Fishery Data Series No. 15-17

Hydrologic Investigations in Support of Reservations of Water for the Chilkoot River, Alaska

by

Jarrod J. Sowa

July 2015

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat or long
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

The Chilkoot River watershed, located near Haines in Southeast Alaska, supports a number of anadromous fish species. Alaska Department of Fish and Game, Division of Sport Fish selected the Chilkoot River as a candidate water body for a reservation of water. In order to collect the data necessary to file a reservation of water application, a streamgage was operated on the Chilkoot River near the outlet of Chilkoot Lake from August 14, 2007, to October 16, 2012. Streamflow data collected at the streamgage was used to prepare a reservation of water application to reserve instream flows in one reach of the Chilkoot River. The application was filed using one year of preliminary data and was accepted by the Alaska Department of Natural Resources (DNR) and given a priority date of July 14, 2009. After 5 years of streamflow data were collected and analyzed, updated streamflow statistics and instream flow requests were submitted to and accepted by DNR on December 17, 2012. The application is now in pending status until the adjudication process begins.

The mean annual discharge of the river measured at the streamgage averaged 794 ft^3/s. The mean monthly discharge ranged from 119 ft^3/s in March to 1,915 ft^3/s in July.

Key words: Chilkoot River, streamgage, discharge, reservation of water, instream flow

INTRODUCTION

Alaska's rivers and lakes support some of North America's most viable and productive salmon fisheries. Over 18,000 streams, rivers, or lakes have been identified throughout the state as being important for spawning, rearing or migration of anadromous fish (Johnson and Coleman 2014). Fish migration, spawning, rearing, and ultimately production in these water bodies are dependent upon sufficient seasonal quantities of water. Demand for water to support hydroelectric power generation, petroleum production, mining, water supply (including out-of-state export), residential, forestry, agriculture, and other projects has the potential to modify the naturally occurring instream flows to which fish have adapted and are dependent upon (Poff et al. 1997).

The Fish and Game Act requires the Alaska Department of Fish and Game (ADF&G), to "manage, protect, maintain, improve, and extend the fish, game and aquatic plant resources of the state in the interest of the economy and general well-being of the state" (Alaska Statute 16.05.020; AS). One mechanism ADF&G uses to fulfill its mandate is to reserve water in rivers and lakes for fish and wildlife. An appropriation of water that remains within a river is legally defined under Alaska law (AS 46.15.145) and regulations (11 AAC 93.970) as a reservation of water. To reserve water an application with supporting data and analyses must be submitted to the Alaska Department of Natural Resources (DNR). A minimum of 5 years of mean daily flow data is recommended by DNR to quantify instream flow requirements within an application.

Instream flows can be legally reserved by a private individual, group, or government agency in order to maintain specific flow rates in a river or volumes and water levels in a lake during specified time periods for one or a combination of four types of uses:

- protection of fish and wildlife habitat, migration, and propagation;
- recreation and parks;
- navigation and transportation; and
- sanitary and water quality purposes.

Priority dates for reservation of water applications are based on the date they are accepted by DNR. Alaska water law is based on the doctrine of prior appropriation, also known as "first in time first in right." According to the rules of prior appropriation, the right to the requested amount of water is first given to the appropriator who has the earliest priority date to beneficially

use the water. Senior water right holders have a legal standing to assert their right against conflicting uses of water from others who do not have a water right or who are junior in priority.

ADF&G began a project in 2001 that ranked Southeast Alaska watersheds by their importance for the protection of instream flows. From this study, the Chilkoot River ranked 31st out of the 4,597 watersheds in Southeast (Klein 2011). In 2007, ADF&G began a multi-year project funded by the Alaska Sustainable Salmon Fund (AKSSF) to collect the hydrologic data necessary to file reservation of water applications to protect instream flows within one reach of the Chilkoot River. Before this study began, no hydrologic data existed that could be used to support a reservation of water application. This report summarizes a 5-year study to collect the streamflow data necessary to file a reservation of water application for one reach of the Chilkoot River.

OBJECTIVE

The objective of this project was to collect the hydrological data necessary to file a reservation of water application to reserve instream flows within one reach (Reach A) of the Chilkoot River. Two tasks were necessary to complete this objective:

1. Install and operate a streamgage on the Chilkoot River for 5 years to quantify streamflows within Reach A; and
2. Complete and file a reservation of water application for one reach of the Chilkoot River to protect fish habitat, migration, and propagation.

STUDY AREA

The Chilkoot River is located 7 miles north of the community of Haines in Southeast Alaska and drains an area of 130 square miles (Figure 1). From its headwaters in the glaciers east of the Takshanuk Mountains and west of Ferebee Glacier, the Chilkoot River flows 20 miles to Chilkoot Lake. Chilkoot Lake is 2.5 miles long and 1 mile wide, with a surface area of 1,734 acres and a mean depth of 179 ft (Erickson 2000). From the lake, the river flows approximately 1.7 miles to saltwater at Lutak Inlet. Connelly Lake, which drains into the Chilkoot upstream of Chilkoot Lake, has been studied as the location for a possible hydroelectric project. Land ownership within the drainage is fragmented between Haines Borough and private, state, and federal landowners, along with some Alaska Native allotments. The Chilkoot Lake and portions of the river are within the Chilkoot Lake State Recreation Site and the Chilkat Bald Eagle Preserve. Downstream of the lake, the Chilkoot River is an important sport fishing destination and a popular bear viewing area.

The Chilkoot River has been specified as important to anadromous fish under Alaska state statute AS 16.05.871, as AWC number 115-33-10200 by ADF&G (Johnson and Coleman 2014).The river supports valuable stocks of coho salmon (*Oncorhynchus kisutch*), pink salmon (*O. gorbuscha*), sockeye salmon (*O. nerka*), chum salmon (*O. keta*), cutthroat trout (*O. clarki*), Dolly Varden (*Salvelinus malma*), and eulachon (*Thaleichthys pacificus*).

Chilkoot Lake and the lower portion of the Chilkoot River are easily accessible by road and compose the 2nd largest freshwater sport fishery for salmon and Dolly Varden in Southeast Alaska (Alaska Sport Fishing Survey database 2015). The Chilkoot River drainage is one of the two largest contributors of wild sockeye salmon to the commercial drift gillnet fisheries in Lynn Canal (McPherson and others 1992). Chilkoot River sockeye salmon are also harvested in a

subsistence fishery near the mouth of the Chilkoot River, in Lutak Inlet. Since 1976, ADF&G has maintained a salmon counting weir on the Chilkoot River. The weir is located between Chilkoot Lake and the Chilkoot River Bridge, to monitor the strength of sockeye salmon runs in northern Lynn Canal as they return to Chilkoot Lake. The total sockeye escapement into the Chilkoot River in 2012 was 118,166 fish (Bachman et al. 2014). Chilkoot Indian Association members traditionally harvest eulachon in the lower mile of the Chilkoot River (Betts 1984). A study conducted by the Takshanuk Watershed Council estimated that 2.2 million and 12.6 million eulachon returned to the Chilkoot River in 2010 and 2011 respectively (Takshanuk Watershed Council 2011).

METHODS

HYDROLOGIC DATA STUDY DESIGN

The AKSSF grant funding the project limited the extent of the work to anadromous reaches only. In July of 2007, a road-accessible streamgage site was found on the Chilkoot River just downstream of the lake outlet. It was decided not to operate a streamgage upstream of the lake due to its difficult accessibility and the braided nature of the river not being suitable for a streamgage.

No tributaries enter the river between the lake outlet and saltwater, and the difference in flows (from accretion and reduction) within the reach is minimal. This reach (Reach A) of the Chilkoot River was selected for instream flow protection (Figure 2). Reach A began at the mouth of the river at mean lower low water and extended upstream 1.7 miles to the outlet of Chilkoot Lake (Figure 2). To quantify streamflows within Reach A, streamgage 11901 was installed just downstream of the Chilkoot Lake outlet near the upstream end of Reach A (Figure 2). This streamgage was in operation from August 14, 2007, to October 16, 2012.

GAGING STATION

The objective of operating a streamgage is to obtain a continuous record of discharge at the site (Carter and Davidian 1968). The collection of stage and direct measurements of discharge are essential components in the operation of a streamgage. A continuous record of stage is obtained by installing a water-level data logger that measures and records water surface elevation (WSE) in the river. Direct measurements of discharge are taken at different times of year and with varying flow rates in order to define the stage–discharge relationship (rating curve) and to detect the timing and magnitude of changes to this relationship over time. ADF&G followed USGS streamgage operation protocols and procedures described in Rantz and others (1982) and Klein (2013).

Rantz and others (1982) provides guidance for selection of a streamgage site. The ideal site includes a straight section of stream upstream and downstream of the site, has all the flow confined to one channel, and is far enough upstream from the confluence with another stream so as not to be affected by backwater. Each streamgage was located in a pool, with a stable hydraulic control, and far enough upstream of confluences so as not to be affected by backwater.

To measure stage and water temperature at streamgage 11901, one In-Situ Level TROLL 500 water level data logger was housed in 1¼-inch pipe driven through the streambank and secured to the streambed with custom pipe brackets and 5/8-inch rebar.

Typically, ADF&G installs a staff gage in the gage pool and the data logger is programmed to read the same as the staff gage. To reduce the potential for vandalism and also make the streamgage site more aesthetically pleasing, it was decided to not install a staff gage at the streamgage site. In lieu of installing a staff gage, differential surveying techniques using an auto level were conducted every field visit to survey WSE (Kenney 2010). Three survey reference marks (RMs) were established near the transducer to establish the gage datum. An arbitrary elevation of 10 feet was given to RM 1, which was designated as the primary reference point. At the time of installation, the data logger was programmed to record WSE and water temperature every 15 minutes on the quarter hour. The data logger reading and surveyed WSE were compared at each site visit to check for consistency. If a discrepancy was identified, protocols described in Klein (2013) or manufacturer guidelines were followed to correct the problem.

Two additional RMs (named RM2 and RM3) were established near the gage site to monitor possible changes in the elevation of RM1. Elevations of these RMs in relation to RM1 were also measured using standard differential surveying techniques following USGS protocols (Kenney 2010).

DISCHARGE MEASUREMENTS

Streamflow, or discharge, is defined as the volume rate of flow of water and is typically reported in cubic feet per second (ft^3/s; Buchanan and Somers 1969). Discharge is determined by measuring the average velocity, depth, and width of subsections across the stream and summing the discharge of each subsection. Discharge measurements were taken periodically throughout the year and during periods of extreme low and high flows following USGS protocols (Rantz and others 1982).

Discharge measurements were taken just downstream of the bridge that crosses the Chilkoot River. This section of the river was influenced daily by high tide cycles. Discharge measurements were taken during low tide cycles when the discharge transect was not tidally affected. In the winter, during low flows, discharge measurements were collected by wading across the river and using a top-set wading rod and a Price AA velocity meter. A JBS Energy, Inc. AquaCalc electronic digital counter was used to record the transect parameters, count meter revolutions, and calculate discharge. During all other times of year when it was too deep or unsafe to wade across the river, a StreamPro Acoustic Doppler Current Profiler (ADCP) was used to measure discharge. One person with a rope would cross the bridge near the discharge transect, and the StreamPro was attached to this rope. The tethered StreamPro was then towed back and forth across the river to take a discharge measurement. Using a Bluetooth connection, data collected by the ADCP was recorded on a ruggedized laptop computer.

SITE VISITS

Site visits to the streamgage were made about 6 times a year during the period of operation of the streamgage. In the winter, the road used to access the streamgage was closed and the site was accessed by cross-country skiing along the road. During all other times of the year, the road was open and the streamgage site could be driven to. During a typical site visit, data was downloaded from the data logger, stream discharge was measured, the water surface elevation was surveyed, and routine gage maintenance was performed. Data was downloaded from the data logger using an In-Situ RuggedReader Handheld PC. Discharge measurement data, differential survey notes,

and other site visit notes were recorded in waterproof field notebooks. Photographs of the streamgage pool, discharge measurement transect, and the control were typically taken.

After each site visit, discharge measurement data was downloaded from the AquaCalc counter or ADCP laptop to Microsoft Excel, pictures were downloaded and labeled, and data was downloaded from the RuggedReader to a desktop computer. Transducer stage, water surface elevations, air temperature, and discharge measurement data were imported into the Water Information System Kisters Incorporated (WISKI) hydrological software database for storage and analysis.

STREAMFLOW RECORDS COMPUTATION

Streamflow records computation is a step-by-step process in which stream stage measured at the streamgage is converted to discharge using the stage–discharge relationship (rating curve). Before being converted to discharge, the stage record was corrected for movement of the staff gage, transducer movement and drift, or fill and scour of the hydraulic control. WISKI was used to develop rating curves; make corrections to the stage record; apply rating curves to corrected stage values to calculate 15-minute discharges; and summarize these discharges to mean daily, mean monthly, and mean annual flow values. Missing or suspect data caused by ice, operator error, or recorder malfunction were estimated by using the hydrographic- and climatic comparison method (Rantz and others 1982). This included comparison of water temperatures measured by the transducer, nearby weather records, trends of the hydrograph, and instantaneous discharge measurements that were made.

Computed discharge values were typically summarized as mean daily, mean monthly, and mean annual flow values for the water year (October 1–September 30). The procedures used to compute streamflow records coincide with those described in Rantz and others (1982), Kennedy (1983), and Klein (2013).

Mean daily flow records computed for each gage were analyzed by a series of SAS programs to estimate the annual, monthly, and mean daily summaries and flow duration values for specified time periods. Mean annual flow was estimated as a mean of the annual mean daily flow values over all complete water years of record. Mean monthly flows were estimated as the mean of monthly mean daily flows for all complete months over the entire period of record. 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. This provided an estimate of the percentage of time a given mean daily flow was equaled or exceeded within the distribution of mean daily flows for each time period analyzed.

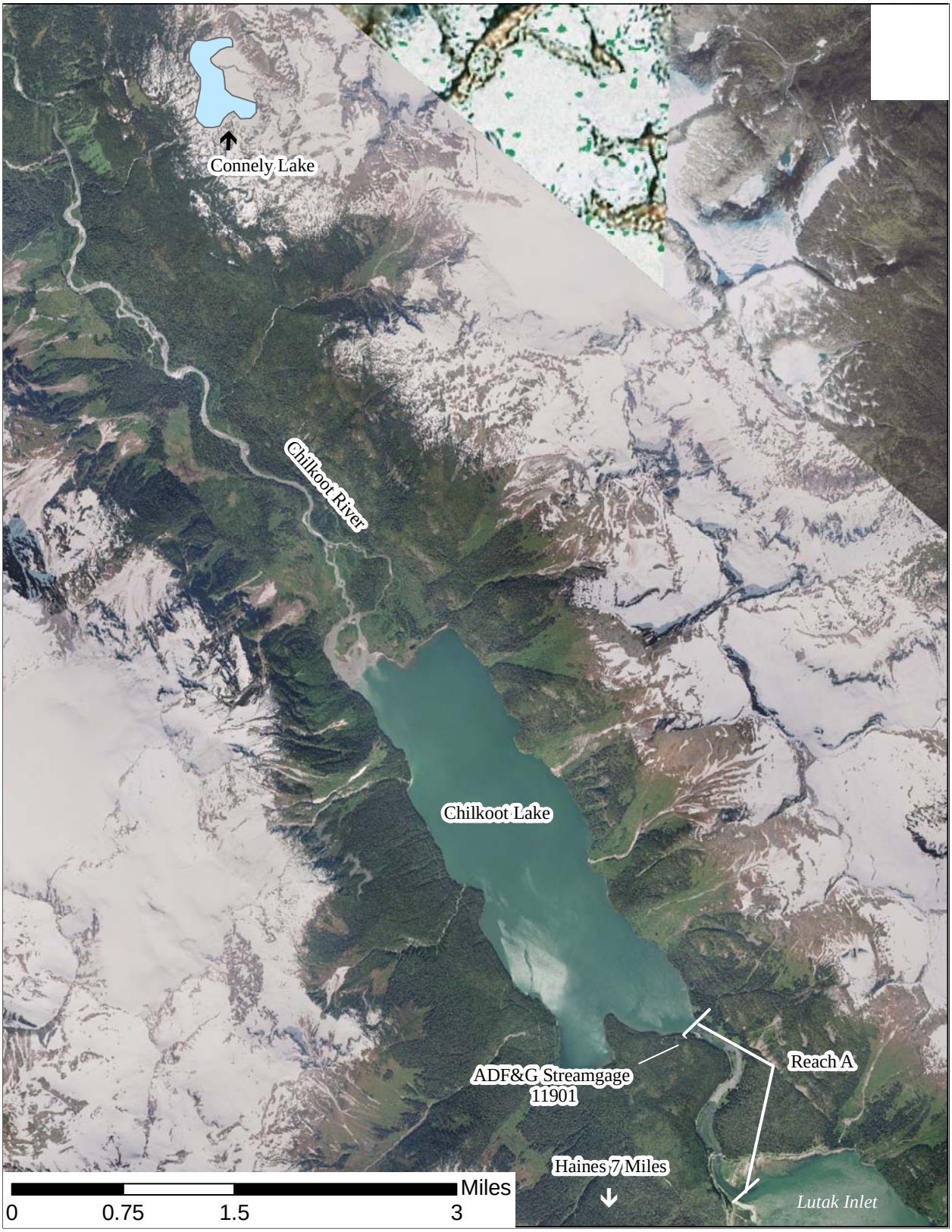

Figure 1.–Area map of the Chilkoot River watershed in Southeast Alaska.

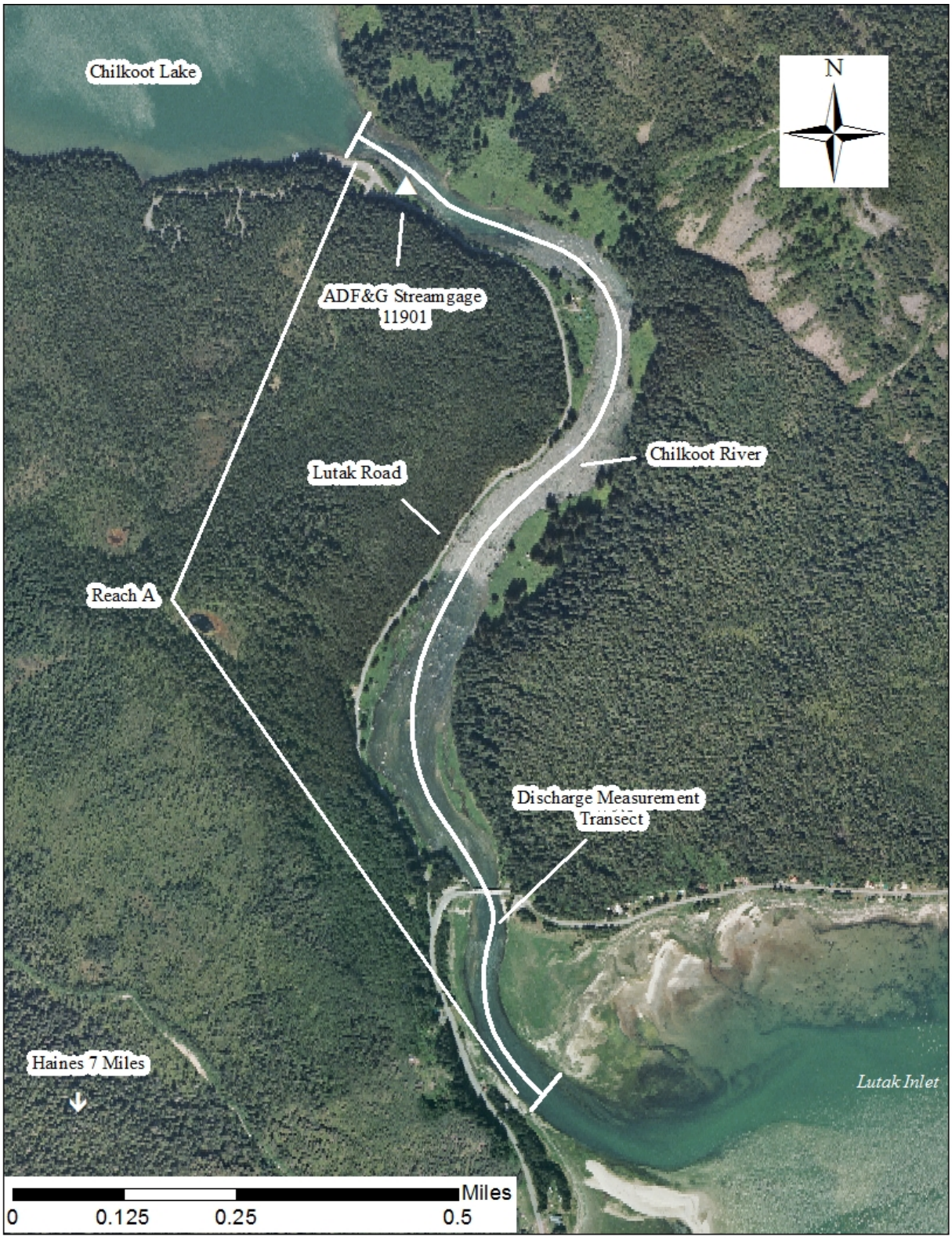

Figure 2.–Location of reservation of water Reach A Boundaries, streamgage 11901, and the discharge measurement transect location at the Chilkoot River, Alaska.

RESULTS

HYDROLOGIC DATA

Streamgage 11901 was operated from August 14, 2007, to October 16, 2012. Twenty-seven measurements of instantaneous discharge, ranging from 87 to 3,050 ft^3/s, were taken at the site (Table 1). Mean annual flow at the site ranged from 734 to 847 ft^3/s and averaged 794 ft^3/s for water years 2008 to 2012 (Table 2). The highest flow recorded at the gage was 4,590 ft^3/s on August 30, 2009, and the lowest flow recorded at the gage was 75 ft^3/s on March 23, 2009. The lowest flows of the years were typically at at the end of March during dry cold spells (Figure 3).

Because of snowmelt, Flows began to increase from these lows from April to May. Flows typically peaked June to July due to glacial melt then receded throughout the rest of summer and into fall and winter. Appendix A contains mean daily and mean monthly flows summarized by water year. The durations of mean daily flows are also presented in this appendix.

A streamgage 15 miles northwest of the Chilkoot River was operated concurrently by the USGS on the Taiya River (Station 15056210). The Taiya River watershed drains an additional 49 square miles and has no major lakes as compared to the Chilkoot River. Concurrent streamflows from the two systems have similar seasonal patterns (Figure 4). One notable difference is during late fall and winter when the Chilkoot River has higher streamflows than the Taiya River. From water years 2008 to 2012, Taiya River streamflows were 6.4% below the long-term average measured at the station (Table 3).

RESERVATION OF WATER APPLICATION

Preliminary streamflow data was used to prepare a reservation of water application for one reach of the Chilkoot River. The reservation of water application was based on 1 year of data and included the following components: 1) maps and legal descriptions describing the reach boundaries and streamgage location; 2) hydrologic data collected within the reach; 3) description and justification of the method used to quantify instream flow needs; 4) fish species periodicity chart; and 5) the water quantities requested by time period for the reach. The application for Reach A was accepted by DNR (Land Administration System number 27349) and given a priority date of July 14, 2009. Following 5 years of data collection, updated flow statistics and instream flow requests were submitted to DNR on December 17, 2012.

Table 1.–Summary of instantaneous discharge measurements taken on the Chilkoot River, Alaska.

Data Record Number	Date	Start Time	End Time	Made By	Width (ft)	Area (ft^2)	Mean Vel (ft/s)	Q (cfs)	Staff Gage Stage Start	Staff Gage Stage End	No. Sections	Quality	Control	Comments
1	8/16/2007	10:50	11:07	JJS, TCS, JTH	178	1090	1.10	1190	3.36	3.36	195	fair	clear	ADCP pulled across by hand.
2	10/16/2007	10:51	11:10	JJS, JTH, ACB	151	299	1.70	502	2.39	2.38	352	excellent	clear	ADCP pulled across by hand below bridge
3	12/6/2007	14:14	15:00	JJS, JTH, ACB	139	204	0.67	136	1.53	1.53	30	fair	clear	Wading AA below bridge
4	3/3/2008	15:05	15:52	JJS, JTH, ACB	137	175	0.58	101	1.39	1.39	30	fair	clear	Wading AA below bridge
5	5/22/2008	14:00	14:15	JJS, JTH	152	407	2.60	1072	3.25	3.25	300	fair	clear	ADCP pulled across by hand below bridge
6	8/7/2008	10:11	10:25	JJS, ACB, TCS	163	476	3.60	1697	3.83	3.85	247	fair	clear	ADCP pulled across by hand below bridge
7	10/2/2008	11:42	12:01	JTH, TCS	155	547	4.16	2278	4.274	4.283	266	fair	clear	ADCP pulled across by hand above bridge
8	12/16/2008	10:17	11:02	JJS, JTH	152	222	0.74	165	1.60	1.62	28	fair	clear	Wading AA below bridge
9	2/18/2009	14:44	15:21	JJS, JTH	137	181	0.56	101	1.43	1.43	26	fair	clear	Wading AA below bridge; WSE suspect shore ice.
10	4/14/2009	11:37	12:25	JJS, JTH	135	185	0.55	103	1.36	1.36	28	fair	clear	Wading AA below bridge, no shore ice.
11	6/10/2009	8:31	8:50	JJS, JTH	184	612	5.00	3050	4.81	4.77	324	fair	clear	ADCP pulled across by hand below bridge
12	9/11/2009	11:18	11:36	JJS, JTH, SLJ	173	529	4.20	2239	4.27	4.26	226	fair	clear	ADCP pulled across by hand below bridge
13	10/8/2009	10:57	11:20	JJS, JTH, TAC	152	318	2.18	694	2.74	2.73	193	fair	clear	ADCP pulled across by hand below bridge
14	2/12/2010	12:08	12:57	JJS, TCS	242	295	0.61	179	1.51	1.51	27	poor	clear	Tide at bridge; had to take q upstream of weir. DO NOT USE FOR RATING.
15	5/6/2010	12:32	13:37	JJS, JTH	154	365	1.70	619	2.62	2.63	28	fair	clear	Wading AA below bridge.
16	7/15/2010	11:52	12:08	JJS, JTH	174	498	3.92	1950	4.05	4.03	237	fair	clear	ADCP pulled across by hand below bridge

Table 1.–Page 2 of 2.

Data Record Number	Date	Start Time	End Time	Made By	Width (ft)	Area (ft^2)	Mean Vel (ft/s)	Q (cfs)	Staff Gage Stage Start	Staff Gage Stage End	No. Sections	Quality	Control	Comments
17	9/10/2010	9:43	9:55	JJS, JTH	165	393	2.86	1130	3.36	3.32	214	fair	clear	ADCP pulled across by hand below bridge
18	1/28/2011	11:16	11:55	JJS, JTH	130	184	0.89	164	1.63	1.61	26	fair	clear	Wading AA below bridge.
19	4/22/2011	10:20	11:14	JJS, JTH	128	172	0.80	137	1.50	1.47	30	good	clear	Wading AA below bridge.
20	4/28/2011	10:45	11:24	JJS, JTH	224	152	1.31	199	1.71	1.72	33	fair	clear	Wading AA above bridge.
21	6/17/2011	11:34	11:47	JJS, JTH, TCS	160	437	3.40	1480	3.65	3.65	250	good	clear	ADCP pulled across by hand below bridge
22	8/25/2011	8:17	8:42	JJS, JTH, TCS	167	481	3.75	1801	3.90	3.89	367	good	clear	ADCP pulled across by hand below bridge
23	1/13/2012	12:39	13:25	JJS	137	229	1.00	238	1.81	1.81	36	fair	clear	Wading AA below bridge.
24	3/23/2012	8:41	9:20	JJS, JTH, TCS	128	151	0.57	87	1.29	1.29	30	fair	clear	Wading AA below bridge.
25	5/10/2012	9:36	10:33	JJS, JTH	154	321	1.80	566	2.50	2.48	29	fair	clear	Wading AA below bridge.
26	7/19/2012	10:19	10:33	JJS, SLJ, Alex	157	520	4.50	2340	4.37	4.37	232	fair	clear	ADCP pulled across by hand below bridge
27	10/16/2012	10:11	10:26	JJS, JTH	145	285	1.80	526	2.51	2.51	278	fair	clear	Last measurement. Gage removed at this visit.

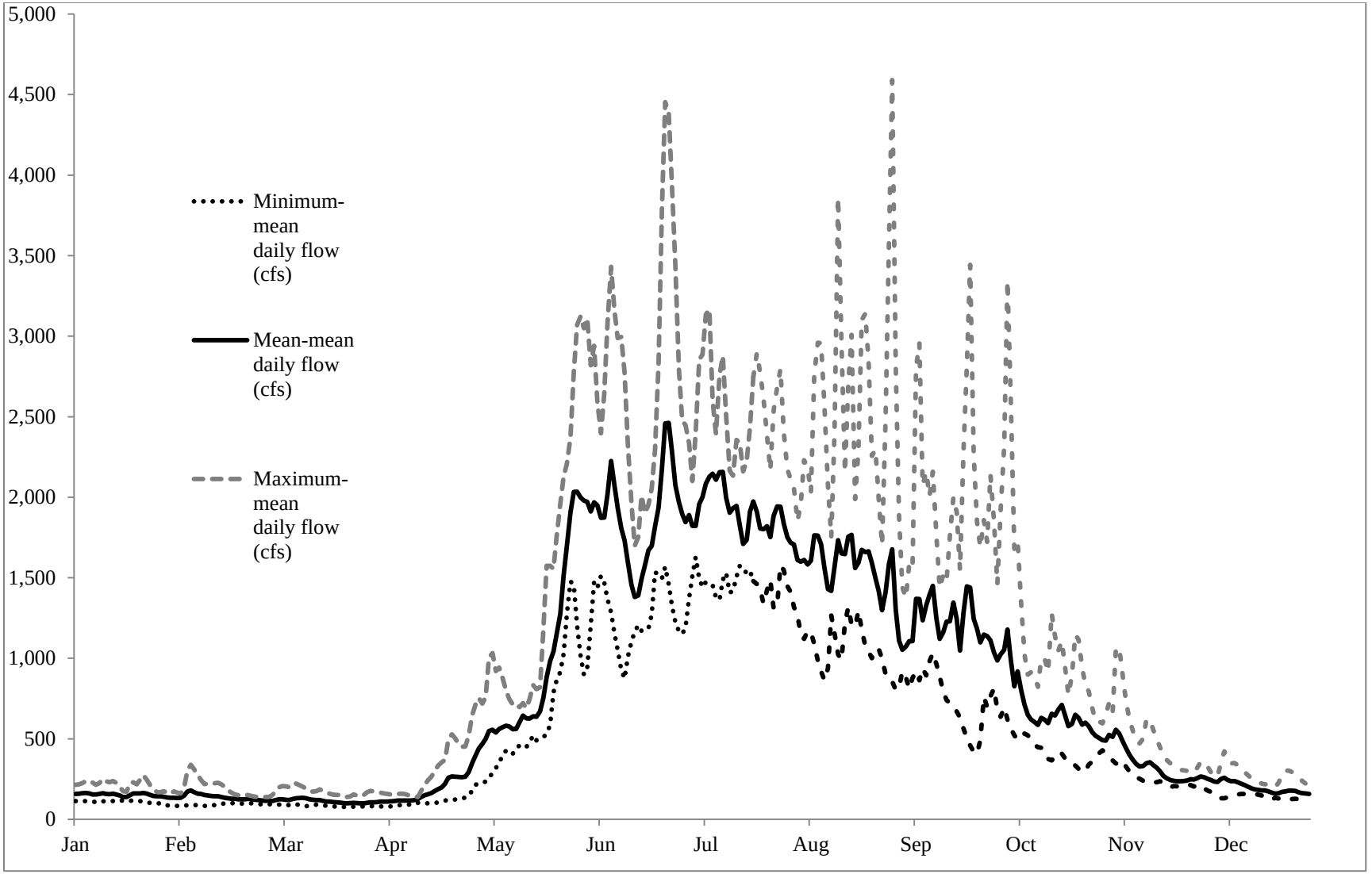

Figure 3.–Annual hydrograph of minimum, mean, and maximum mean daily flows (in ft^3/s) for Chilkoot River, Alaska (October 1, 2006, to September 30, 2011) based on data from streamgage 11901 located on the Chilkoot River downstream of Chilkoot Lake.

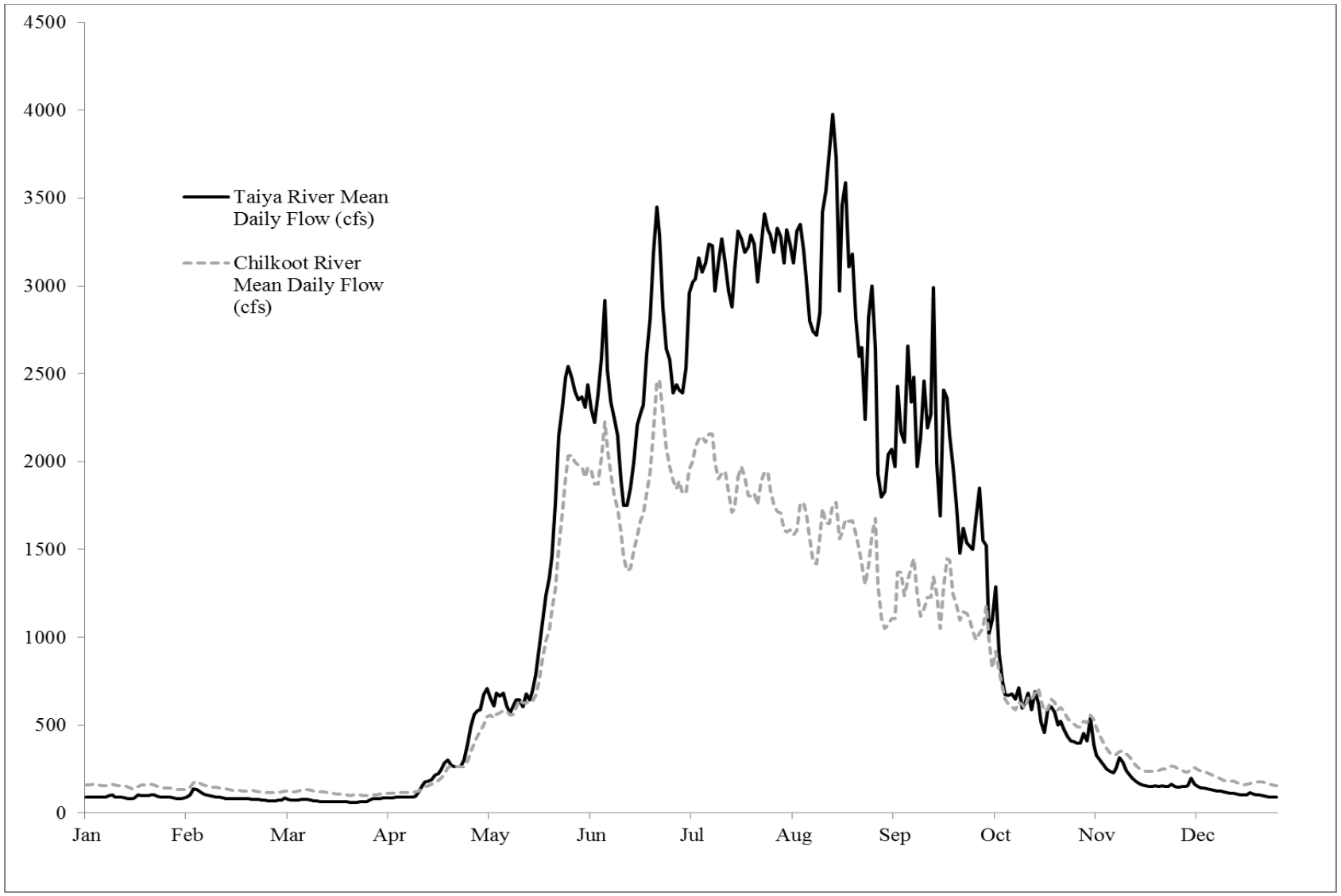

Figure 4.–Annual hydrograph of mean daily flows (in ft^3/s) for Chilkoot River (ADF&G 11901) and Taiya River (USGS 15056210) from October 1, 2006, to September 30, 2011.

Table 2.–Mean annual flow (ft^3/s) by water year for the Chilkoot River (ADF&G Station 11901) and percent difference of annual mean to the mean for the entire period of record.

Water Year	Mean Flow (ft^3/s)	Percent Difference
2008	734	-8.0
2009	830	4.5
2010	769	-3.0
2011	790	-0.5
2012	847	6.7
Mean All Years	794	

Table 3.–Mean annual flow (ft^3/s) by water year for the Taiya River (USGS Station 15056210) and percent difference of annual mean to the mean for the entire period of record.

Water Year	Mean Flow (ft^3/s)	Percent Difference
1970	1058	-12.0
1971	1257	4.7
1972	1131	-5.8
1973	880	-27.0
1974	968	-19.0
1975	1302	8.4
1976	1154	-3.9
1977	1338	11.0
2004	1424	19.0
2005	1374	14.0
2006	1229	2.4
2007	1200	-0.1
2008	1016	-15.0
2009	1308	8.9
2010	1057	-12.0
2011	1089	-9.3
2012	1150	-4.2.0
2013	1540	28
2014	1339	12.0
Mean 2008-2012	1124	
Mean All Years	1201	

DISCUSSION

According to ADF&G's anadromous waters catalog, over 18,000 streams, rivers, and lakes have been specified as supporting anadromous fish populations in Alaska (Johnson and Colemen 2014). These waterbodies are all potentially subject to water withdrawals and modification of their natural streamflows. Although most water bodies in the state are currently not subject to flow modifications, it is important to protect these unallocated streamflows before competition over the water arises. In 2005, total freshwater surface withdrawals in Alaska were only 393 million gallons per day (MGD), compared to 4,190 MGD in Washington and 22,200 MGD in California (Kenney 2009).

ADF&G has filed applications for reservation of water for 213 river reaches and 4 lakes since 1980 and has been granted certificates for 79 river reaches and 1 lake (Klein 2013). There are potentially tens of thousands more stream reaches where instream flows can still be protected within the state. One major challenge to filing more applications is the lack of available streamflow data that can be used to file applications. Only 128 continuous streamgages were operated by the USGS in federal Water Year 2012 (October 1, 2001, through September 30, 2012; Klein 2013). Recognizing this data limitation, ADF&G began a program in 2001 to collect streamflow data at important fisheries throughout the state.

The Chilkoot River is an important freshwater fishery that provides habitat for many fish species at various life stages. Prior to this project, no known streamflow data had been collected within the river. This project collected the 5 years (water years 2008 to 2012) of streamflow data needed to support a reservation of water application within one reach of the Chilkoot River.

Mean annual discharge at the Taiya River streamgage (USGS 15056210) from water years 2008 to 2012 had on average a -6.4% difference from streamflows measured over its 19 years of record. The Taiya and Chilkoot River basins have similar drainage basin characteristics and climactic patterns, and it can be argued that mean annual discharge measured (water years 2008 to 2012) at the Chilkoot River were similarly lower than would be found on average.

Instream flows were requested to attempt to mimic the natural seasonal patterns of streamflows observed within the Chilkoot River. All requested flows were near the mean daily flow for the requested time periods. Although not requested, research has shown that flows near bankfull are needed to maintain the channel's sediment, riparian vegetation, and floodplain habitat (Leopold et al. 1964, Reiser et al. 1985, Schmidt and Potyondy 2004). Changes in the magnitude, frequency, timing, and duration of these flows could directly lead to biological and geomorphic changes (Whiting 2002).

The accepted reservation of water application has not been adjudicated by DNR. Adjudication is the legal process that determines the amount of water to be reserved (Klein 2012). If a Certificate of Reservation is granted by DNR, approximately 1.7 river miles of fish habitat would be protected. Klein (2012) provides further information on DNR's water right process.

At this time, no major water withdrawals or impoundments occur within the Chilkoot River watershed, although Connelly Lake, which drains into the Chilkoot River, was studied in the 1990s by Haines Light & Power as the location for a potential hydroelectric project (Figure 1). More recently, on July 15, 2011, Alaska Power and Telephone (AP&T) filed a Preliminary Permit Application to the Federal Energy Regulatory Commission (FERC) for a proposed hydroelectric project at Connelly Lake. AP&T was issued a preliminary permit by FERC on

March 19, 2012. The project was estimated to have a capacity of 12 megawatts. Citing a lack of projected electrical load to make the project economical and insufficient local public support, AP&T surrendered their preliminary permit on June 13, 2013.

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APPENDIX A.
ADF&G STREAMGAGE 11901 DATA SUMMARY

Appendix A1.–Streamgage 11901 Water Year 2007 mean daily discharge values reported in cubic feet per second (ft^3/s).

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	---	---	---	---	---	---	---	---	---	---	---	884
2	---	---	---	---	---	---	---	---	---	---	---	918
3	---	---	---	---	---	---	---	---	---	---	---	881
4	---	---	---	---	---	---	---	---	---	---	---	811
5	---	---	---	---	---	---	---	---	---	---	---	877
6	---	---	---	---	---	---	---	---	---	---	---	1094
7	---	---	---	---	---	---	---	---	---	---	---	1183
8	---	---	---	---	---	---	---	---	---	---	---	1093
9	---	---	---	---	---	---	---	---	---	---	---	1164
10	---	---	---	---	---	---	---	---	---	---	---	1377
11	---	---	---	---	---	---	---	---	---	---	---	1516
12	---	---	---	---	---	---	---	---	---	---	---	1304
13	---	---	---	---	---	---	---	---	---	---	---	1104
14	---	---	---	---	---	---	---	---	---	---	1195	952
15	---	---	---	---	---	---	---	---	---	---	1194	1323
16	---	---	---	---	---	---	---	---	---	---	1220	1755
17	---	---	---	---	---	---	---	---	---	---	1317	1445
18	---	---	---	---	---	---	---	---	---	---	1398	1106
19	---	---	---	---	---	---	---	---	---	---	1398	929
20	---	---	---	---	---	---	---	---	---	---	1313	896
21	---	---	---	---	---	---	---	---	---	---	1178	916
22	---	---	---	---	---	---	---	---	---	---	1077	828
23	---	---	---	---	---	---	---	---	---	---	1042	717
24	---	---	---	---	---	---	---	---	---	---	1000	776
25	---	---	---	---	---	---	---	---	---	---	1057	957
26	---	---	---	---	---	---	---	---	---	---	1058	1214
27	---	---	---	---	---	---	---	---	---	---	997	1226
28	---	---	---	---	---	---	---	---	---	---	902	1015
29	---	---	---	---	---	---	---	---	---	---	866	813
30	---	---	---	---	---	---	---	---	---	---	878	680
31	---	---	---	---	---	---	---	---	---	---	907	---
Total	---	---	---	---	---	---	---	---	---	---	---	31754
Mean	---	---	---	---	---	---	---	---	---	---	---	1058
Max	---	---	---	---	---	---	---	---	---	---	---	1755
Min	---	---	---	---	---	---	---	---	---	---	---	680

Note: Streamflow values in this report are based on USGS guidelines for daily mean discharge (http://wdr.water.usgs.gov/current/documentation.html#sqw, accessed January 7, 2014): "Values of daily mean discharge are shown to the nearest hundredth of a cubic foot per second for discharges of less than 1 ft^3/s; to the nearest tenths between 1.0 and 10 ft^3/s; to whole numbers between 10 and 1,000 ft^3/s; and to three significant figures above 1,000 ft^3/s. The number of significant figures used is based solely on the magnitude of the discharge value. The same rounding rules apply to discharge values listed for partial-record stations."

Appendix A2.–Streamgage 11901 Water Year 2008 mean daily discharge values reported in cubic feet per second (ft^3/s).

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	636	492	179	119	83	101	88	392	1549	1732	1621	942
2	729	538	170	128	83	102	88	383	1436	2100	1536	952
3	797	522	149	149	88	100	89	421	1473	2399	1459	983
4	713	459	135	142	91	96	97	447	1692	2856	1399	1028
5	657	406	130	129	90	94	103	447	1681	2885	1376	987
6	672	362	131	123	87	99	107	443	1485	3134	1442	919
7	649	326	137	121	86	121	108	440	1367	3166	1690	863
8	592	298	142	117	83	146	108	425	1285	2595	1803	937
9	541	275	152	115	82	157	106	403	1156	2225	1790	952
10	497	261	154	114	87	154	105	408	1051	1846	1610	982
11	464	252	157	110	89	145	104	463	928	1633	1422	1251
12	447	239	158	113	94	138	120	568	874	1530	1419	1164
13	480	228	157	123	94	131	141	667	1008	1408	2413	1038
14	505	231	156	121	100	123	152	681	1103	1418	3861	1102
15	508	232	159	113	101	116	157	747	1165	1506	2977	1365
16	480	230	155	114	100	116	164	834	1254	1576	2156	1344
17	443	236	148	115	102	119	176	809	1348	1623	1706	2000
18	417	224	140	126	100	117	167	819	1596	1734	1482	1908
19	408	214	130	123	98	114	157	788	1625	2375	1315	1547
20	378	208	121	113	99	110	150	877	1576	2319	1293	2295
21	358	206	134	105	109	107	146	1099	1837	1760	1372	1816
22	353	213	146	102	113	112	151	1134	1967	1431	1576	1359
23	334	213	143	102	112	116	175	1198	1809	1339	1917	1210
24	314	228	138	100	108	113	207	1454	1645	1423	2150	1068
25	293	231	145	98	106	109	219	1852	1647	1633	2296	898
26	299	238	143	101	104	105	218	2205	1590	2537	1989	776
27	341	229	137	91	103	101	256	2346	1497	2329	1702	698
28	357	220	127	86	104	97	347	2408	1757	2010	1379	765
29	383	208	124	85	105	94	392	2497	1947	1684	1259	861
30	409	194	121	83	---	92	402	2341	1731	1573	1170	1161
31	482	---	118	83	---	90	---	1848	---	1559	1032	---
Total	14936	8413	4436	3464	2801	3535	5000	31844	44079	61338	53612	35171
Mean	482	280	143	112	97	114	167	1027	1469	1979	1729	1172
Max	797	538	179	149	113	157	402	2497	1967	3166	3861	2295
Min	293	194	118	83	82	90	88	383	874	1339	1032	698

Water Year 2008 Total 268,269 Mean 734 Max 3,861 Min 82

Note: Streamflow values in this report are based on USGS guidelines for daily mean discharge (http://wdr.water.usgs.gov/current/documentation.html#sqw, accessed January 7, 2014): "Values of daily mean discharge are shown to the nearest hundredth of a cubic foot per second for discharges of less than 1 ft^3/s; to the nearest tenths between 1.0 and 10 ft^3/s; to whole numbers between 10 and 1,000 ft^3/s; and to three significant figures above 1,000 ft^3/s. The number of significant figures used is based solely on the magnitude of the discharge value. The same rounding rules apply to discharge values listed for partial-record stations."

Appendix A3.–Streamgage 11901 Water Year 2009 mean daily discharge values reported in cubic feet per second (ft^3/s).

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	1918	457	330	113	161	91	81	566	941	1372	2007	1882
2	2315	428	293	112	158	92	79	760	1209	1511	1774	1440
3	3344	421	265	112	155	91	77	1004	1669	1772	1493	1248
4	2606	413	264	114	147	90	80	1032	2160	2071	1395	1103
5	1680	390	253	112	138	88	87	920	2397	2313	1424	1012
6	1263	373	242	110	136	94	88	943	2644	2476	1424	1055
7	1009	372	232	107	152	94	88	876	3085	2403	1306	1026
8	852	349	228	106	152	88	90	799	3430	2345	1236	944
9	747	323	241	112	141	84	91	747	3163	2394	1215	893
10	677	302	234	112	134	82	92	694	2988	2423	1300	1205
11	745	291	228	113	127	83	102	667	2996	2255	1314	2159
12	812	282	216	120	120	87	103	657	2774	2136	1266	1767
13	933	271	194	120	113	92	102	660	2328	2165	1154	1435
14	870	269	175	126	107	90	101	648	1969	2123	1025	1235
15	915	263	164	129	105	88	100	620	1698	2032	990	1027
16	1280	252	163	133	105	83	99	574	1752	1773	1268	1077
17	1140	236	162	142	105	82	101	560	2011	1560	2702	1675
18	960	220	157	189	104	80	105	580	1900	1527	3009	1687
19	872	214	153	209	102	79	111	611	1798	1559	1988	1326
20	777	210	147	246	101	78	116	668	1697	1789	1508	1173
21	717	208	138	274	101	77	120	745	1611	1922	1519	1658
22	897	205	129	244	99	76	122	796	1523	1731	1607	1487
23	1148	214	125	211	96	75	123	867	1495	1830	1627	1653
24	1115	217	127	187	94	78	124	916	1568	1781	1573	1849
25	940	228	124	168	93	78	129	1028	1459	1486	1447	1690
26	778	257	126	164	93	79	135	1276	1324	1311	1553	1858
27	695	287	127	161	94	80	145	1563	1226	1328	1462	1452
28	650	320	124	153	92	80	179	1457	1167	1578	2491	1163
29	609	356	122	159	---	80	261	1204	1151	1946	3566	925
30	548	357	120	173	---	83	392	1013	1191	2175	4590	792
31	494	---	117	165	---	82	---	898	---	2112	2810	---
Total	34306	8985	5720	4696	3325	2604	3623	26349	58324	59199	55043	40896
Mean	1107	300	185	151	119	84	121	850	1944	1910	1776	1363
Max	3344	457	330	274	161	94	392	1563	3430	2476	4590	2159
Min	494	205	117	106	92	75	77	560	941	1311	990	792

Water Year 2009	Total 303,070	Mean 830	Max 4,590	Min 75

Note: Streamflow values in this report are based on USGS guidelines for daily mean discharge (http://wdr.water.usgs.gov/current/documentation.html#sqw, accessed January 7, 2014): "Values of daily mean discharge are shown to the nearest hundredth of a cubic foot per second for discharges of less than 1 ft^3/s; to the nearest tenths between 1.0 and 10 ft^3/s; to whole numbers between 10 and 1,000 ft^3/s; and to three significant figures above 1,000 ft^3/s. The number of significant figures used is based solely on the magnitude of the discharge value. The same rounding rules apply to discharge values listed for partial-record stations."

Appendix A4.–Streamgage 11901 Water Year 2010 mean daily discharge values reported in cubic feet per second.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	798	410	249	130	125	174	165	718	2820	2067	1529	821
2	782	390	278	125	122	198	161	669	2530	1808	1627	931
3	703	366	291	123	119	207	157	609	2940	1637	1941	952
4	643	347	265	124	119	205	155	567	2590	1805	2230	904
5	645	345	238	123	118	200	152	581	2122	1879	2181	939
6	775	371	218	123	123	222	158	617	1880	1858	2030	1101
7	749	382	204	132	138	222	159	655	1884	1885	1969	998
8	688	372	198	142	147	213	158	677	1860	2044	1823	954
9	615	351	192	147	147	204	152	696	1836	2179	1659	1038
10	562	330	184	153	144	191	146	712	2021	2390	1468	1149
11	520	313	175	157	140	178	142	719	1956	2878	1401	1032
12	482	328	165	157	135	172	139	697	2016	2505	1362	965
13	444	324	162	154	130	175	138	715	1880	2015	1359	887
14	401	372	161	152	130	186	139	691	1580	1876	1437	794
15	375	377	157	149	136	178	142	684	1322	1926	1693	741
16	365	351	153	171	139	168	150	733	1206	1695	1879	721
17	388	324	168	226	145	159	167	757	1169	1559	1780	708
18	437	296	189	230	149	153	193	783	1175	1588	1786	670
19	508	274	181	217	147	151	232	1171	1185	1648	1770	632
20	523	253	167	199	146	151	336	1574	1273	1533	1642	563
21	494	240	152	184	145	144	495	1574	1533	1461	1471	504
22	533	230	144	170	143	139	528	1556	1641	1491	1242	458
23	669	224	142	160	141	142	503	1764	2059	1614	1192	419
24	690	220	141	151	139	154	470	1961	2735	1849	1186	407
25	716	229	158	141	138	148	450	2127	2664	1633	1098	491
26	834	244	166	134	139	143	453	2209	2380	1432	1084	759
27	795	243	170	130	138	151	518	2372	2058	1487	1023	842
28	691	241	167	130	150	169	647	2774	1841	1609	935	788
29	598	260	162	129	---	177	713	3069	1610	1597	891	873
30	520	261	153	128	---	173	753	3124	1755	1508	856	967
31	456	---	140	128	---	167	---	3049	---	1456	804	---
Total	18399	9268	5690	4719	3832	5414	8871	40604	57521	55912	46348	24008
Mean	594	309	184	152	137	175	296	1310	1917	1804	1495	800
Max	834	410	291	230	150	222	753	3124	2940	2878	2230	1149
Min	365	220	140	123	118	139	138	567	1169	1432	804	407

Water Year 2010	Total 280,586	Mean 769	Max 3,124	Min 118

Note: Streamflow values in this report are based on USGS guidelines for daily mean discharge (http://wdr.water.usgs.gov/current/documentation.html#sqw, accessed January 7, 2014): "Values of daily mean discharge are shown to the nearest hundredth of a cubic foot per second for discharges of less than 1 ft^3/s; to the nearest tenths between 1.0 and 10 ft^3/s; to whole numbers between 10 and 1,000 ft^3/s; and to three significant figures above 1,000 ft^3/s. The number of significant figures used is based solely on the magnitude of the discharge value. The same rounding rules apply to discharge values listed for partial-record stations."

Appendix A5.–Streamgage 11901 Water Year 2011 mean daily discharge values reported in cubic feet per second.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	878	433	266	215	148	120	126	226	3110	1944	1319	1130
2	873	542	247	218	196	116	134	234	2820	1723	1266	1072
3	823	661	233	225	306	114	136	252	2214	1628	1150	1375
4	742	1060	246	237	339	111	139	291	1872	1560	1120	1585
5	836	1065	279	239	311	110	137	318	1648	1485	1170	1560
6	1729	889	283	229	275	110	133	348	1471	1473	1162	2807
7	1360	731	274	215	245	108	128	402	1603	1464	1089	2955
8	1024	622	264	200	219	106	127	447	1946	1453	986	2076
9	898	548	253	185	220	104	129	459	1710	1378	918	2157
10	914	497	243	173	218	103	130	449	1457	1363	863	2006
11	884	471	237	169	223	99	130	439	1305	1488	938	1483
12	823	501	232	165	227	96	130	459	1191	1786	1292	1188
13	1001	618	226	148	218	94	131	462	1159	2013	1261	1125
14	993	619	219	138	202	92	135	449	1253	2112	1171	1366
15	856	556	211	127	179	92	138	477	1458	1911	1272	1482
16	806	499	206	118	166	93	140	521	1501	1735	1606	1194
17	788	448	201	116	155	92	139	569	1484	1646	1415	995
18	1047	390	197	116	147	91	138	659	1499	1603	1208	886
19	1107	369	191	116	151	90	137	678	1788	1543	1197	807
20	943	349	183	118	155	89	136	758	1885	1479	2294	1858
21	772	333	174	128	150	87	134	909	1812	1513	3102	2820
22	655	320	168	137	145	86	133	932	1710	1601	3139	3444
23	577	308	164	141	139	85	140	939	1720	1605	2844	2264
24	525	304	160	141	135	84	146	948	1891	1662	2256	1652
25	481	301	160	150	133	83	153	1164	2158	1844	1731	1315
26	444	291	162	169	132	83	165	1416	2182	1878	1465	1054
27	413	278	162	175	132	83	179	1770	2152	1886	1332	887
28	389	274	161	165	125	85	195	2044	2292	1711	1309	797
29	413	299	163	153	---	87	215	2067	2293	1548	1304	892
30	446	291	187	142	---	93	223	2259	2100	1448	1224	858
31	429	---	201	136	---	108	---	2792	---	1412	1108	---
Total	24869	14867	6553	5104	5391	2994	4356	26137	54684	50895	45511	47090
Mean	802	496	211	165	193	97	145	843	1823	1642	1468	1570
Max	1729	1065	283	239	339	120	223	2792	3110	2112	3139	3444
Min	389	274	160	116	125	83	126	226	1159	1363	863	797
Water Year 2011		Total 288,451			Mean 790			Max 3,444		Min 83		

Note: Streamflow values in this report are based on USGS guidelines for daily mean discharge (http://wdr.water.usgs.gov/current/documentation.html#sqw, accessed January 7, 2014): "Values of daily mean discharge are shown to the nearest hundredth of a cubic foot per second for discharges of less than 1 ft^3/s; to the nearest tenths between 1.0 and 10 ft^3/s; to whole numbers between 10 and 1,000 ft^3/s; and to three significant figures above 1,000 ft^3/s. The number of significant figures used is based solely on the magnitude of the discharge value. The same rounding rules apply to discharge values listed for partial-record stations."

Appendix A6.–Streamgage 11901 Water Year 2012 mean daily discharge values reported in cubic feet per second.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	774	651	238	211	151	110	88	440	1436	2335	2057	1001
2	693	722	232	214	176	112	89	455	1566	1963	1852	997
3	620	588	234	205	204	110	89	459	1547	1670	1958	1000
4	565	504	251	203	201	108	90	445	1438	1497	1912	1207
5	521	459	355	196	187	106	91	428	1512	1441	1759	1268
6	493	426	423	186	175	104	94	455	1884	1475	1972	1236
7	508	395	375	200	164	104	96	486	2166	1724	2760	1180
8	532	368	346	226	156	112	99	562	2606	2291	2960	1410
9	522	341	350	251	150	119	104	579	2515	2370	2956	1768
10	504	327	335	237	144	121	109	534	2146	2757	2574	1648
11	479	315	304	230	142	119	118	519	1848	2531	2072	1252
12	465	306	293	238	145	113	138	627	1803	2026	1752	1101
13	456	298	272	227	137	107	176	722	1608	1920	1664	1136
14	431	283	253	202	133	103	216	665	1387	2133	1714	1519
15	422	264	238	175	130	100	243	598	1259	2356	1779	1421
16	456	271	231	160	130	97	266	534	1238	2335	1744	1281
17	465	245	222	150	128	96	302	490	1457	2161	1616	1246
18	545	220	217	143	125	96	334	504	1711	2225	1721	1211
19	656	207	217	135	122	95	355	510	1953	2435	1692	1049
20	605	199	208	128	124	93	368	529	2055	2747	1507	931
21	555	206	199	127	130	91	394	588	2295	2895	1399	962
22	523	213	229	141	126	89	400	788	2837	2774	1318	1058
23	516	222	276	144	122	88	386	996	3780	2618	1361	1207
24	504	221	302	148	118	87	368	1104	4454	2383	1385	1343
25	504	215	303	156	113	87	353	1402	4383	2167	1358	1236
26	651	213	293	154	109	86	356	1394	3924	2267	1346	1223
27	649	204	283	149	112	85	368	1476	3444	2684	1276	1723
28	618	218	257	145	114	85	381	1483	2795	2796	1448	2140
29	586	209	238	143	111	85	395	1336	2473	2405	1620	1849
30	608	205	222	144	---	86	426	1253	2449	2060	1338	1460
31	596	---	207	147	---	88	---	1314	---	2052	1138	---
Total	17022	9515	8403	5515	4079	3082	7292	23675	67969	69493	55008	39063
Mean	549	317	271	178	141	99	243	764	2266	2242	1774	1302
Max	774	722	423	251	204	121	426	1483	4454	2895	2960	2140
Min	422	199	199	127	109	85	88	428	1238	1441	1138	931

Water Year 2012	Total	310,116	Mean	847	Max	4,454	Min	85

Note: Streamflow values in this report are based on USGS guidelines for daily mean discharge (http://wdr.water.usgs.gov/current/documentation.html#sqw, accessed January 7, 2014): "Values of daily mean discharge are shown to the nearest hundredth of a cubic foot per second for discharges of less than 1 ft^3/s; to the nearest tenths between 1.0 and 10 ft^3/s; to whole numbers between 10 and 1,000 ft^3/s; and to three significant figures above 1,000 ft^3/s. The number of significant figures used is based solely on the magnitude of the discharge value. The same rounding rules apply to discharge values listed for partial-record stations."

Appendix A7.–Streamgage 11901 monthly exceedance flows reported in cubic feet per second.

	Discharge (ft^3/s)											
% Time exceeded	January	February	March	April	May	June	July	August	September	October	November	December
0	274	339	222	753	3124	4454	3166	4590	3444	3344	1065	423
5	237	220	198	470	2372	3110	2774	2960	2108	1280	622	304
10	218	196	173	393	2044	2808	2505	2413	1833	1009	530	283
15	205	161	154	356	1563	2530	2390	2072	1656	914	459	265
20	188	152	145	264	1398	2294	2332	1964	1485	863	417	250
25	173	148	121	216	1171	2152	2225	1803	1394	806	382	238
30	165	145	116	176	1004	2019	2123	1752	1319	775	369	232
35	156	142	112	161	909	1946	2044	1692	1236	717	349	222
40	151	139	110	154	804	1876	1945	1621	1206	689	328	208
45	147	136	106	146	757	1809	1879	1553	1162	651	315	197
50	142	131	101	140	715	1726	1808	1471	1102	618	299	181
55	137	126	96	138	678	1681	1735	1437	1055	586	283	168
60	130	122	94	135	660	1611	1690	1399	1014	537	270	163
65	128	114	92	130	611	1568	1633	1361	975	520	253	161
70	123	109	90	123	569	1500	1601	1315	948	504	240	157
75	120	105	88	108	529	1459	1559	1276	919	481	230	152
80	116	102	87	104	470	1377	1520	1239	887	456	224	144
85	113	99	85	99	449	1259	1487	1171	835	437	218	138
90	112	94	83	91	440	1191	1456	1108	782	408	213	130
95	101	88	79	88	392	1156	1412	986	689	358	207	124
100	83	82	75	77	226	874	1311	804	407	293	194	117

Note: Streamflow values in this report are based on USGS guidelines for daily mean discharge (http://wdr.water.usgs.gov/current/documentation.html#sqw, accessed January 7, 2014): "Values of daily mean discharge are shown to the nearest hundredth of a cubic foot per second for discharges of less than 1 ft^3/s; to the nearest tenths between 1.0 and 10 ft^3/s; to whole numbers between 10 and 1,000 ft^3/s; and to three significant figures above 1,000 ft^3/s. The number of significant figures used is based solely on the magnitude of the discharge value. The same rounding rules apply to discharge values listed for partial-record stations."

APPENDIX B.
ADF&G STREAMGAGE 11901 AVAILABLE DATA

Appendix B1.–ADF&G Streamgage 11901 available data. The following data used for this report are stored in the WISKI database and are available upon request.

Station	Station location	Data available	WISKI database reference
11901	Chilkoot River below lake outlet	Mean daily flow from 8/14/2007 to 10/16/2012	ChilkootRiver n.Q.DayMean.E
11901	Chilkoot River below lake outlet	Instantaneous discharge measurements from 8/16/2007 to 10/16/2012	ChilootRiver n.Q.Obs.Q

Note: Contact SARCU Surface Water Data Coordinator, ADF&G Division of Sport Fish, Research and Technical Services, 802 3rd St. Douglas, AK 99824.

APPENDIX C.
PHOTOGRAPHS

Appendix C1.–View of the Chilkoot River looking from Lutak Road immediately downstream of Chilkoot Lake. The streamgage (11901) was located just downstream of the lake.

Appendix C2.–Surveying the water surface elevation near the streamgage on March 3, 2008, at a discharge of 101 ft^3/s.

Appendix C3.–Looking across the discharge transect from the right bank on October 16, 2007, at a discharge of 500 ft^3/s. In this picture the StreamPro is being towed back and forth across the river to measure the discharge.