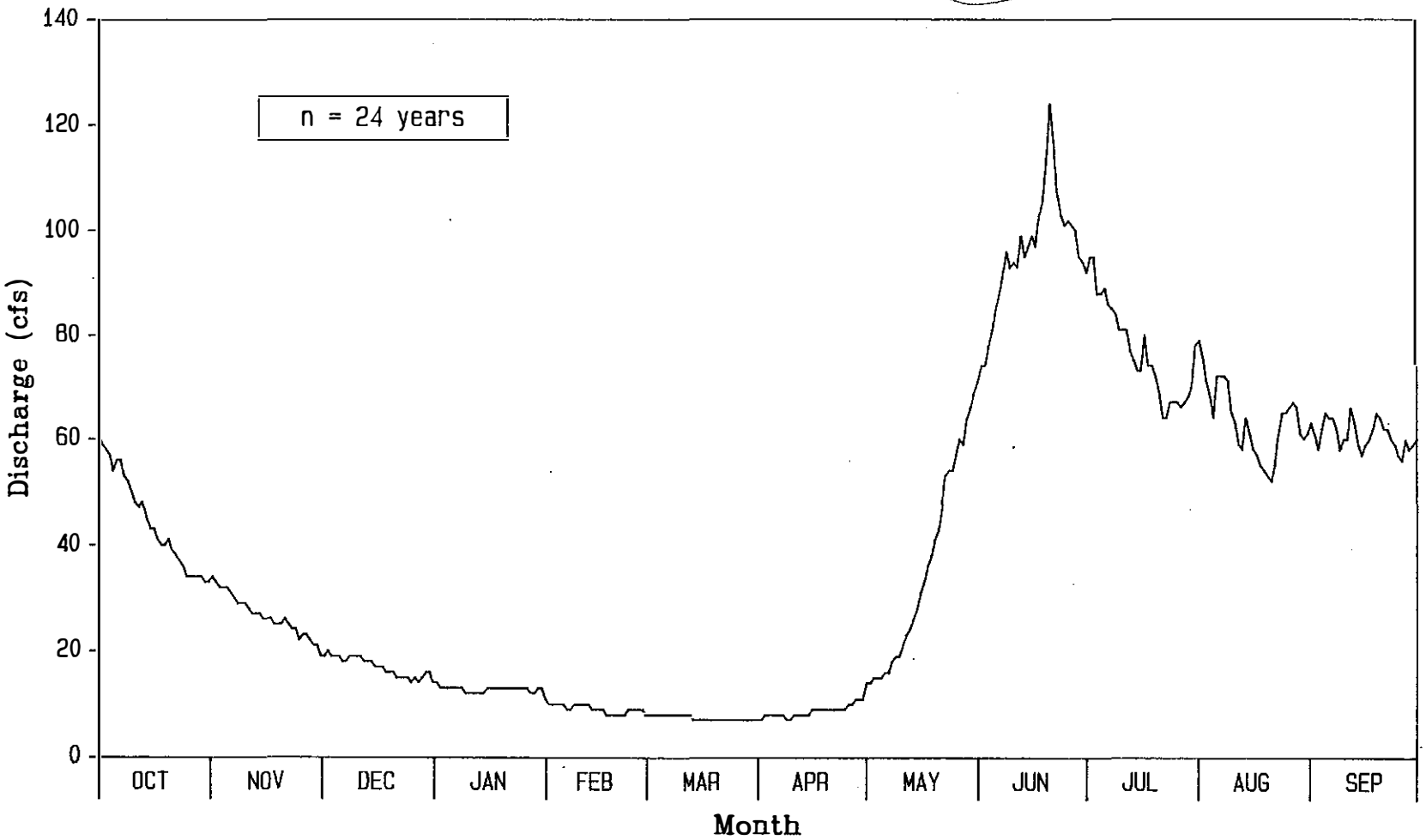
Appendix A. Figure 3. Species periodicity chart for: South Fork of Campbell Creek

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON												
Passage					XX	XXXX	XXXX					
Spawning							XXXX	XXXX				
Incubation	XXXX	XXXX	XXXX	XXXX			XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
COHO SALMON												
Passage							XXXX	XXXX	XXXX	XX		
Spawning								XXXX	XXXX	XXXX		
Incubation	XXXX	XXXX	XXXX	XXXX	XX			XXXX	XXXX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
PINK SALMON												
Passage							XXXX	XXXX	X			
Spawning							XXXX	XXXX	X			
Incubation	XXXX	XXXX	XXXX	XXXX			XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing				XXXX	XXXX							
DOLLY VARDEN												
Passage ?												
Spawning									XX	XXXX	XX	
Incubation	XXXX	XXXX	XXXX	XXXX	XX				XX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
RAINBOW TROUT												
Passage ?												
Spawning				XX	XXXX	XX						
Incubation				XX	XXXX	XXXX	XXXX	XX				
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

Based on professional judgement of ADF&G biologists.
Incubation life phase includes period from egg deposition to fry emergence.
? = Data not available.

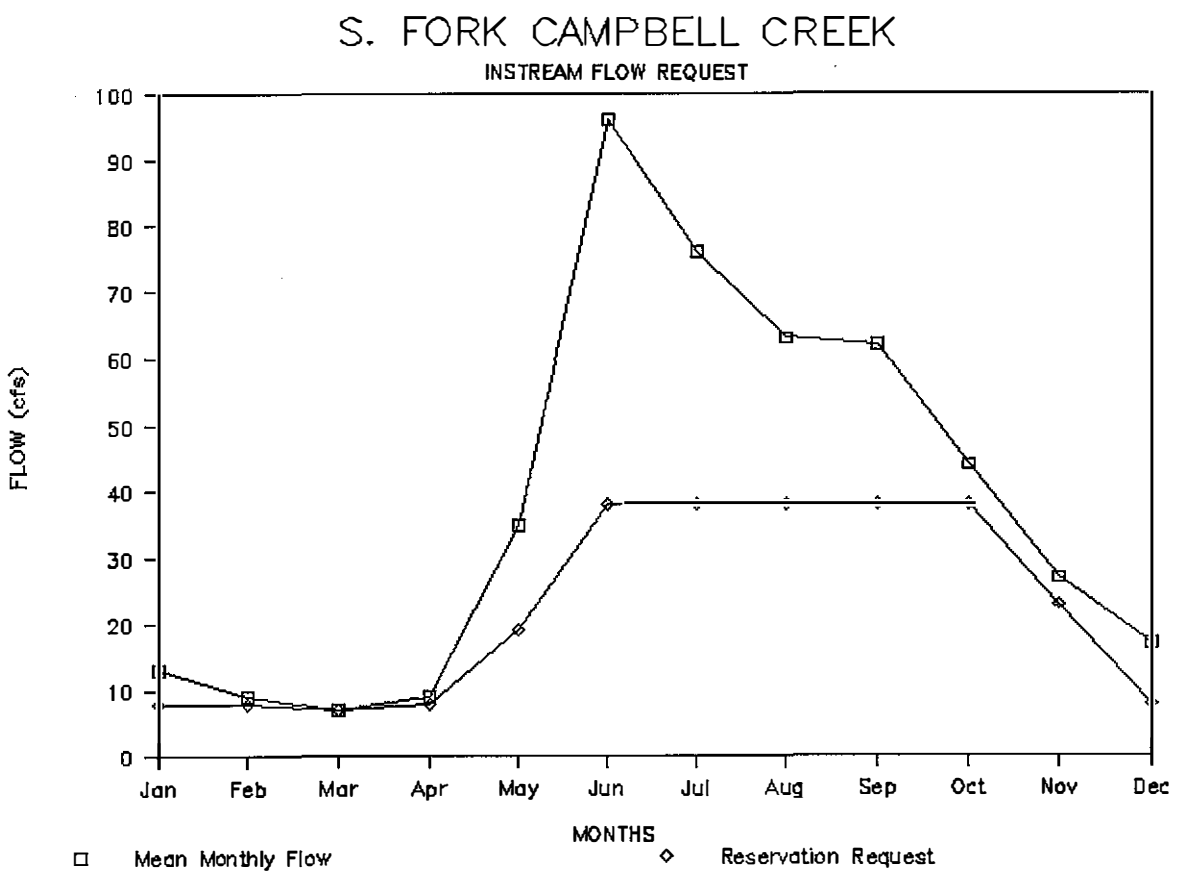
SOUTH FORK CAMPBELL CREEK NEAR ANCHORAGE

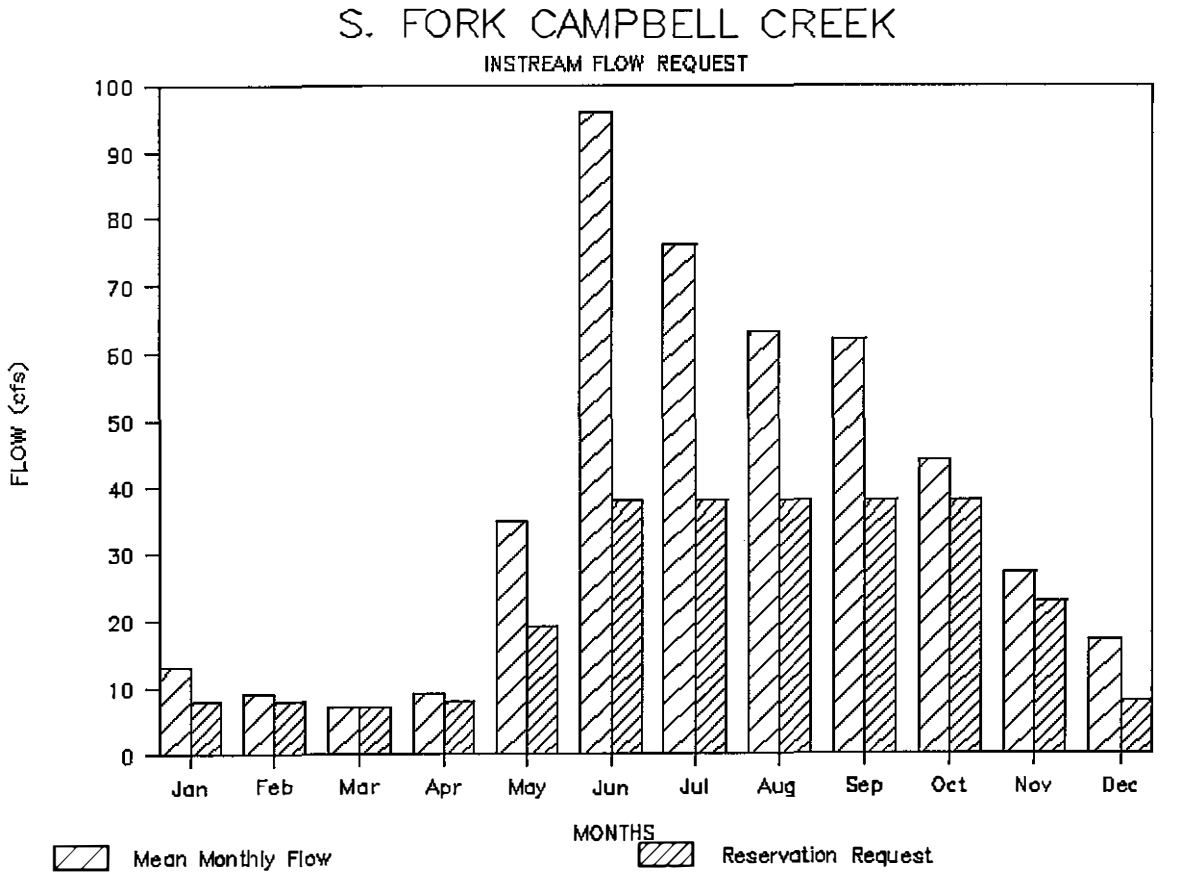
ANNUAL HYDROGRAPH OF MEAN DAILY FLOW VALUES
IN ALASKA, USGS SITE NUMBER 15274000
PERIOD OF RECORD: 1 OCT 1947–30 SEP 1971



Appendix A, Figure 4.

Appendix A. Figure 5.





Appendix A. Table 1.

Tennant Method Flow Classifications (adapted from Tennant 1975)

Narrative Description of Flows	Seasonal Base Flow (Q) Regimens as Percentages (%) of Average Annual Flow (QAA)	
Location: SOUTH FORK OF CAMPBELL CREEK		
	% of QAA	Flow (cfs)
Month	Nov.- Apr.	
QAA	100	38
Flushing or Maximum	200	76
Optimum Range	60-100	23-38
Outstanding	40	15
Excellent	30	11
Good	20	8
Fair or Degrading	10	4
Poor or Minimum	10	4
Severe Degredation	<10	<4
Month	May - Oct.	
QAA	100	38
Flushing or Maximum	200	76
Optimum Range	60-100	23-38
Outstanding	60	23
Excellent	50	19
Good	40	15
Fair or Degrading	30	11
Poor or Minimum	10	4
Severe Degredation	<10	<4

Appendix A. Table 2. Long-term Monthly Flow Characteristics.

Month	Long-term Mean Monthly Flow (cfs) Mean	Instantaneous Flow (cfs) Recommendation*
Jan	13	8 Good
Feb	9	8 Good
Mar	7	7 Fair
Apr	9	8 Good
May	35	19 Excellent
Jun	96	38 Optimum
Jul	76	38 Optimum
Aug	63	38 Optimum
Sep	62	38 Optimum
Oct	44	38 Optimum
Nov	27	23 Outstanding/Optimum
Dec	17	8 Good

*Adjusted by mean monthly and duration analysis values.
Higher flows than those being requested for the months of June and July are required for maintaining physical characteristics of the river suitable for fish and related organisms.

SAS

CALCULATE AND SUMMARIZE MEAN MONTHLY FLOWS AND QAA FOR
SF CAMPBELL CR NEAR ANCHORAGE, ALASKA, SITE NUMBER 15274000

DATES OF RECORD FOR ANALYSES ARE
01 JULY 1947 - 30 SEPTEMBER 1971

MONTHLY FLOW STATISTICS	Q (cfs) SF CAMPBELL CR NEAR ANCHORAGE			
	# OF DAYS	MIN	MEAN	MAX
MONTH				
JAN	744	4	13	41
FEB	678	3	9	29
MAR	744	2	7	20
APR	720	3	9	28
MAY	744	4	35	190
JUN	720	20	96	572
JUL	775	21	76	298
AUG	775	24	63	220
SEP	750	19	62	210
OCT	744	11	44	185
NOV	720	6	27	74
DEC	744	6	17	70

Appendix B. Mean Monthly Flows.

CALCULATE AND SUMMARIZE MEAN MONTHLY FLOWS AND QAA FOR
SF CAMPBELL CR NEAR ANCHORAGE, ALASKA, SITE NUMBER 15274000

DATES OF RECORD FOR ANALYSES ARE
01 OCTOBER 1947 - 30 SEPTEMBER 1971

ANNUAL FLOW STATISTICS	N	MIN	MEAN	MAX
WATER YEAR				
1948	366	8	43	150
1949	365	6	51	572
1950	365	8	31	140
1951	365	4	33	172
1952	366	7	36	155
1953	365	8	50	183
1954	365	8	30	118
1955	365	5	44	298
1956	366	8	33	197
1957	365	6	32	129
1958	365	9	37	147
1959	365	6	40	146
1960	366	6	46	198
1961	365	9	51	209
1962	365	8	47	347
1963	365	5	47	292
1964	366	2	36	159
1965	365	4	32	140
1966	365	4	38	140
1967	365	7	41	186
1968	366	4	34	123

(CONTINUED)

CALCULATE AND SUMMARIZE MEAN MONTHLY FLOWS AND QAA FOR
SF CAMPBELL CR NEAR ANCHORAGE, ALASKA, SITE NUMBER 15274000

DATES OF RECORD FOR ANALYSES ARE
01 OCTOBER 1947 - 30 SEPTEMBER 1971

ANNUAL FLOW STATISTICS	N	MIN	MEAN	MAX
WATER YEAR				
1969	365	3	20	97
1970	365	3	34	155
1971	365	3	33	220
MEAN STATS FOR ALL YEARS	24	20	38	51

FLOW DURATION CURVE DATA FROM DAILY FLOW LEVELS FOR
SF CAMPBELL CR NEAR ANCHORAGE, ALASKA, SITE NUMBER 15274000
BY MONTH

DATES OF RECORD FOR ANALYSES ARE 01 JUL 1947 THRU 30 SEP 1971

MONTH=JAN

PERCENT EXCEEDANCE	FLOW VALUE (cfs)	LOG(10) FLOW VALUE
100	3.80	0.57978
95	6.00	0.77815
90	7.00	0.84510
85	8.00	0.90309
80	9.00	0.95424
75	10.00	1.00000
70	10.00	1.00000
65	11.00	1.04139
60	11.00	1.04139
55	12.00	1.07918
50	12.00	1.07918
45	13.00	1.11394
40	13.00	1.11394
35	13.00	1.11394
30	14.00	1.14613
25	14.00	1.14613
20	14.00	1.14613
15	15.00	1.17609
10	16.00	1.20412
5	25.00	1.39794
0	41.00	1.61278

FLOW DURATION CURVE DATA FROM DAILY FLOW LEVELS FOR
SF CAMPBELL CR NEAR ANCHORAGE, ALASKA, SITE NUMBER 15274000
BY MONTH

DATES OF RECORD FOR ANALYSES ARE 01 JUL 1947 THRU 30 SEP 1971

MONTH=FEB

PERCENT EXCEEDANCE	FLOW VALUE (cfs)	LOG(10) FLOW VALUE
100	3.00	0.47712
95	4.50	0.65321
90	5.50	0.74036
85	6.00	0.77815
80	6.00	0.77815
75	7.00	0.84510
70	7.00	0.84510
65	8.00	0.90309
60	8.00	0.90309
55	8.00	0.90309
50	9.00	0.95424
45	9.00	0.95424
40	10.00	1.00000
35	10.00	1.00000
30	10.00	1.00000
25	11.00	1.04139
20	12.00	1.07918
15	12.00	1.07918
10	13.00	1.11394
5	16.00	1.20412
0	29.00	1.46240

FLOW DURATION CURVE DATA FROM DAILY FLOW LEVELS FOR
SF CAMPBELL CR NEAR ANCHORAGE, ALASKA, SITE NUMBER 15274000
BY MONTH

DATES OF RECORD FOR ANALYSES ARE 01 JUL 1947 THRU 30 SEP 1971

MONTH=MAR

PERCENT EXCEEDANCE	FLOW VALUE (cfs)	LOG(10) FLOW VALUE
100	2.00	0.30103
95	3.50	0.54407
90	4.00	0.60206
85	4.00	0.60206
80	5.00	0.69897
75	5.25	0.72016
70	6.00	0.77815
65	7.00	0.84510
60	7.00	0.84510
55	7.00	0.84510
50	8.00	0.90309
45	8.00	0.90309
40	8.00	0.90309
35	9.00	0.95424
30	9.00	0.95424
25	9.00	0.95424
20	9.00	0.95424
15	10.00	1.00000
10	10.00	1.00000
5	11.00	1.04139
0	20.00	1.30103

FLOW DURATION CURVE DATA FROM DAILY FLOW LEVELS FOR
SF CAMPBELL CR NEAR ANCHORAGE, ALASKA, SITE NUMBER 15274000
BY MONTH

DATES OF RECORD FOR ANALYSES ARE 01 JUL 1947 THRU 30 SEP 1971

MONTH=APR

PERCENT EXCEEDANCE	FLOW VALUE (cfs)	LOG(10) FLOW VALUE
100	2.80	0.44716
95	4.00	0.60206
90	4.50	0.65321
85	5.00	0.69897
80	6.00	0.77815
75	6.00	0.77815
70	6.00	0.77815
65	7.00	0.84510
60	7.00	0.84510
55	7.00	0.84510
50	8.00	0.90309
45	8.00	0.90309
40	8.00	0.90309
35	9.00	0.95424
30	9.00	0.95424
25	10.00	1.00000
20	10.00	1.00000
15	10.00	1.00000
10	12.00	1.07918
5	20.00	1.30103
0	28.00	1.44716

FLOW DURATION CURVE DATA FROM DAILY FLOW LEVELS FOR
SF CAMPBELL CR NEAR ANCHORAGE, ALASKA, SITE NUMBER 15274000
BY MONTH

DATES OF RECORD FOR ANALYSES ARE 01 JUL 1947 THRU 30 SEP 1971

MONTH=MAY

PERCENT EXCEEDANCE	FLOW VALUE (cfs)	LOG(10) FLOW VALUE
100	3.50	0.54407
95	8.00	0.90309
90	10.00	1.00000
85	12.00	1.07918
80	13.00	1.11394
75	14.00	1.14613
70	16.00	1.20412
65	20.00	1.30103
60	21.00	1.32222
55	24.00	1.38021
50	27.00	1.43136
45	29.00	1.46240
40	34.00	1.53148
35	39.00	1.59106
30	43.00	1.63347
25	47.00	1.67210
20	54.00	1.73239
15	61.00	1.78533
10	66.00	1.81954
5	90.00	1.95424
0	190.00	2.27875

FLOW DURATION CURVE DATA FROM DAILY FLOW LEVELS FOR
SF CAMPBELL CR NEAR ANCHORAGE, ALASKA, SITE NUMBER 15274000
BY MONTH

DATES OF RECORD FOR ANALYSES ARE 01 JUL 1947 THRU 30 SEP 1971

MONTH=JUN

PERCENT EXCEEDANCE	FLOW VALUE (cfs)	LOG(10) FLOW VALUE
100	20.00	1.30103
95	44.00	1.64345
90	52.00	1.71600
85	57.50	1.75967
80	64.00	1.80618
75	68.00	1.83251
70	71.50	1.85431
65	76.00	1.88081
60	80.00	1.90309
55	84.00	1.92428
50	88.50	1.94694
45	92.00	1.96379
40	97.00	1.98677
35	100.00	2.00000
30	109.00	2.03743
25	115.00	2.06070
20	123.00	2.08991
15	130.00	2.11394
10	141.00	2.14922
5	160.00	2.20412
0	572.00	2.75740

FLOW DURATION CURVE DATA FROM DAILY FLOW LEVELS FOR
SF CAMPBELL CR NEAR ANCHORAGE, ALASKA, SITE NUMBER 15274000
BY MONTH

DATES OF RECORD FOR ANALYSES ARE 01 JUL 1947 THRU 30 SEP 1971

MONTH=JUL

PERCENT EXCEEDANCE	FLOW VALUE (cfs)	LOG(10) FLOW VALUE
100	21.00	1.32222
95	33.00	1.51851
90	43.00	1.63347
85	48.00	1.68124
80	52.00	1.71600
75	54.00	1.73239
70	57.00	1.75587
65	60.00	1.77815
60	65.00	1.81291
55	68.00	1.83251
50	71.00	1.85126
45	73.00	1.86332
40	75.00	1.87506
35	80.00	1.90309
30	83.00	1.91908
25	87.00	1.93952
20	93.00	1.96848
15	105.00	2.02119
10	120.00	2.07918
5	144.00	2.15836
0	298.00	2.47422

FLOW DURATION CURVE DATA FROM DAILY FLOW LEVELS FOR
SF CAMPBELL CR NEAR ANCHORAGE, ALASKA, SITE NUMBER 15274000
BY MONTH

DATES OF RECORD FOR ANALYSES ARE 01 JUL 1947 THRU 30 SEP 1971

MONTH=AUG

PERCENT EXCEEDANCE	FLOW VALUE (cfs)	LOG(10) FLOW VALUE
100	24.00	1.38021
95	30.00	1.47712
90	36.00	1.55630
85	38.00	1.57978
80	41.00	1.61278
75	43.00	1.63347
70	45.00	1.65321
65	48.00	1.68124
60	50.00	1.69897
55	53.00	1.72428
50	56.00	1.74819
45	59.00	1.77085
40	63.00	1.79934
35	68.00	1.83251
30	71.00	1.85126
25	76.00	1.88081
20	80.00	1.90309
15	88.00	1.94448
10	99.00	1.99564
5	119.00	2.07555
0	220.00	2.34242

FLOW DURATION CURVE DATA FROM DAILY FLOW LEVELS FOR
SF CAMPBELL CR NEAR ANCHORAGE, ALASKA, SITE NUMBER 15274000
BY MONTH

DATES OF RECORD FOR ANALYSES ARE 01 JUL 1947 THRU 30 SEP 1971

MONTH=SEP

PERCENT EXCEEDANCE	FLOW VALUE (cfs)	LOG(10) FLOW VALUE
100	19.00	1.27875
95	23.00	1.36173
90	30.00	1.47712
85	32.00	1.50515
80	35.00	1.54407
75	37.00	1.56820
70	40.00	1.60206
65	43.00	1.63347
60	46.00	1.66276
55	49.00	1.69020
50	52.00	1.71600
45	57.00	1.75587
40	61.00	1.78533
35	67.00	1.82607
30	71.50	1.85431
25	79.00	1.89763
20	86.00	1.93450
15	95.00	1.97772
10	105.50	2.02325
5	124.00	2.09342
0	210.00	2.32222

FLOW DURATION CURVE DATA FROM DAILY FLOW LEVELS FOR
SF CAMPBELL CR NEAR ANCHORAGE, ALASKA, SITE NUMBER 15274000
BY MONTH

DATES OF RECORD FOR ANALYSES ARE 01 JUL 1947 THRU 30 SEP 1971

MONTH=OCT

PERCENT EXCEEDANCE	FLOW VALUE (cfs)	LOG(10) FLOW VALUE
100	11.00	1.04139
95	18.00	1.25527
90	22.00	1.34242
85	25.00	1.39794
80	27.00	1.43136
75	30.00	1.47712
70	31.00	1.49136
65	33.00	1.51851
60	35.00	1.54407
55	37.00	1.56820
50	39.00	1.59106
45	41.00	1.61278
40	45.00	1.65321
35	49.00	1.69020
30	53.00	1.72428
25	56.00	1.74819
20	60.00	1.77815
15	66.00	1.81954
10	72.00	1.85733
5	84.00	1.92428
0	185.00	2.26717

FLOW DURATION CURVE DATA FROM DAILY FLOW LEVELS FOR
SF CAMPBELL CR NEAR ANCHORAGE, ALASKA, SITE NUMBER 15274000
BY MONTH

DATES OF RECORD FOR ANALYSES ARE 01 JUL 1947 THRU 30 SEP 1971

MONTH=NOV

PERCENT EXCEEDANCE	FLOW VALUE (cfs)	LOG(10) FLOW VALUE
100	6.00	0.77815
95	12.00	1.07918
90	13.00	1.11394
85	15.00	1.17609
80	18.00	1.25527
75	19.00	1.27875
70	20.00	1.30103
65	21.00	1.32222
60	23.00	1.36173
55	24.00	1.38021
50	25.00	1.39794
45	27.00	1.43136
40	28.00	1.44716
35	29.00	1.46240
30	30.00	1.47712
25	32.00	1.50515
20	35.00	1.54407
15	38.00	1.57978
10	40.50	1.60746
5	46.50	1.66745
0	74.00	1.86923

FLOW DURATION CURVE DATA FROM DAILY FLOW LEVELS FOR
SF CAMPBELL CR NEAR ANCHORAGE, ALASKA, SITE NUMBER 15274000
BY MONTH

DATES OF RECORD FOR ANALYSES ARE 01 JUL 1947 THRU 30 SEP 1971

MONTH=DEC

PERCENT EXCEEDANCE	FLOW VALUE (cfs)	LOG(10) FLOW VALUE
100	6.00	0.77815
95	10.00	1.00000
90	11.00	1.04139
85	11.00	1.04139
80	13.00	1.11394
75	13.00	1.11394
70	14.00	1.14613
65	15.00	1.17609
60	15.00	1.17609
55	16.00	1.20412
50	17.00	1.23045
45	17.00	1.23045
40	18.00	1.25527
35	19.00	1.27875
30	19.00	1.27875
25	20.00	1.30103
20	21.00	1.32222
15	22.00	1.34242
10	24.00	1.38021
5	26.00	1.41497
0	70.00	1.84510