

DIVISION OF MINING, LAND AND WATER
WATER RESOURCES SECTION
www.dnr.state.ak.us/mlw/water/index.htm



Anchorage Office 550 West 7 th Avenue, Suite 1020 Anchorage, AK 99501-3562 (907) 269-8588 Fax: (907) 269-8947		For ADNR Use Only Date/Time Stamp
For ADNR Use Only LAS #	For ADNR Use Only CID #	For ADNR Use Only Receipt Type WR

APPLICATION FOR RESERVATION OF WATER

INSTRUCTIONS <ol style="list-style-type: none"> 1. Complete one application per stream segment or water body (incomplete applications will not be accepted). 2. Attach legible map(s) indicating all sections from the beginning to the end of stream segment or for all parts of the lake or water body. 3. Submit non-refundable fee of \$1,500. 4. Attach extra pages for each section, as needed.
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APPLICANT INFORMATION			
Organization Name (if applicable)		Agent or Consultant Name (if applicable)	
Individual Applicant Name (if applicable)		Individual Co-applicant Name (if applicable)	
Mailing Address	City	State	Zip Code
Daytime Phone Number		Alternate Phone Number (optional)	
Fax Number (optional)		E-Mail Address (optional)	

LOCATION OF PROPOSED RESERVATION OF WATER					
Geographic Name of Waterbody					
Meridian	Township	Range	Section	Quarter Sections	
				1/4	1/4
				1/4	1/4

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 or water body.

Attach a US 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:

1. Sections, townships, range 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

WATER USE

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

- Protection of fish and wildlife habitat, migration, and propagation
- Recreation and park purposes
- Navigation and transportation purposes
- Sanitary and water quality purposes

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.

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

Yes

No If no, when will use for this purpose begin? Specify approximate date _____

WATER QUANTITY

Water requested to be reserved – **Check one**

- To maintain a specific instream flow rate, measured in cubic feet per second
- To maintain a specific amount of surface water, measured in cubic feet or acre feet
- To maintain a specific surface water elevation, measured in relation to a permanent benchmark

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 requested time periods of the year during which the reservation is proposed. Include any flow release schedules from projects upstream of the proposed reservation that would be necessary.

METHODOLOGY AND MONITORING

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 the reservation is being requested.
- (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:
 - 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 were 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 were analyzed, and
 - 7. Maps, photos, aerial photos, calculations, and any other documents supporting this application

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

- (a) Description of monitoring equipment (such as gaging stations, staff gages, weirs)
- (b) Location of monitoring equipment
- (c) Provisions for payment for monitoring
- (d) Reporting system

11 AAC 93.142 sets out the required information on the application for a reservation of water. 11 AAC 93.143 authorizes the commissioner to decide what additional information needed to process an application for a reservation of water. This information is made a part of the state public water records and becomes public information under AS 40.25.110 and 40.25.120. Public information is open to inspection by you or any member of the public. A person who is the subject of the information may challenge its accuracy or completeness under AS 44.99.310, by giving a written description of the challenged information, the changes needed to correct it, and a name and address where the person can be reached. False statements made in an application for a benefit are punishable under AS 11.56.210.

SIGNATURE

The information presented in this application is true and correct to the best of my knowledge.

Signature

Date

Name (please print)

Title (if applicable)

Fee required by regulation 11 AAC 05.010(a)(8)

- **\$1,500** for up to 40 hours of staff time

Make checks payable to "Department of Natural Resources."

LOCATION OF PROPOSED RESERVATION OF WATER

Meridian	Township	Range	Sections
Copper River	48S	63E	21, 27, 28

Kadashan River is located near the community of Tenakee Springs in Southeast Alaska (Figure 1). This proposed reservation of water applies to stream flows within Reach B, one of five reaches within the Kadashan River watershed for which ADF&G has submitted a reservation of water application. Reach B begins just upstream of Reach A and extends upstream 1.8 river miles to the confluence with Hook Creek (Figure 2). Stream reach boundaries were selected to ensure fish were present and to minimize the differences in flows (from accretion or reduction) within the reach. Reach boundaries were based on U.S. Geological Survey (U.S. Geological Survey, 1962) topographic maps.

WATER USE

The primary purpose of this proposed reservation is to protect fish habitat, migration and propagation within the Kadashan River and its watershed. This reach has been specified as important to anadromous fish (under AS 16.05.871) as Anadromous Water Catalog stream number 112-24-10250 by the Alaska Department of Fish and Game (Johnson and Blanche 2011). Coho salmon (*Oncorhynchus kisutch*), chum salmon (*O. keta*), steelhead trout (*O. mykiss*), rainbow trout (*O. mykiss*), pink salmon (*O. gorbuscha*), cutthroat trout (*O. clarki*), and Dolly Varden (*Salvelinus malma*) utilize the Kadashan River for a portion of, or all of their spawning, incubation, rearing, and passage life phases (B. Glynn, Fishery Biologist, Douglas, ADF&G, 2007 personal communication; Figure 3). These species contribute to sport and commercial fisheries in the area and provide recreational opportunities and values as well. Water of sufficient quantity is needed to sustain production of these valuable fisheries.

WATER QUANTITY

Requested instantaneous flows in cubic feet per second (cfs) to be reserved:

Time Period	Requested Reservation Flows (cfs)
January	26
February	35
March	40
April	87
May	191
June	145
July	58
August	33
September	65

October	132
November	79
December	40

METHODOLOGY AND MONITORING

Procedures used to prepare this reservation complied with reservation of water application instructions and requirements established by state law (AS 46.15.145) and regulations (11 AAC 93.141-147), and relevant portions of the *"State of Alaska Instream Flow Handbook"* (DNR 1985).

Requested flows were based primarily on flow duration analyses (Annear et al. 2004) combined with available fish data. Flow duration analyses for specified time periods were used to develop flow requests with seasonal flow variability that mimicked the natural hydrograph of mean daily flows. This approach provided a basis to mimic natural seasonal flows to which fish and other aquatic fauna have adapted to and are dependent upon (Hynes 1970; Estes 1984; Estes and Orsborn 1986; Poff et al. 1997; Richter et al. 1997; Stewardson and Gippel 2003; Annear et al. 2004; Lytle and Poff 2004; Arthington et al. 2006).

Hydrologic Analyses:

Mean daily flow data for the entire period of record were obtained from United State Geological Survey (USGS) National Water Information System website (<http://waterdata.usgs.gov/nwis>) for the Kadashan River above Hook Creek Gage (No. 15106920) and Hook Creek Gage (No. 15106960). Gage No. 15106920 is located at latitude 57° 39' 46", longitude 135° 11' 06" on the mainstem of the Kadashan River upstream of Hook Creek (Figure 2) and has a period of record from January 1, 1968 to September 30, 2007. Gage No. 15106960 is located on Hook Creek at latitude 57° 40' 22", longitude 135° 10' 40" and has a period of record from December 1, 1966 to September 30, 1980. These gages operated concurrently from January 1, 1968 to September 30, 1978.

Mean daily flows in Reach B were estimated by summing concurrent mean daily flows from Gage No. 15106920 and 15106960. SAS-based applications¹ were then used to calculate annual, monthly, mean daily, and flow duration summaries.

Flow Duration Analyses:

Duration estimates represent the expected frequency of occurrence of mean daily flows within the specified time periods. The durations of daily mean flows were calculated as the percentiles of the empirical distribution of observed values within the specified time periods over the period of record (Table 1). This provided an estimate of the percentage of time a given mean daily flow

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was equaled or exceeded within the distribution of mean daily flows for each time period analyzed.

Mean Flow Statistics:

Mean monthly flows were estimated as the mean of monthly mean daily flows for all complete months over the entire period of record (Figure 5 and Table 2). Mean annual flow was estimated as a mean of the annual mean daily flow values for all complete water years of record (Table 3). Mean daily flows are presented in Figure 4 and Table 4.

Reservation of Water:

Sufficient flows are needed to support riverine habitats used by fish and to provide fluvial processes that maintain these habitats. To maintain seasonal uses of habitats by each life history stage, we recommend maintaining a flow regime that mimics the magnitude and timing of the natural flow regime as discussed above. This approach is necessary to meet the needs of species' life history stages that have coevolved and exhibit biological adaptations to the river's flow regime.

In general, flow requests fell within the 25 to 75% exceedance range for the specified time periods. Flows within the 25 to 75% exceedance range are normal hydrologic conditions and should provide flows and habitat conditions to which fish have adapted. Deviations from these levels subject riverine species to conditions that are increasingly uncommon. Flows outside of this range are defined as dry (75 to 100% exceedance) or wet (0 to 25% exceedance) conditions according to the USGS (2009).

Although important for maintaining fish habitat and overall aquatic and riparian productivity, channel maintenance or other high flows were not specified and requested within this application. Channel maintenance flows are gradually ascending and descending and most effectively meet sediment transport thresholds for the full-range of particle sizes. Evidence suggests that bankfull flow approximates the effective discharge in stable stream channels (Andrews 1980; Leopold 1994; Annear et al. 2004). Other types of periodic high flows are recognized for their importance to habitat maintenance and support of other environmental and biological needs, such as fish migration cues. Collectively, these flows provide the function and structure of river ecosystems (Annear et al. 2004; Schmidt and Potyondy 2004).

Currently, there is no monitoring of streamflow in the Kadashan River watershed.

REFERENCES

Alaska Administrative Code Chapter 11 Section 93.141-147.

Alaska Department of Natural Resources (DNR). 1985. State of Alaska instream flow handbook. DNR. Anchorage, Alaska.

Andrews, E.D. 1980. Effective and bankfull discharges of streams in the Yampa River basin, Colorado and Wyoming. *Journal of Hydrology* 46:311-330.

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Figure 1. Area map of Kadashan River near Tenakee Springs, Southeast Alaska.

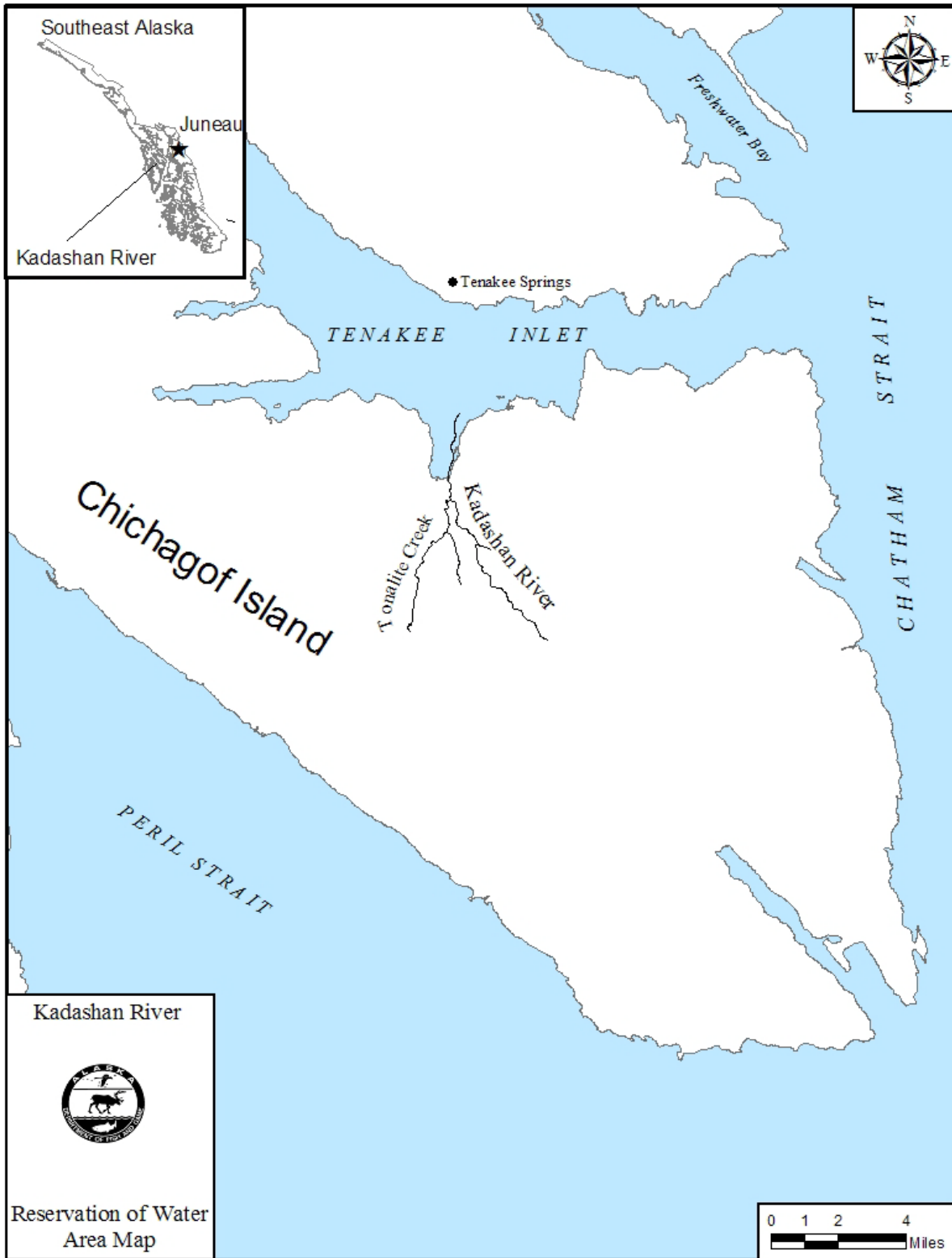


Figure 2. Reservation reach boundaries and location of USGS gages, Kadashan River near Tenakee Springs, Southeast Alaska.

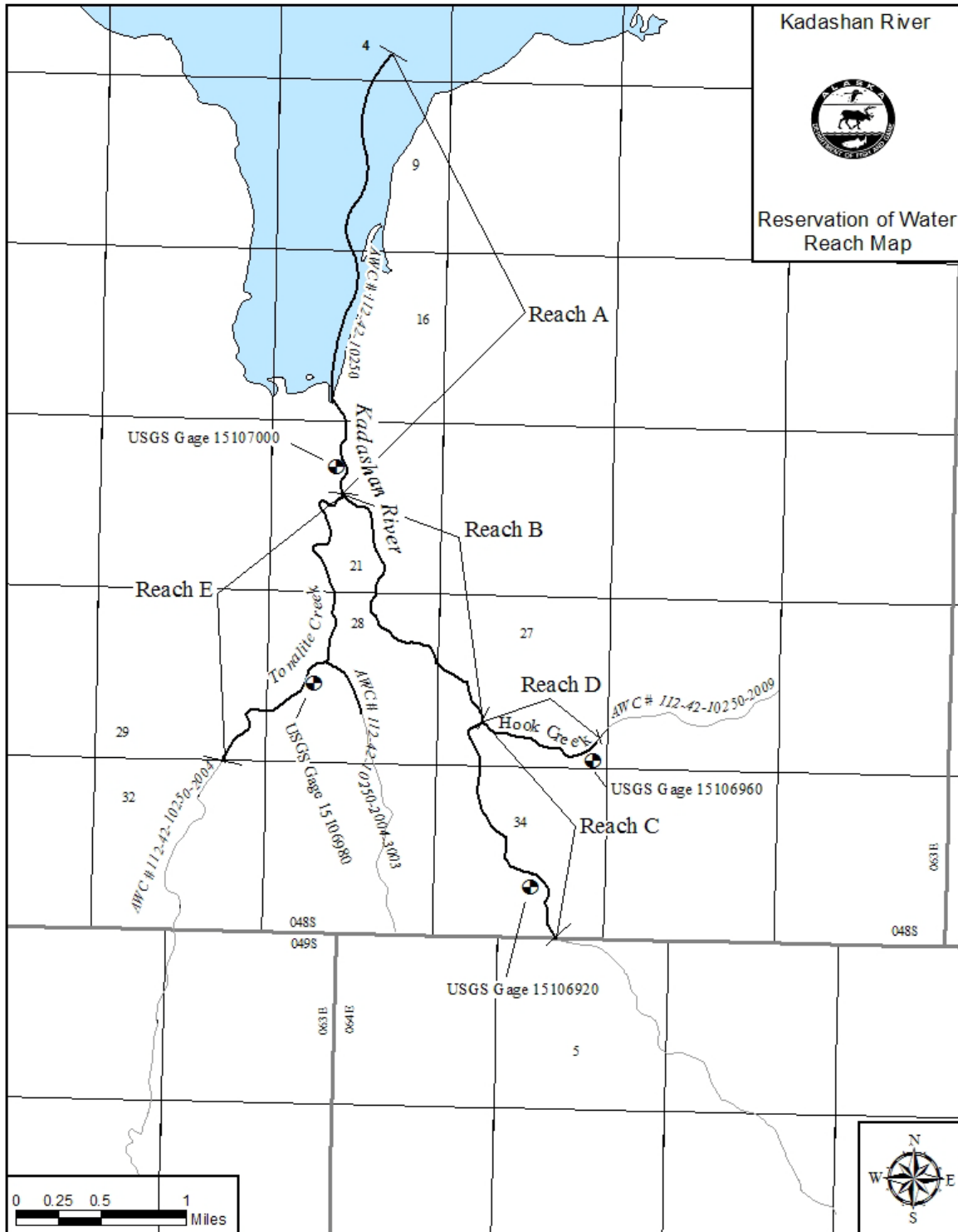


Figure 3. Fish species periodicity chart for Kadashan River near Tenakee Springs, Alaska.

Chum Salmon	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fry Passage			XX	XXXX	XXXX	XX						
Adult Passage							X	XXXX	XXXX	XX		
Spawning								XXXX	XXXX	XXX		
Incubation	XXXX	XXXX	XXXX	XXXX				XXXX	XXXX	XXXX	XXXX	XXXX
Rearing				XXXX	XX							
Coho Salmon	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Smolt Passage			XX	XXXX	XXXX	XX						
Adult Passage								XXXX	XXXX	XXXX	XX	
Spawning								XX	XXXX	XXXX	XXXX	XX
Incubation	XXXX	XXXX	XXXX	XXXX				XX	XXXX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Pink Salmon	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fry Passage			XX	XXXX	XXXX	XX						
Adult Passage							XXXX	XXXX	XXXX			
Spawning							XX	XXXX	XXXX	XX		
Incubation	XXXX	XXXX	XXXX	XXXX	XX		XX	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing				XXXX	XX							
Dolly Varden	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Smolt Passage*			XXXX	XXXX	XXXX							
Adult Passage			XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	
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
Based upon professional judgment of ADF&G biologists												
Smolt passage is for juvenile emigration to estuarine/marine environment												
Adult passage: for salmon is immigration: for trout, char, and other species, immigration and emigration.												
Incubation life phase includes time of egg deposition to fry emergence												
* DV and CT smolt defined as those fish undergoing initial emigration												

Figure 3. continued.

Steelhead Trout												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Smolt Passage				XX	XXXX	XXXX						
Adult Passage				XXXX	XXXX	XXXX	XX					
Spawning				XX	XXXX	XXXX						
Incubation				XX	XXXX	XXXX	XXXX	XXXX				
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Rainbow Trout												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Resident Adult Passage			XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX		
Spawning			X	XXXX	XXXX	XXXX						
Incubation			X	XXXX	XXXX	XXXX	XXXX	XXXX				
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Cutthroat Trout												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Smolt Passage*			XXXX	XXXX	XXXX							
Adult Passage			XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	
Spawning				XXX	XXXX	XX						
Incubation				XXX	XXXX	XXXX	XXXX	XX				
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Based upon professional judgment of ADF&G biologists												
Smolt passage is for juvenile emigration to estuarine/marine environment												
Adult passage: for salmon is immigration: for trout, char, and other species, immigration and emigration.												
Incubation life phase includes time of egg deposition to fry emergence												
* DV and CT smolt defined as those fish undergoing initial emigration												

Figure 4. Annual hydrograph of estimated mean daily flow (cfs) for Kadashan Reservation Reach B. Based on complete concurrent water years of record for USGS Gaging Stations 15106920 and 15106960 (October 1, 1968 to September 30, 1978).

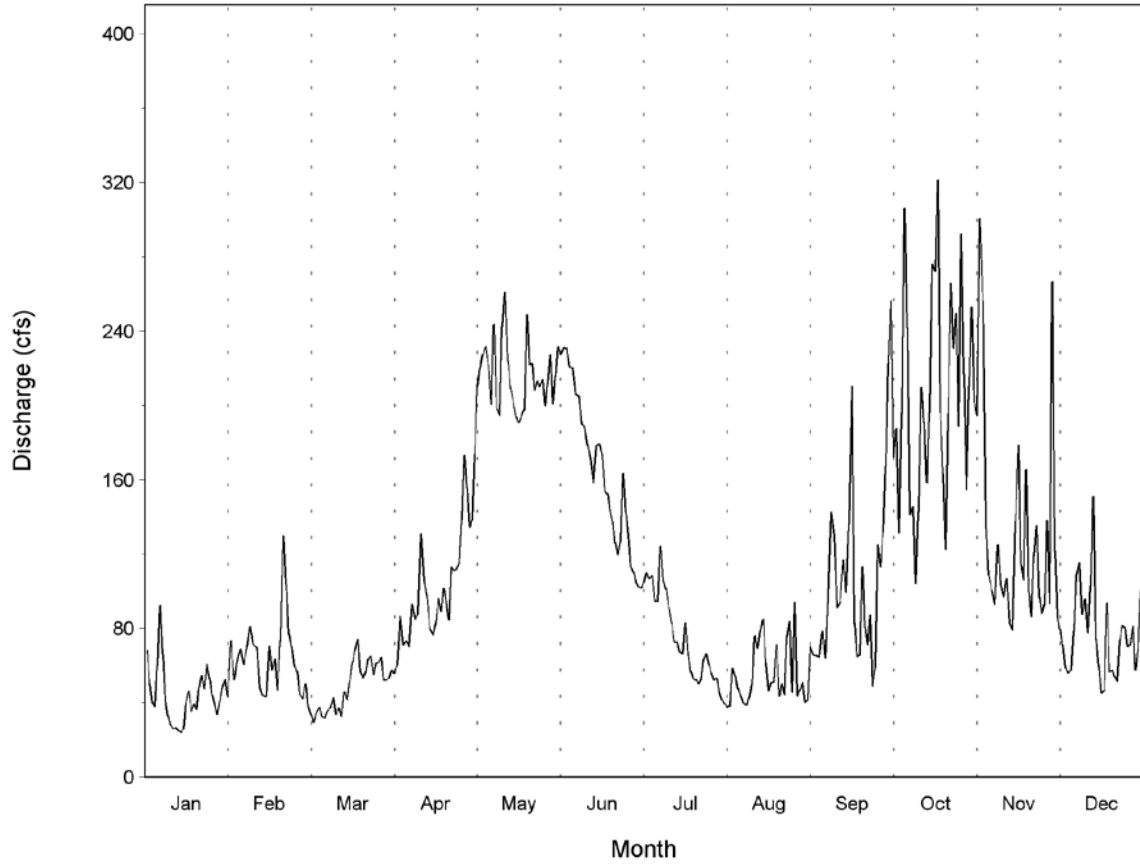
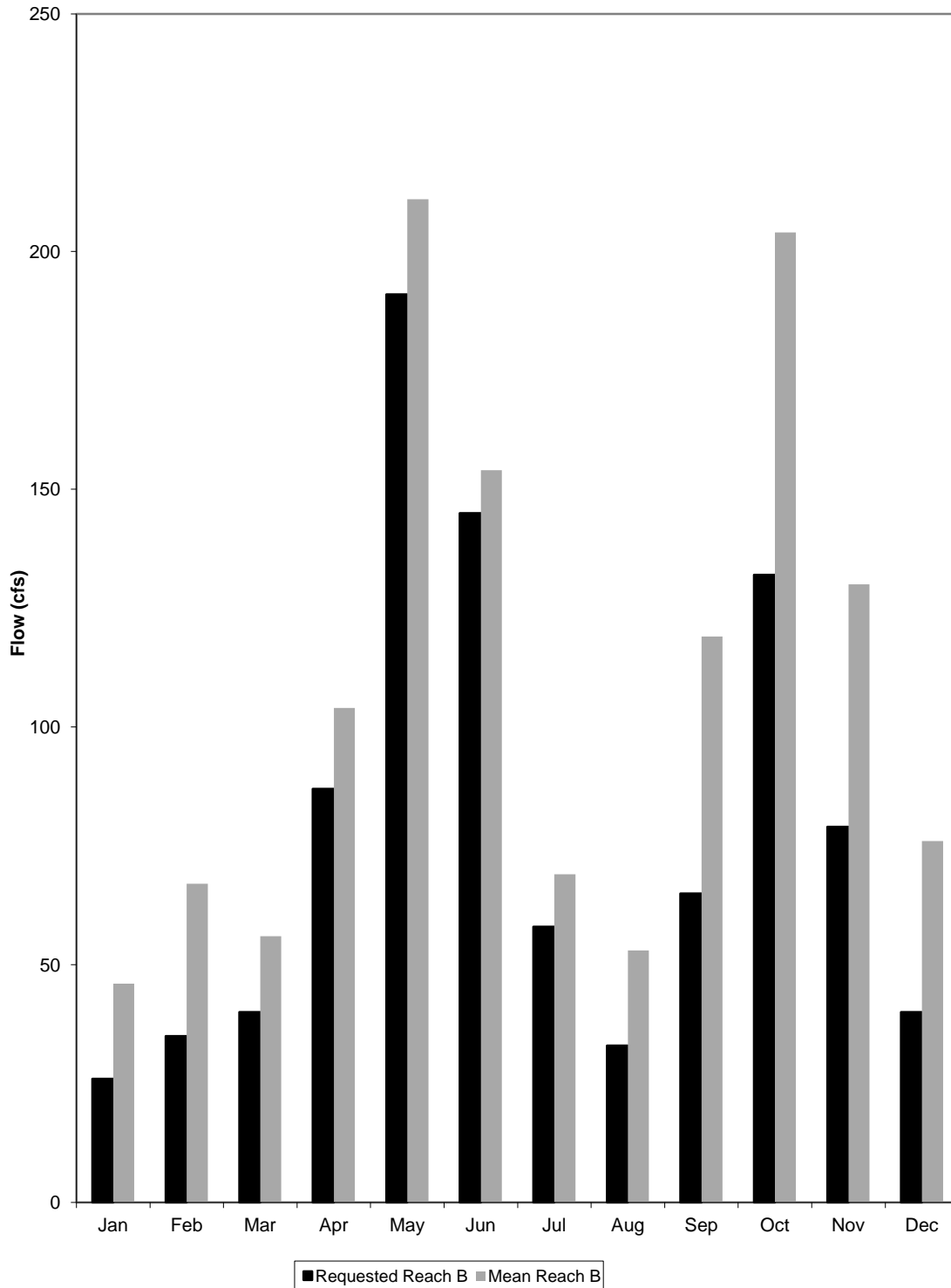


Figure 5. Estimated mean monthly flows and reservation requests for Kadashan Reservation Reach B. Based on complete concurrent months of record for USGS Gaging Stations 15106920 and 15106960 (October 1, 1968 to September 30, 1978).



ATTACHMENT A. KADASHAN RIVER REACH B RESERVATION OF WATER APPLICATION.

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Table 1. Estimated monthly exceedance flows (cfs) for Kadashan Reservation Reach B. Based on complete concurrent months of record for USGS Gaging Stations 15106920 and 15106960 (October 1, 1968 to September 30, 1978).

% Time exceeded	January	February	March	April	May	June	July	August	September	October	November	December
0	463	794	426	421	787	408	495	594	1,007	1,716	1,214	926
5	150	233	167	233	393	317	161	165	416	588	364	242
10	100	150	116	198	343	275	131	120	277	469	267	172
15	85	119	90	168	294	243	110	83	203	368	219	141
20	67	96	80	147	268	222	94	69	167	282	171	110
25	55	78	70	133	246	204	84	58	136	237	148	88
30	48	66	61	120	233	186	77	49	114	211	124	80
35	40	55	55	108	221	174	72	44	92	188	110	68
40	36	47	49	98	210	163	66	39	82	169	101	58
45	30	42	44	92	201	153	64	36	76	149	88	51
50	26	35	40	87	191	145	58	33	65	132	79	40
55	23	31	32	80	182	136	56	31	58	119	72	33
60	20	28	26	75	174	125	49	29	51	104	63	29
65	17	25	25	69	160	108	45	27	47	99	56	26
70	16	21	23	64	152	95	41	24	43	86	52	24
75	14	16	20	57	144	90	36	20	40	77	47	22
80	13	15	17	52	135	81	31	18	37	68	41	20
85	11	13	16	44	118	64	27	17	32	58	33	18
90	9.5	11	15	34	108	49	25	15	25	50	28	16
95	8.5	11	14	26	92	38	22	14	18	38	19	14
100	7.0	8.8	12	23	57	28	13	11	13	24	15	10
Mean	46	67	56	104	211	154	69	53	119	204	130	76

Table 2. Estimated monthly flow summaries (cfs) for Kadashan Reservation Reach B. Based on complete concurrent months of record for USGS Gaging Stations 15106920 and 15106960 (October 1, 1968 to September 30, 1978).

Month	# of Months	Minimum monthly flow (cfs)	Mean monthly flow (cfs)	Maximum monthly flow (cfs)
January	11	12	46	104
February	11	11	67	182
March	11	17	56	125
April	11	39	104	177
May	11	103	211	293
June	11	62	154	247
July	11	23	69	107
August	11	17	53	108
September	11	66	119	237
October	10	80	204	418
November	10	29	130	272
December	10	19	76	139

Table 3. Estimated annual flow summaries (cfs) for Kadashan Reservation Reach B. Based on complete concurrent water years of record for USGS Gaging Stations 15106920 and 15106960 (October 1, 1968 to September 30, 1978).

Water year	Number of days of record	QAA (cfs)
1969	365	96
1970	365	118
1971	365	113
1972	366	105
1973	365	110
1974	365	89
1975	365	138
1976	366	113
1977	365	112
1978	365	79
Mean for period of record	3,652	107

Table 4. Estimated daily flow summaries (cfs) for Kadashan Reservation Reach B. Based on complete concurrent water years of record for USGS Gaging Stations 15106920 and 15106960 (October 1, 1968 to September 30, 1978).

Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
1	January 1	10	14	68	204
2	January 2	10	14	50	128
3	January 3	10	13	40	74
4	January 4	10	12	38	85
5	January 5	10	11	60	221
6	January 6	10	11	92	400
7	January 7	10	9.6	66	350
8	January 8	10	9.4	41	155
9	January 9	10	9.3	33	110
10	January 10	10	8.2	28	85
11	January 11	10	8.1	26	70
12	January 12	10	8.0	26	57
13	January 13	10	7.5	25	51
14	January 14	10	7.5	24	51
15	January 15	10	7.0	26	53
16	January 16	10	7.0	40	121
17	January 17	10	7.0	46	187
18	January 18	10	7.0	36	104
19	January 19	10	7.6	39	110
20	January 20	10	7.7	36	90
21	January 21	10	7.8	48	178
22	January 22	10	8.0	54	184
23	January 23	10	8.5	48	163
24	January 24	10	9.1	60	175
25	January 25	10	8.5	53	150
26	January 26	10	8.5	44	96
27	January 27	10	8.5	39	96
28	January 28	10	8.5	34	95
29	January 29	10	8.5	41	104
30	January 30	10	9.0	49	126
31	January 31	10	9.0	52	184

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Table 4. Page 2 of 12.

Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
32	February 1	10	9.7	43	124
33	February 2	10	9.4	73	361
34	February 3	10	9.0	53	187
35	February 4	10	8.8	63	224
36	February 5	10	9.7	69	256
37	February 6	10	11	61	243
38	February 7	10	11	70	273
39	February 8	10	11	81	390
40	February 9	10	11	71	300
41	February 10	10	11	70	340
42	February 11	10	9.5	48	150
43	February 12	10	9.0	44	137
44	February 13	10	9.5	43	138
45	February 14	10	11	70	358
46	February 15	10	11	58	214
47	February 16	10	11	63	178
48	February 17	10	11	47	116
49	February 18	10	11	74	341
50	February 19	10	11	130	794
51	February 20	10	11	104	484
52	February 21	10	11	77	227
53	February 22	10	11	70	182
54	February 23	10	11	60	182
55	February 24	10	12	57	233
56	February 25	10	12	45	128
57	February 26	10	13	42	107
58	February 27	10	13	50	196
59	February 28 OR 29	12	12	38	109

-continued-

Table 4. Page 3 of 12.

Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
60	March 1	10	12	34	86
61	March 2	10	12	30	73
62	March 3	10	12	35	128
63	March 4	10	13	37	167
64	March 5	10	15	32	102
65	March 6	10	15	32	72
66	March 7	10	15	36	79
67	March 8	10	15	37	92
68	March 9	10	15	43	116
69	March 10	10	16	34	72
70	March 11	10	15	37	116
71	March 12	10	14	33	61
72	March 13	10	14	46	115
73	March 14	10	14	42	93
74	March 15	10	14	52	178
75	March 16	10	14	62	227
76	March 17	10	13	69	317
77	March 18	10	13	74	266
78	March 19	10	14	56	132
79	March 20	10	14	54	170
80	March 21	10	15	56	151
81	March 22	10	14	63	202
82	March 23	10	14	65	185
83	March 24	10	14	55	129
84	March 25	10	16	61	132
85	March 26	10	15	62	175
86	March 27	10	14	64	243
87	March 28	10	16	52	133
88	March 29	10	20	52	108
89	March 30	10	24	53	89
90	March 31	10	24	58	116

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Table 4. Page 4 of 12.

Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
91	April 1	10	25	56	95
92	April 2	10	25	61	102
93	April 3	10	26	87	284
94	April 4	10	24	71	150
95	April 5	10	24	73	167
96	April 6	10	25	70	155
97	April 7	10	25	93	209
98	April 8	10	24	85	173
99	April 9	10	25	88	204
100	April 10	10	25	131	337
101	April 11	10	24	106	189
102	April 12	10	25	98	246
103	April 13	10	27	79	110
104	April 14	10	30	77	108
105	April 15	10	26	83	203
106	April 16	10	24	96	298
107	April 17	10	23	89	228
108	April 18	10	60	101	222
109	April 19	10	56	95	190
110	April 20	10	35	85	158
111	April 21	10	29	113	341
112	April 22	10	27	111	241
113	April 23	10	27	112	190
114	April 24	10	58	115	181
115	April 25	10	68	139	268
116	April 26	10	62	173	361
117	April 27	10	57	155	269
118	April 28	10	67	135	247
119	April 29	10	50	139	331
120	April 30	10	51	174	421

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Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
121	May 1	10	57	210	517
122	May 2	10	81	220	444
123	May 3	10	77	227	641
124	May 4	10	88	231	565
125	May 5	10	110	222	390
126	May 6	10	108	201	332
127	May 7	10	97	244	534
128	May 8	10	97	198	357
129	May 9	10	83	195	379
130	May 10	10	72	243	468
131	May 11	10	66	261	521
132	May 12	10	65	224	354
133	May 13	10	71	209	334
134	May 14	10	91	201	333
135	May 15	10	92	194	360
136	May 16	10	83	191	275
137	May 17	10	95	195	341
138	May 18	10	123	198	304
139	May 19	10	113	249	787
140	May 20	10	110	222	693
141	May 21	10	81	222	383
142	May 22	10	78	208	291
143	May 23	10	85	213	394
144	May 24	10	98	210	373
145	May 25	10	97	214	303
146	May 26	10	94	200	310
147	May 27	10	101	212	426
148	May 28	10	109	227	400
149	May 29	10	104	201	393
150	May 30	10	109	216	539
151	May 31	10	116	231	397

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Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
152	June 1	10	144	227	307
153	June 2	10	145	231	385
154	June 3	10	133	231	408
155	June 4	10	105	221	359
156	June 5	10	115	220	393
157	June 6	10	107	206	395
158	June 7	10	101	205	385
159	June 8	10	87	190	370
160	June 9	10	72	188	344
161	June 10	10	65	179	319
162	June 11	10	68	172	331
163	June 12	10	62	159	299
164	June 13	10	59	178	289
165	June 14	10	56	179	343
166	June 15	10	48	173	376
167	June 16	10	52	154	253
168	June 17	10	86	153	244
169	June 18	10	54	143	232
170	June 19	10	47	137	245
171	June 20	10	48	126	234
172	June 21	10	43	120	201
173	June 22	10	38	127	263
174	June 23	10	34	163	364
175	June 24	10	31	142	244
176	June 25	10	28	130	202
177	June 26	10	37	113	171
178	June 27	10	38	110	200
179	June 28	10	36	105	175
180	June 29	10	33	102	176
181	June 30	10	32	102	223

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Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
182	July 1	10	29	105	217
183	July 2	10	29	110	253
184	July 3	10	27	107	218
185	July 4	10	27	108	205
186	July 5	10	25	95	196
187	July 6	10	25	95	182
188	July 7	10	27	124	495
189	July 8	10	27	105	267
190	July 9	10	24	101	208
191	July 10	10	22	91	147
192	July 11	10	22	83	147
193	July 12	10	24	73	120
194	July 13	10	25	73	132
195	July 14	10	29	67	101
196	July 15	10	45	66	105
197	July 16	10	45	83	218
198	July 17	10	33	66	96
199	July 18	10	27	57	91
200	July 19	10	24	53	71
201	July 20	10	23	52	89
202	July 21	10	21	50	72
203	July 22	10	23	53	100
204	July 23	10	29	63	137
205	July 24	10	25	66	119
206	July 25	10	28	61	148
207	July 26	10	26	56	155
208	July 27	10	25	52	88
209	July 28	10	26	53	83
210	July 29	10	24	45	67
211	July 30	10	22	41	64
212	July 31	10	20	40	64

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Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
213	August 1	10	19	38	71
214	August 2	10	18	38	69
215	August 3	10	17	58	208
216	August 4	10	17	54	158
217	August 5	10	16	47	165
218	August 6	10	15	44	139
219	August 7	10	16	40	83
220	August 8	10	18	39	80
221	August 9	10	20	43	71
222	August 10	10	24	50	94
223	August 11	10	22	76	278
224	August 12	10	20	70	202
225	August 13	10	18	79	233
226	August 14	10	17	85	268
227	August 15	10	16	61	181
228	August 16	10	15	47	92
229	August 17	10	14	51	176
230	August 18	10	14	51	186
231	August 19	10	14	71	211
232	August 20	10	14	44	78
233	August 21	10	13	50	121
234	August 22	10	14	45	140
235	August 23	10	15	76	280
236	August 24	10	15	84	329
237	August 25	10	14	46	100
238	August 26	10	14	94	594
239	August 27	10	14	44	142
240	August 28	10	13	47	125
241	August 29	10	13	51	179
242	August 30	10	18	40	90
243	August 31	10	15	42	79

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Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
244	September 1	10	14	70	274
245	September 2	10	13	66	182
246	September 3	10	13	65	220
247	September 4	10	13	65	162
248	September 5	10	13	78	276
249	September 6	10	13	64	172
250	September 7	10	13	97	330
251	September 8	10	13	143	482
252	September 9	10	13	130	282
253	September 10	10	13	92	278
254	September 11	10	13	94	292
255	September 12	10	22	117	453
256	September 13	10	26	100	162
257	September 14	10	41	137	442
258	September 15	10	39	210	1,007
259	September 16	10	33	83	186
260	September 17	10	25	65	114
261	September 18	10	21	66	132
262	September 19	10	29	113	421
263	September 20	10	36	80	296
264	September 21	10	41	71	158
265	September 22	10	37	87	330
266	September 23	10	32	49	81
267	September 24	10	33	59	126
268	September 25	10	29	125	500
269	September 26	10	24	113	365
270	September 27	10	25	132	340
271	September 28	10	29	168	688
272	September 29	10	32	223	844
273	September 30	10	42	256	679

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Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
274	October 1	10	53	173	523
275	October 2	10	49	187	709
276	October 3	10	39	132	295
277	October 4	10	33	196	533
278	October 5	10	29	306	1,716
279	October 6	10	26	242	1,074
280	October 7	10	58	141	381
281	October 8	10	54	145	499
282	October 9	10	40	104	219
283	October 10	10	42	143	319
284	October 11	10	42	210	504
285	October 12	10	45	191	351
286	October 13	10	43	159	425
287	October 14	10	38	196	741
288	October 15	10	37	276	878
289	October 16	10	34	272	831
290	October 17	10	31	321	1,119
291	October 18	10	31	196	441
292	October 19	10	34	163	351
293	October 20	10	48	123	241
294	October 21	10	49	195	628
295	October 22	10	34	266	981
296	October 23	10	30	231	620
297	October 24	10	32	249	1,025
298	October 25	10	29	189	501
299	October 26	10	27	292	1,332
300	October 27	10	25	217	461
301	October 28	10	24	155	264
302	October 29	10	47	211	551
303	October 30	10	68	253	744
304	October 31	10	70	202	313

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Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
305	November 1	10	56	195	588
306	November 2	10	63	300	936
307	November 3	10	59	256	871
308	November 4	10	54	137	331
309	November 5	10	48	109	270
310	November 6	10	40	101	230
311	November 7	10	31	93	217
312	November 8	10	30	125	538
313	November 9	10	27	104	245
314	November 10	10	26	97	254
315	November 11	10	23	107	247
316	November 12	10	23	83	139
317	November 13	10	21	79	156
318	November 14	10	21	138	319
319	November 15	10	19	179	986
320	November 16	10	19	114	275
321	November 17	10	18	106	302
322	November 18	10	17	165	947
323	November 19	10	16	99	308
324	November 20	10	16	86	211
325	November 21	10	16	119	494
326	November 22	10	19	135	368
327	November 23	10	19	97	193
328	November 24	10	20	88	170
329	November 25	10	19	93	316
330	November 26	10	18	138	346
331	November 27	10	16	93	244
332	November 28	10	15	266	1,214
333	November 29	10	16	122	402
334	November 30	10	19	86	235

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Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
335	December 1	10	18	80	214
336	December 2	10	17	71	236
337	December 3	10	18	59	198
338	December 4	10	21	56	192
339	December 5	10	16	58	160
340	December 6	10	15	79	196
341	December 7	10	13	109	404
342	December 8	10	13	115	493
343	December 9	10	17	88	265
344	December 10	10	16	96	337
345	December 11	10	16	78	268
346	December 12	10	15	103	509
347	December 13	10	15	151	926
348	December 14	10	15	74	294
349	December 15	10	16	59	170
350	December 16	10	18	45	116
351	December 17	10	19	47	95
352	December 18	10	17	94	580
353	December 19	10	16	57	160
354	December 20	10	15	57	120
355	December 21	10	14	54	166
356	December 22	10	12	52	179
357	December 23	10	10	74	301
358	December 24	10	12	82	280
359	December 25	10	12	81	264
360	December 26	10	13	70	221
361	December 27	10	14	71	241
362	December 28	10	14	81	241
363	December 29	10	14	58	145
364	December 30	10	14	69	183
365	December 31	10	14	100	395