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Instream Flow Protection in Alaska, 1999-2009

by

Joe Klein

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

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

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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INSTREAM FLOW PROTECTION IN ALASKA, 1999-2009

by
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ABSTRACT

This report summarizes instream flow protection and related activities of the Alaska Department of Fish and Game (ADF&G) from 1999 through 2009. The status of reservation of water applications by other agencies and the private sector in Alaska is also presented.

Alaska Department of Natural Resources (DNR) received 359 applications for reservations of water from ADF&G, federal agencies, and the private sector as of December 2009. ADF&G completed reservation of water applications on 112 river systems and 1 lake. DNR issued certificates of reservations for 26 ADF&G applications for rivers and one for a lake; one BLM application for a river; and for one river and lake under the water export provision.

In 2002, a Memorandum of Understanding was signed between DNR and ADF&G to assist with the increasing backlog of reservation of water applications needing adjudication and to improve the overall process.

Staff from the Statewide Aquatic Resources Coordination Unit (SARCU) performed hydrologic investigations on 72 sites. Investigations were generally performed to provide the necessary data to complete reservation of water applications. Stream gages were operated at 44 sites, discharge measurements were collected at 27 sites, and stage readings were collected from one site.

ADF&G monitored 68 existing and proposed Federal Energy Regulatory Commission hydroelectric and hydrokinetic projects. SARCU serves as ADF&G's representative for the Alaska Clean Waters Actions program which is a collaboration with Alaska Department of Environmental Conservation and DNR to protect, assess, and restore Alaska's waters and aquatic habitat. SARCU also supports an instream flow training, education and outreach program to empower the public to be good stewards of Alaska's water resources.

Key words: instream flow, reservation of water, water rights, adjudication, Alaska Water Use Act, Peterson Creek, Sitkoh Creek, Chilkoot River, Cowee Creek, Lost River, Lower Talarik Creek, Sheep Creek, Fish Creek, Meadow Creek, Wasilla Creek, Moose Creek, Stariski Creek, Little Campbell Creek, Chatanika River, Federal Energy Regulatory Commission, hydroelectric, hydrokinetic, Alaska Clean Water Actions, instream flow education, training, and outreach.

INTRODUCTION

The State of Alaska has abundant and diverse sport fisheries that are of considerable recreational importance to anglers and others. To date, approximately 17,000 water bodies in Alaska have been identified as supporting anadromous and resident fish species (Johnson and Klein 2009). It is assumed there are many others that have yet to be investigated.

In 2008, an estimated 477,281 anglers fished 2,315,601 days and harvested approximately 3 million fish of over 7 million caught in Alaska (Jennings et al. 2010). The continued production of these fishery resources depends, in part, upon sufficient amounts of good quality water to maintain seasonal fish habitat requirements in rivers, lakes, and related habitats. Fish and other aquatic and terrestrial organisms have adapted to natural streamflow regimes that provide essential seasonal habitats utilized by the various life stages of each species. For fish species using freshwater and estuarine habitats, the various life history activities of migration, feeding, rearing, reproduction, and incubation require different seasonal quantities of flowing waters or lake volumes to sustain aquatic habitat needs (Hynes 1970; Estes 1984; Hill et al. 1991; Poff et al. 1997; Bovee et al. 1998; Annear et al. 2004).

Water uses such as hydroelectric power, mining, petroleum production, water supply (including out-of-state water export), forestry, and agriculture, have the potential to change both the riparian and aquatic habitat conditions needed to support productive fish and wildlife populations. These developments may adversely impact fish production and passage unless sufficient amounts of water are maintained within water bodies during appropriate time periods to provide for important habitat functions and waterway access.

BACKGROUND

The Fish and Game Act (AS 16) requires 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" (AS 16.05.020). ADF&G has the authority to use a variety of legal, regulatory and administrative options to quantify and acquire water rights that will protect water quantities within lotic[1] and lentic[2] water bodies to sustain fish and wildlife resources (AS 16.05.050). Fish habitat permits (AS 16.05.841 and .871) are issued by the department as one of the tools to retain sufficient amounts of water in lotic and lentic fish-bearing systems.

Fish habitat permitting authority also provides equal footing to the department with respect to departmental recommendations to the Alaska Department of Natural Resources (DNR) to balance public interest considerations (under AS 46.15.080) if the water allocation in question has the potential to impact a fish-bearing water body. ADF&G and DNR have agreed to coordinate water right and fish habitat permits to ensure permit conditions are consistent.[3]

These two agencies' statutory tools pertaining to consideration and protection of instream flows in rivers and water levels in lakes were complimented by passage of an amendment to the Alaska's Water Act in 1980, commonly called the Instream Flow Law. Alaska's water laws treat the term *instream flow* more broadly than most states' jurisdictions because the term may be used to refer to the rate or volume of flow in a river, the volume of water in a lake, or a related physical attribute such as water depth for identified resource(s) and value(s). Water rights to retain water in lentic and lotic habitats can be acquired from DNR by a private individual, group, or government agency for one or a combination of four purposes:

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

Alaska's water law follows the prior appropriation doctrine which assigns seniority of water rights in the order they are filed (Alaska Constitution, Article VIII, Section 13). Under Alaska water law (AS 46.15.145) and regulations (11 AAC 93.970), an appropriation of water to retain water within a water body for any of these purposes may also be defined as a "*reservation of water*". The term, "*reservation of water*" is often used to differentiate between retaining water within lotic or lentic water bodies versus out of stream withdrawals.[4] It is important to note that passage of the instream flow amendment expanded the meaning of *appropriation* to represent all water rights uses. However, an *appropriation* is still more commonly associated with out-of-stream and diversionary uses/water rights while the term *reservation* typically refers to retention of water within a lotic and lentic water body (Estes 1998). Further information related to

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1 Lotic refers to flowing waters such as rivers and streams.

2 Lentic refers to still waters such as lakes and ponds.

3 Memorandum from F. Rue, ADF&G Director of the Division of Habitat to G. Gustafon, DNR Director of Division of Land and Water Management, August 10, 1989 reaffirmed by ADF&G and DNR on December 16, 2009.

4 Withdrawals can be from surface or subsurface water sources.

Alaska's reservation of water law can be found in Curran and Dwight (1979), White (1982), Anderson (1991), Harle and Estes (1993), Spence (1995), Estes (1998), and Burkardt (2000).

The Statewide Aquatic Resources Coordination Unit (SARCU) was created in 1986 within the Division of Sport Fish (SF) to acquire water rights for the protection of sport fish resources and related instream uses. SARCU staff also performed technical analyses of proposed and existing water developments and provided recommendations for local, state and federal permits to mitigate negative impacts to fish and wildlife production and habitat.

Over time, the program has expanded to address other issues such as hydroelectric licensing under the Federal Energy Regulatory Commission (FERC), the Alaska Clean Water Actions Program (ACWA), and instream flow education, training, and outreach. This included developing the capacity to collect streamflow data for filing reservation of water applications. The program is largely supported with funding from the U.S. Fish and Wildlife Service (USFWS) Sport Fish Restoration Grant Program (Federal Aid) and the Alaska Sustainable Salmon Fund (AKSSF).

RESERVATIONS OF WATER

To reserve water, a DNR Reservation of Water application must be completed, signed and submitted to DNR with the appropriate application fee, if applicable.[5] SARCU staff developed an operational plan for completing reservation of water applications to comply with requirements established by state law (AS 46.15.145), state regulations (11 AAC 93.141-147), reservation of water application form instructions, and the *State of Alaska Instream Flow Handbook* (DNR 1985) when applicable. Following is an overview of the reservation of water process used by ADF&G.

Nominations

In 1984, ADF&G developed a work plan for nominating water bodies to file for a reservation of water[6]. This work plan included a list of nominated water bodies. SARCU staff updated the list of nominated water bodies in SF Region 1 in 2001 (Appendix A) and in SF Regions II and III in 2007 (Appendix B).

This work plan served as the basis for coordinating with regional management and research staff to nominate water bodies for instream flow protection. Nomination reviews were coordinated by SF regional research coordinators and included input from other staff or agencies that had information on fish resources and/or future water uses in the region.

Final selections of a water body to be reserved were made by the SARCU supervisor in consultation with SF regional supervisors or their designees. In general, final selections were based on the importance of a water body to the sport fishery resources for Federal Aid supported projects or salmon and steelhead species for AKSSF funded projects, the likelihood for competing out-of-stream uses, the amount of existing hydrological data, and the ability for other mechanisms[7] to provide instream flow protection.

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[5] There is no charge to state agencies.

[6] Memorandum from D. W. Collinsworth, ADF&G Commissioner to ADF&G Division Directors, May 30, 1984.

[7] Other mechanisms may include fish habitat permits, water right permits, Clean Water Act permits (Section 401 Water Quality Certification, Section 402 National Pollution Discharge Elimination System, and Section 404 Dredge and Fill permits), Special Permits from land management agencies, Coastal Zone Management Act, Federal Power Act.

Data Compilation, Collection, and Analysis

A reservation of water application needs to include information that substantiates the amount of streamflow or level of water being requested for the selected purpose(s). Applications prepared by ADF&G included biological and hydrological data to support reservations of water for the protection of fish habitat, migration, and propagation. ADF&G strived to collect and analyze all data according to accepted scientific methods and procedures that will meet evidentiary standards and any challenges[8] that may be filed.

Biological Data

A variety of sources were used to obtain information needed to document fish use in the selected water body. This information typically included fish distribution and life history periodicity[9] data that were summarized from ADF&G biologists, scientific literature, and the *Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes* (e. g., Johnson and Klein 2009). SARCU staff worked with ADF&G and other biologists as needed to compile fish use information.

Hydrological Data

DNR recommends a minimum of 5 years of continuous streamflow or lake level data to support reservation of water applications. This 5 year recommendation is intended to reduce potential bias that may be associated with intra- and inter-annual hydrologic variability.

When available, streamflow data for describing seasonal and long-term hydrologic characteristics and quantifying instream flow needs were obtained from the USGS National Water Information System website.[10] When hydrological data were limited or not available, SARCU collected streamflow data in accordance with USGS standards (Rantz and others 1982).

Streamflow data collected by SARCU go through an extensive synthesis and review prior to analysis using Statistical Analysis System (SAS)® software[11]. Water Information System Kisters Incorporated (WISKI)® hydrological data management software was used to reduce field data after they were proofed for nonsensical data and transformed into a WISKI® compliant format. WISKI® is a Windows-based hydrological time series management system that meets USGS standards for data reduction. Streamflow records obtained from USGS or collected by SARCU were analyzed using the most current version of SAS® with support from SF biometricians.

Simple linear regression was used to extend streamflow data when less than 5 years of data were available, if a suitable, long term stream gage with a concurrent period of record existed.

Instream Flow Analysis

Under Alaska law, applicants are not required to use a specific method for quantifying instream flow needs (DNR 1985). The burden is on the applicant to choose and defend the approach used.

ADF&G used hydrologically based approaches combined with fish use information to quantify instream flow needs for fish. These included analyses based on historic streamflow data (Annear

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[8] Challenges may be filed to contest the validity of the data set, analyses, and rationale for the requested amount of water the department considers necessary.

[9] Seasonal use of habitat by species and life stage for passage, spawning, incubation, and rearing.

[10] See http://waterdata.usgs.gov/ak/nwis/sw.

[11] Product names used in this publication are included for scientific completeness, but do not constitute product endorsement.

et al. 2004) and modification of the Tennant Method (Estes 1998; Tennant 1976) calibrated to local hydrologic and biologic conditions. ADF&G recommended streamflow regimes similar to the magnitude, timing, and duration of the natural streamflow regime to maintain seasonal uses of fish habitats by each life history stage.

Hydrological characteristics of a river were used as the primary basis to delineate reaches. This information came from various sources including: USGS topographic maps, ADF&G *Anadromous Waters Catalog* for the appropriate region (e.g. Arctic Region; Johnson and Klein 2009), ADF&G Freshwater Fish Inventory[12], and USGS National Hydrography Database[13]. Reach boundaries were based on documented fish use and to minimize the differences in streamflows from accretion or reduction. Major tributaries upstream and downstream of the chosen reach were generally selected as reach boundaries.

Adjudication

Adjudication is the legal process of determining the validity and amount of a water right and includes the settlement of conflicting claims among competing appropriators of record [11 AAC 93.970(1)]. Once DNR makes a determination on the amount of water to reserve, the public is provided 15 days to comment on the decision. After reviewing all public comments and if no further administrative actions are needed, DNR prepares a "Finding of Fact, Conclusion of Law and Decision" document that describes the information and rationale used for the decision. If DNR's decision is challenged, there is an administrative appeal process with the option to seek further remedy through Alaska's court system.

If the adjudication is successfully completed, DNR will issue a *Certificate of Reservation of Water*. The certificate will be recorded in the State Recorders Office and will include a description of the water right, any conditions placed on it, and the priority date which establishes the seniority of the water right.

PROGRAM ACTIVITIES

RESERVATIONS OF WATER

Between 1980 and 2009, ADF&G completed reservation of water applications on 117 river systems and 1 lake from a total of 359 applications received by DNR (Figures 1–2 and Tables 1-2). During this same period, DNR issued certificates of reservations for 27 river and one lake application submitted by ADF&G, one river application submitted by BLM, and one river and lake under the water export provision [14] (Figures 3–4, Tables 1 and 3).

ADF&G has filed on average four reservation of water applications per year between 1986 and 2009; however, the actual number of applications filed each year has varied (Figure 5). In 2001, ADF&G implemented the Southeast Alaska Instream Flow project to file applications on water bodies supporting salmon and steelhead. This project has contributed substantially to the number of applications filed since 2006.

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[12] See http://www.adfg.alaska.gov/index.cfm?adfg=ffinventory.main

[13] See http://nhd.usgs.gov/data.html

[14] Water exported out of one of the six defined hydrologic units requires a mandatory reservation to protect fish resources (AS 46.15.035).

In 2002, a Memorandum of Understanding (MOU) was signed between DNR and ADF&G to assist with the increasing backlog of reservation of water applications needing adjudication and to improve the overall process. As part of the agreement, ADF&G partially funds a position at DNR to adjudicate applications. This position also provides assistance with preparing applications and other instream flow related needs. DNR and ADF&G also meet annually to prepare a work plan that prioritizes applications to adjudicate in the coming year and discuss any instream flow issues.

HYDROLOGIC INVESTIGATIONS

Hydrologic investigations were generally performed to obtain data to either support a new reservation of water application or amend a prior application. SARCU staff performed hydrologic investigations on 72 sites from 1999 through 2009 (Figures 6–7 and Table 4). During this time, stream gages were operated at 44 sites, discharge measurements were collected at 27 sites, and stage readings were collected from one site. The following summaries describe major hydrologic investigations performed by SARCU staff listed by SF regions[15].

Region I

SF Region I covers Southeast Alaska from Cape Suckling to Dixon Entrance (Figure 8).

Peterson Creek

Peterson Creek is located in southeast Alaska on Douglas Island near Juneau at the end of North Douglas Highway (Figure 7). The drainage area is approximately 4.1 square miles. The headwaters of the creek drain from the slopes of 3,130-foot Mt. Meek and flows into Fritz Cove. Coho salmon (*Oncorhynchus kisutch*), chum salmon (*O. keta*), pink salmon (*O. gorbuscha*), cutthroat trout (*O. clarki*), and Dolly Varden char (*Salvelinus malma*) utilize the creek.

USGS operated a stream gage on Peterson (Station #15109048) from 1998 to 2004, approximately 1.5 miles upstream from the mouth. From 2001 to 2005, ADF&G staff operated four stream gages on Peterson Creek tributaries and higher reaches of the mainstem. Nine reaches were filed for reservations of water in 2008.

Sitkoh Creek

Sitkoh Creek is located in Southeast Alaska on southeastern Chichagof Island across Chatham Strait from the community of Angoon (Figure 7). The creek supports coho, sockeye (*O. nerka*), chum, and pink salmon, cutthroat, rainbow and steelhead trout (*O. mykiss*), and Dolly Varden char.

Sitkoh Creek produces between 400 and 1,000 adult steelhead a year[16] and is a popular sport-fishing destination. In 2007, ADF&G completed a steelhead carrying capacity project and in 2009, ADF&G completed a multi-year steelhead population assessment (Crupi et al. *In prep*). Portions of the watershed around the lake have been logged. Angoon residents participate in a subsistence fishery in the creek mainly for sockeye but also for pink, coho, and chum salmon.

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[15] The state is divided into three SF administrative regions – Southeast, Southcentral and Southwest, and the Arctic-Yukon-Kuskokwim regions. Each region roughly corresponds to the Board of Fish regulatory areas.

[16] Statewide electronic fish ticket database. 1st edition. Alaska Department of Fish and Game, Division of Commercial Fisheries, accessed May 1, 2009.

Three stream reaches were identified for filing reservation of water applications. ADF&G staff installed a stream gage at the outlet of Sitkoh Lake in June 2006 and it will remain operational until November 2011.

Chilkoot River

The Chilkoot River, located near the community of Haines, supports coho, sockeye, chum, and pink salmon, cutthroat trout, and eulachon (*Thaleichthys pacificus*)(Figure 7).

Chilkoot Lake and the lower portion of the Chilkoot River are easily accessible by road and compose one of the largest freshwater sport fisheries in Southeast Alaska. The Chilkoot River drainage is one of the two largest contributors of wild sockeye salmon to the commercial drift gillnet fisheries in Lynn Canal. Chilkoot River sockeye salmon are also harvested in a subsistence fishery near the mouth in Lutak Inlet. Since 1976, ADF&G has maintained a salmon counting weir on the Chilkoot River, between the Chilkoot Lake outlet and the Chilkoot River Bridge, to monitor the strength of sockeye salmon runs in northern Lynn Canal as they return to Chilkoot Lake.

The reservation reach begins at the river mouth at Lutak Inlet and extends upstream to the outlet of Chilkoot Lake. ADF&G staff installed a stream gage in 2007 near the lake outlet. The gage will remain in operation through October 2012. A reservation of water application was filed for this reach in 2009. After hydrological data collection and analysis is complete, the existing application will be amended if necessary.

Cowee Creek

Cowee Creek is located approximately 40 miles north of Juneau within the temperate coastal rainforest of Southeast Alaska (Figure 7). It supports coho, chum, and pink salmon, cutthroat and steelhead trout, and Dolly Varden char. The majority of the Cowee Creek watershed is within the Tongass National Forest with the lower portion located within Point Bridget Alaska State Park.

The watershed has a drainage area of approximately 46 square miles and is bounded by snow and glacier covered mountains that reach up to 5,894 feet in elevation. Cowee Creek flows in a northwesterly direction approximately six miles into Berners Bay. Two main tributaries, South Fork Cowee Creek and Davies Creek, enter the mainstem from the south and north respectively. The lower portion of the Cowee Creek watershed consists of low gradient meadows, meandering streams, and rocky beach fringe. Cowee Creek is a popular freshwater sport fishing destination among Juneau area anglers due to its productive fisheries, road system access, and the three public use cabins that are nearby (Suchanek and Bingham 1990).

ADF&G staff installed a stream gage just below the Glacier Highway Bridge and plan to keep it in operation until October 2012. A reservation of water application was submitted to DNR in 2009. After hydrological data collection is complete and analyzed, the application will be amended, if necessary.

Lost River

The Lost River is located near the community of Yakutat and supports coho, sockeye, and pink salmon, cutthroat and steelhead trout, Dolly Varden char, and eulachon (Figure 7). Lost River is the smallest system in southeast Alaska to have established coho salmon escapement goals (R. A. Clark, Fisheries Scientist, ADF&G, Anchorage, August 12, 2010, personal communication).

In 2003, ADF&G estimated the total abundance of coho salmon in the Lost River system was 23,685 fish (Clark et al. 2006). An estimated 6,000 Lost River bound coho salmon are harvested in the commercial troll fishery per year (Clark and Clark 1994). From 1972 to 1999, coho salmon harvests in the Lost River commercial set gill net fishery averaged about 6,000 fish per year. The commercial set gill net harvest of coho salmon is now closed at the mouth of the Lost River to protect the stock. Anglers caught an average of 1,000 coho per year over the past 15 years. A small number of coho salmon are also harvested in a subsistence fishery (Clark et al. 2006). Annual peak escapement counts the last five years indicated a downward trend in the Lost River coho and sockeye salmon stocks.

ADF&G staff installed a stream gage in 2006 and will keep it operational until October 2012. Reservation of water applications will be submitted to DNR for five reaches. After hydrological data collection is completed and the data have been analyzed, amendments will be filed to update existing applications, if needed.

Region II

SF Region II covers portions of Southcentral and Southwest Alaska including the Prince William Sound, Kenai Peninsula, Kenai River Drainage, Cook Inlet–Resurrection Bay Saltwater, Anchorage Bowl Drainages, Knik Arm, Susitna River Drainage, West Cook Inlet, Kodiak, Bristol Bay, and the Alaska Peninsula and Aleutian Islands (Figure 8).

Lower Talarik Creek

Lower Talarik Creek is a tributary to Lake Iliamna located in southwest Alaska (Figure 6). The creek supports Chinook (*O. tshawytscha*), coho, sockeye, chum, and pink salmon, rainbow trout, Arctic grayling (*Thymallus arcticus*), Arctic char (*S. alpines*), Dolly Varden char, round (*Prosopium cylindraceum*) and broad whitefish (*Coregonus nasus*), burbot (*Lota lota*), and northern pike (*Esox lucius*). The lower portion of the creek is accessible by plane and is a world-renowned angling destination for trophy rainbow trout. Mining claims have been filed in the upper drainage but so far have not been developed.

The Nature Conservancy (TNC), under a cooperative agreement with DNR and ADF&G, purchased land adjacent to Lower Talarik Creek for the protection of fish, wildlife, and aesthetic values and the long-term health of the watershed. Portions of this area were designated as the Lower Talarik Creek Special Use Area (ADL 227445).

A reservation of water application for Lower Talarik Creek was filed in 2000 with the intent to collect five years of data and amend the application if needed. The hydrological data used to support this initial application was based on a regional regression model and hydrological records collected by USGS at nearby Iliamna River. In October 2001, ADF&G staff with the assistance of TNC staff, installed a stream gage at approximately river mile 1.5 on the mainstem, below the confluence of an unnamed tributary (referred to as West Fork Lower Talarik Creek). The gage was relocated to the opposite bank in 2002 due to aufeis and flooding and operated at this site through September 2007.

In July 2003, ADF&G staff installed a stream gage on West Fork Lower Talarik Creek at the outlet of an unnamed lake. This gage operated for a year and was used to acquire a short-term record to be extended using streamflow records collected at the mainstem gage. The reservation of water application for the mainstem was amended in 2005 to include approximately two years

of additional streamflow data. An application was filed for the West Fork Lower Talarik Creek in December 2004.

Sheep Creek

Sheep Creek crosses the Parks Highway approximately 25 miles south of Talkeetna (Figure 6). Sheep Creek is a popular sport fishing and tourist destination that is easily accessible from the state's largest population center. The stream supports Chinook, coho, chum, and pink salmon, rainbow trout, Arctic grayling, and Dolly Varden char. It is reputed for its runs of Chinook salmon with individuals attaining weights in excess of 70 pounds. The stream is also becoming more popular as a fall rainbow trout fishery. These values, along with high land and natural resources development potential led ADF&G staff to nominate Sheep Creek for instream flow protection.

ADF&G staff operated a stream gage on Sheep Creek since fall 2005. The gage will remain in operation until fall 2010. The reservation reach for Sheep Creek extends from the confluence with Goose Creek upstream of the Parks Highway downstream to the Susitna River. Within this reach, the river is characterized as a relatively low gradient stream with winding meanders.

MatSu Instream Flow Project (Fish, Meadow, Wasilla and Moose Creeks)

ADF&G initiated the Matanuska-Susitna (MatSu) Instream Flow project in 2008 to target high priority water bodies in the area for instream flow protection. Meadow, Fish, Wasilla, and Moose Creeks support salmon and resident fish populations and were deemed high priority for receiving instream flow protection by ADF&G staff and the Matanuska-Susitna (MatSu) Basin Salmon Conservation Partnership (MSCP; Figure 6). Streamflow data collected during this project will be used to file new and update existing reservation of water applications. The project will continue until 2013, if funding is received.

Meadow and Fish Creeks

Meadow Creek is the primary surface water source for Big Lake; Fish Creek flows out of Big Lake into Knik Arm. This drainage is a major wild and hatchery-enhanced sockeye salmon producing system. The Big Lake state hatchery operated on Meadow Creek from 1975 to 1993 and was closed due to years of mediocre success and increasing costs. Until 2007, Cook Inlet Aquaculture Association continued to collect eggs from sockeye salmon at Meadow Creek and incubated them at the Trail Lakes Hatchery. Fry and smolts were then returned to Meadow Creek and Big Lake. Fish Creek, Big Lake and Meadow Creek are on ACWA's list of high priority streams, primarily due to poor water quality and concerns over fish habitat integrity. Big Lake is one of the most popular water-recreational destinations in the state.

ADF&G filed reservation of water applications for two reaches on Fish Creek and one reach on Meadow Creek in 1988. Streamflow data used in these applications were based on regional regression analyses and supported by a few instantaneous discharge measurements. Seasonal streamflow variability was based on nearby Cottonwood Creek. DNR requested and ADF&G agreed to obtain 5-years of continuous streamflow data on both Meadow and Fish Creek. In July 2008, ADF&G staff installed stream gages on lower Fish Creek and lower Meadow Creek, and established discharge measurement sites on upper Fish Creek and upper Meadow Creek. Interestingly, streamflow summaries from Fish and Meadow creek sites to date are similar to predictions from the regional regression and seasonal streamflow variability analysis that was used for the original applications. These creeks are predominately lake and ground-water fed;

therefore seasonal variation in streamflows is relatively low. Inter-annual variation may also be low for the same reasons.

ADF&G contracted the Wasilla Soil and Water Conservation District (WSWCD) to measure discharge and collect water quality information on Fish and Meadow creeks including dissolved oxygen, specific conductivity, pH, nitrates, phosphorus, and fecal coliform. ADF&G provided training and assisted WSWCD staff as needed with streamflow data collection efforts.

Wasilla Creek

USGS was contracted to operate a stream gage on Wasilla Creek (Station #15285000) with funding from Alaska Department of Transportation and Public Facilities (ADOT&PF) and the USFWS. ADF&G staff have considered Wasilla Creek a high priority for instream flow protection since 1984. A reservation of water for Wasilla Creek was filed in December 2009. Wasilla Creek is an important waterway for two state Special Areas, the Matanuska Valley Moose Range and the Palmer Hayflats Wildlife Refuge. It supports wildlife habitat and provides essential habitat for anadromous fishes that contribute to recreational and commercial fisheries including sockeye, pink, coho, chum and Chinook salmon, and rainbow trout.

Moose Creek

The MatSu Instream Flow project will fund a USGS stream gage (Station #15283700) on Moose Creek to complete 5 years of streamflow records. The Chickaloon Traditional Village Council (CTVC) with support from other agencies and the MSCP have been restoring fish passage and improving habitat complexity on Moose Creek, a tributary to the Matanuska River. USFWS and CTVC previously funded the stream gage for 4 years. CTVC will file a reservation of water application for Moose Creek.

Stariski Creek

Stariski Creek is located on the Kenai Peninsula approximately 15 miles north of Homer (Figure 6). It was nominated in 2006 by SF staff as a high priority stream for a reservation of water. Stariski Creek supports small to moderate runs of Chinook and coho salmon, and steelhead trout. In 2006 the non-profit organization Cook Inlet Keepers (CIK) was awarded several grants to monitor an ADOT&PF project to construct a bridge in place of a culvert that was damaged by floods in 2002. This work included measuring discharge, which created an opportunity for ADF&G to work with CIK to obtain information needed to file a reservation of water application. ADF&G agreed to provide hydrological supplies, manage and analyze the data, and assist with field work as needed. A stream gage was installed approximately a quarter-mile upstream from the new Sterling Highway Bridge in June 2006.

Since 2006, ADF&G and CIK have jointly operated the stream gage. CIK obtained AKSSF funds to continue operating the stream gage through June 2011. Records collections prior to 2008 were limited to open water periods because winter discharge measurements were not collected due to funding and staff limitations.

Little Campbell Creek

Little Campbell Creek (LCC) is a small, urban stream flowing through the Municipality of Anchorage (MOA; Figure 6). Although the headwaters of LCC remain undeveloped, most of the lower reaches of the watershed are heavily urbanized. Since 2004, municipal, university, state, and federal biologists have observed high levels of mortality in juvenile salmon in the creek

during storm runoff periods. In partnership with the Anchorage Waterways Council (AWC), ADF&G collected one year of water quantity and quality data as a preliminary assessment of the causes for the high levels of fish mortality. Water quality and streamflow results are included in Appendix C to provide baseline information for any future research.

ADF&G installed a stream gage upstream from the confluence with Campbell Creek. Streamflow data were collected from May 2006 through July 2007. MOA partnered with AWC to continue operation of the gage after ADF&G project concluded.

Water quality samples were collected on February 20, 2007 from two locations, near the confluence with Campbell Creek and at the stream gage, and one location in North Fork LCC. The samples were analyzed for metals, nutrients, and organic and inorganic contaminants. No water quality standards were exceeded and results appeared similar to nearby streams. However, given that the samples were collected in the winter, these findings were not surprising. Sediments and other contaminants normally enter the stream during spring break up and warmer months of the year. Turbidity is suspected as a leading cause for fish mortalities.

Region III

SF Region III covers the upper Copper River and upper Susitna River areas and the Arctic-Yukon-Kuskokwim Region including the North Slope, Northwestern, Yukon River, Tanana River, and Kuskokwim-Goodnews areas (Figure 8).

Chatanika River

Chatanika River is located approximately 20 miles north of Fairbanks (Figure 6). The river supports Chinook, coho, and chum salmon, Arctic grayling, round and humpback whitefish (*C. pidschian*), burbot, inconnu (*Stenodus leucichthys*), and northern pike. In 1991, ADF&G filed two reservation of water applications. However, the hydrologic period of record for both applications was from 1907 to 1912 and only contained records for May through September. DNR requested and ADF&G agreed to obtain more streamflow data. In 2005, USGS installed a stream gage near Poker Creek (Station #15534800). University of Alaska Fairbanks (UAF) researchers concurrently operated a stream gage on Poker Creek and there were historical USGS streamflow records from 1971 to 1978.

The creek was separated into 4 reaches upstream to the confluence of Faith and McManus Creeks. Discharge measurements were collected on each reach in 2008 during June, July, August, and October. Streamflow records at USGS gage 15534800 will be extended using a long-term USGS gage on the Chena River. Seasonal and long-term hydrologic characteristics will be estimated using an analysis of historical streamflow records. These analyses are expected to be completed in the summer of 2010.

HYDROELECTRIC PROJECT LICENSING

FERC administers the Federal Power Act (FPA), which governs the regulation of hydroelectric projects in the United States, among other duties. FERC issues licenses[17] that specify how projects will be constructed, operated and any mitigation measures. FERC licenses specify how streamflows will be allocated between energy generation and other beneficial uses recognized by the FPA and other applicable laws (Roos-Collins and Gantenbein 2005).

[17] A FERC license has a term of 30 to 50 years, subject to renewal.

The FPA affords considerable weight and due deference to ADF&G, as the state's fish and wildlife agency. If FERC does not accept all of ADF&G's recommendations, they must attempt to resolve any such inconsistency, giving due weight to the department's authority and expertise. The FERC process is complex, lengthy, and deadline-driven. Each project is unique, usually with specific project features and issues.

Prior to 1998, ADF&G's review of FERC hydroelectric projects was handled on a regional basis. To provide better consistency and interdepartmental coordination, a position was created in SARCU to oversee statewide coordination efforts for all FERC jurisdictional projects and to ensure all legal and administrative requirements were met. Most hydroelectric projects in Alaska are licensed by FERC; however, smaller and federally-constructed projects may fall outside FERC's jurisdiction. Under the FERC process, applicants first obtain a preliminary permit that gives them three years to study the project's feasibility. If the applicant is still interested in pursuing the project, they must submit a license application and environmental review document before the end of the permit term. ADF&G plays an important role in assisting the applicant in the design of study plans for fish and wildlife resources. The licensing process typically takes two years after a license application is filed with FERC and includes an environmental review in accordance with the National Environmental Policy Act (NEPA).

ADF&G monitored 68 existing and proposed FERC hydroelectric and hydrokinetic projects (Table 5). ADF&G assisted applicants to obtain information needed to prepare license applications and provided recommendations for FERC licenses and regulatory permits[18], and issued department permits[19]. Interest in hydroelectric power has increased recently and is expected to continue for the foreseeable future as energy prices remain high and the state seeks solutions for the railbelt's aging power generation infrastructure.

State Jurisdiction of Small Hydroelectric Projects

Alaska has more new hydroelectric development underway than any other state[20]. To streamline licensing requirements, U.S. Senator Frank Murkowski introduced Senate Bill 422 in 1999 to exempt Alaska from FERC jurisdiction for projects that are five megawatts (MW) or less and provide for jurisdiction by the State of Alaska. The bill passed congress in 2000 and the state legislature in 2002. The Regulatory Commission of Alaska (RCA) was charged with adopting regulations to develop a program. From 2003 through 2005, RCA held stakeholder meetings with agencies, industry and the public to prepare draft regulations followed by public hearings. In 2006, RCA closed the docket citing its inability to conclude the complex regulations within the statutory timeline. However, in 2008 RCA opened a new docket but has not contacted ADF&G regarding any further action.

ALASKA CLEAN WATER ACTIONS PROGRAM

SARCU serves as ADF&G's representative for the Alaska Clean Water Actions program which is a collaboration with Alaska Department of Environmental Conservation and DNR to protect, assess, and restore Alaska's waters and aquatic habitat[21]. ACWA's database of priority waters

[18] Water right permits, ACMP review, and CWA Section 401 certifications if issued. Currently DEC waives all 401 certificates for FERC hydroelectric projects.

[19] Fish habitat and special area permits, if necessary.

[20] See http://www.ferc.gov/for-citizens/projectsearch/SearchProjects.aspx.

[21] For more information on ACWA go to www.state.ak.us/dec/water/acwa/acwa_index.htm.

and identified stewardship actions is a product of this collaboration. This is accomplished by identifying water bodies that need stewardship actions and directing funding toward the highest priorities. Each agency is responsible for collecting and assessing water body information related to its expertise: ADF&G–aquatic habitat, DEC–water quality, and DNR–water quantity. SARCU is ADF&G's representative for the ACWA program.

From 2002 to 2009, 31 projects were funded from an average annual funding of $730,350 (Figure 9; C. Gilder, Environmental Program Manager, DEC, Anchorage, December 1, 2010, personal communication)[22]. Projects ranged from stream gaging for instream flow protection to implementing total maximum daily load criteria for pollutants[23]. Currently, ACWA receives funding from Clean Water Act-Nonpoint Source Pollution, Coastal Zone Management Act-Coastal Nonpoint Source Pollution Program, DEC Beach Grant, and AKSSF programs.

Water bodies can be nominated by agency personnel or by concerned members of the public. Each agency evaluates the information and assigns a priority ranking based on specific criteria. ACWA staff developed a plan with a decision tree diagram that describes the process to be followed.[24] ACWA staff use this process to place each water body in one of the following four categories indicating the type of actions that are needed:

- "Data Collection and Monitoring"
- "Recovery or Restoration"
- "Protection and Maintenance"
- "Adequately Protected" (no action needed)

Water bodies are ranked as high, medium, or lower priority. High priority water bodies may be eligible for project funding through the annual ACWA grant solicitation process. Grant recipients are commonly watershed groups, local governments, and soil and water conservation districts. ACWA tracks information on nominated water bodies through an interagency database. In 2008 there were 392 water bodies listed in the database.[25] Of these, 118 were ranked as high priority; 60 for habitat, 52 for water quality, and 6 for water quantity concerns.

INSTREAM FLOW EDUCATION, TRAINING & OUTREACH PROGRAM

The Instream Flow Education, Training and Outreach program is a technical support service provided by SARCU. This program works with other ADF&G programs and divisions, state and federal agencies, non-profit organizations, and the public throughout the state. Education activities included water education calendar contests, water discovery days, and presentations at schools and with the ADF&G mobile aquatic classroom. Training activities included topics on instream flow, water law, stream discharge measurements, and stream gage installation. Outreach activities included public meetings, conferences, sportsman shows, brochures, and posters.

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[22] For information on ACWA projects see http://www.dec.state.ak.us/water/acwa/acwagrantsproject.htm.

[23] Other projects included fecal coliform, turbidity, hydrocarbon, water temperature, and sediment monitoring; storm water discharge mapping; garbage debris removal; and evaluation of forestry best management practices.

[24] For information on ACWA's plan and decision tree diagram see http://www.dec.state.ak.us/water/acwa/acwa_ranking.htm.

[25] Alaska's Final 2008 Integrated Water Quality Monitoring and Assessment Report, April 1, 2008. See http://www.dec.state.ak.us/water/wqsar/waterbody/docs/2008FinalIntegratedReport.pdf.

The goal of the program was to benefit fish and aquatic habitat by empowering agency staff and the public to be successful stewards of Alaska's waters. SARCU staff provided partners with support such as lending equipment and technical guidance. Appendix D contains further information about this program.

OBSTACLES TO INSTREAM FLOW PROTECTION

HYDROLOGICAL DATA LIMITATIONS

The paucity of hydrological data throughout most of Alaska limits ADF&G's ability to acquire reservations of water (Estes 1998; Brabets 1996). In Water Year 2009 (from October 1, 2008 to September 30, 2009), USGS operated 116 continuous stream gages in Alaska (D. Meyer, USGS Hydrologist, Anchorage, Alaska, March 23, 2010, personal communication; Table 6). This represents approximately one stream gage per 5,000 square miles, which contrasts significantly with the western United States where there is approximately one gage site per 400 square miles. Daily stage and water surface elevation data are practically nonexistent for the majority of Alaskan lakes.

Basic hydrological data are required by water management agencies and all potential water users. These data are necessary for accurate estimates of available streamflows and water volumes. Continuous streamflow and stage data are also necessary to manage and enforce existing water rights. Adding to these challenges, Alaska's limited road systems, extremes in weather conditions, and loss of equipment to bears and other wildlife can make data collection difficult and expensive.

Without long-term streamflow data, hydrologic models must be used. On streams with limited or no streamflow data, using hydrologic models to predict naturally occurring streamflows is difficult at best and often produces estimates with high variability. Furthermore, it is more time consuming to estimate streamflow characteristics for streams having limited or no data as opposed to summarizing data for a stream having an adequate hydrologic record.

To address the need for streamflow data, ADF&G is pursuing several actions. Since 2007, SF has provided annual funding for stream gaging efforts. These funds have been leveraged with USGS and other partners when possible, to maximize the collection of streamflow data[26]. From 2002 through 2008, ADF&G also provided over $500,000 for the installation and operation of USGS stream gages throughout Southeast Alaska[27].

In addition, ADF&G, DNR, and USGS collaborated to implement a StreamStats[28] pilot project for the Cook Inlet region. StreamStats is a web-based, geographic information system (GIS) application developed by USGS in cooperation with Environmental Systems Research Institute, Inc. It allows users to obtain streamflow statistics and drainage-basin information for user-selected stream sites. Depending on results from the pilot project, USGS may evaluate the feasibility of statewide implementation.

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[26] Water bodies gaged include: Indian River, Situk River, Chatanika River, Mulchatna River, Stuyahok River, Ophir Creek, Wasilla Creek, Montana Creek, and Stariski Creek.

[27] These funds were from an AKSSF grant. Stream gages funded were: Taiya River, Starrigavan Creek, Hobo Creek, Falls Creek, Maybeso Creek, Indian River, and Halfmile Creek.

[28] See http://water.usgs.gov/osw/streamstats/.

DNR ADJUDICATIONS

Since the 2002 MOU between DNR and ADF&G was signed, significant progress has been made toward adjudicating reservation of water applications and reducing the backlog of pending applications. However, DNR only has one position performing these functions. Challenges that arise during the process can take substantial DNR staff time to address, reducing DNR's ability to complete adjudications.

DNR's adjudicator relies on their hydrologists to review applications and resolve any hydrological issues that may arise. The number of hydrologists working for DNR's Water Resources Section has been greatly reduced due to retirements and the inability to refill positions. The low number of hydrologists has the potential to significantly decrease DNR's ability to perform adjudications.

To assist DNR with this challenge, ADF&G partially funded a DNR hydrologist position from 2006 through 2009. This effort provided hydrologic support to ADF&G's Southeast Instream Flow project and to DNR staff for hydrologic reviews and related adjudication support.

RECOMMENDATIONS

1) Additional stream gaging stations should be funded to increase baseline hydrological data in Alaska. Stream gaging stations are needed to provide streamflow data that is used by multiple users to develop and improve hydrologic models, monitor floods, and quantify instream flow needs.

2) Legislation should be enacted or regulations established that will guarantee a base level of instream flow protection for all fish bearing waters. Requests for additional instream flows above the base level would still need to use the existing process to acquire a reservation of water.

3) Additional research on habitat suitability criteria for Alaskan fish species is needed. Too often, fish habitat suitability data needed for an instream flow assessment is based on limited or non-Alaskan fish habitat suitability information. Investigations should be conducted over multiple years on fish populations not significantly influenced by human activities so results will reflect conditions needed to sustain natural production. The amount of habitat available versus the amount utilized should be monitored to better understand habitat preference and selection. Fish population dynamics, including exploitation rates, should also be monitored.

4) The adequacy of ADF&G reservations of water certificates should be re-analyzed using state-of-the-art methods for the most important sport fisheries. These investigations should include monitoring fish population dynamics. If results indicate additional water should be reserved, a supplemental reservation of water application should be completed and filed.

5) Out-of-stream appropriations should be automatically reviewed by DNR once every 10 years, similar to reservations of water appropriations. This would allow DNR to better manage Alaska's water resources and avoid future water use conflicts.

6) ADF&G should review the status and adequacy of all water rights held by the department. This should include an evaluation as to whether the water uses are in compliance with water permit conditions and DNR regulations. Out-of-stream water rights that are relinquished can be transferred to reservation of water certificates with DNR's approval.

7) A fundamental goal commonly identified by educators is to achieve public recognition of the purpose and value for maintaining instream flows and lake volumes in Alaska to sustain healthy fish populations. To address this goal, the approach should include marketing, public training and outreach activities. A key step toward achieving comprehensive outreach is the incorporation of instream flow concepts and activities into other department education programs and the school system. A survey of current public knowledge and opinion on instream flow values and perceptions in Alaska would help guide program development and communication tools.

8) For ACWA to be more effective within ADF&G, a full-time position is needed. This position would enhance ACWA outreach and staff participation throughout the department. Information about aquatic habitat issues are needed to improve the ACWA database. This information can range from fish habitat concerns to documented habitat degradation and can include monitoring data, reports, photographs, and observations.

The experience of other states shows that it is prudent to protect instream flows as early as possible in order that these flows and the uses that depend upon them do not have to be protected later, when available water may be scarce and opportunities for protection may be more costly and contentious.

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REFERENCES CITED

Anderson, R. T. 1991. Alaska legislature considers innovative instream flow law. Rivers 2(3):255-261.

Annear, T., I. Chisholm, H. Beecher, A. Locke, P. Aarrestad, C. Coomer, C. Estes, J. Hunt, R. Jacobson, G. Jobsis, J. Kauffman, J. Marshall, K. Mayes, G. Smith, R. Wentworth, and C. Stalnaker. 2004. Instream flows for riverine resource stewardship. Revised edition. Instream Flow Council, Cheyenne, Wyoming.

Bovee, K. D., B. L. Lamb, J. M. Bartholow, C. B. Stalnaker, J. Taylor, and J. Henriksen. 1998. Stream habitat analysis using the instream flow incremental methodology. U.S. Geological Survey, Biological Resources Division Information and Technology Report USGS/BRD-1998-0004, Fort Collins, Colorado.

Brabets, T. P. 1996. Evaluation of the streamflow-gaging network of Alaska in providing regional streamflow information. U.S. Dept. of the Interior, U.S. Geological Survey; prepared in cooperation with the Alaska Department of Natural Resources and U.S. Forest Service. Water-resources investigations report 96-4001, Anchorage.

Burkardt, N. 2000. Paradise confounded: the status of Alaska's instream flow program. Rivers 7(4):361-363.

Clark, J. H., and J. E. Clark. 1994. Escapement goals for Yakutat area coho salmon stocks. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 1J94-14, Douglas.

Clark, J. H., D. Reed, and M. Tracy. 2006. Abundance of coho salmon in the Lost River System, Yakutat, Alaska, 2003. Alaska Department of Fish and Game, Fishery Data Series No. 06-11, Anchorage.

Crupi, A., J. Nichols, B. Frenette, and R. Harding. In prep. Steelhead habitat capability study, Phase I/II: Habitat characterization/fish use on Sitkoh Creek. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.

Curran, H. J., and L. P. Dwight. 1979. Analysis of Alaska's Water Use Act and its interaction with federal reserved water rights. Institute of Water Resources, University of Alaska, Fairbanks.

DNR (Alaska Department of Natural Resources). 1985. State of Alaska instream flow handbook: a guide to reserving water for instream use. Alaska Department of Natural Resources, Division of Land and Water Management, Water Management Section, Anchorage.

Estes, C. C. 1984. Evaluation of methods for recommending instream flows to support spawning by salmon. Master's thesis, Washington State University, Pullman.

Estes, C. C. 1998. Annual summary of instream flow reservations and protection in Alaska. Alaska Department of Fish and Game, Fishery Data Series No. 98-40, Anchorage.

Harle, M. L., and C. C. Estes. 1993. An assessment of instream flow protection in Alaska. Pages 9-1-9-19 [in] MacDonnell, L.J. and T.A. Rice, editors. 1993. Instream flow protection in the West. Revised Edition. University of Colorado School of Law, Natural Resources Law Center, Boulder.

Hill, M. T., W. S. Platts, and R. L. Beschta. 1991. Ecological and geomorphological concepts for instream and out-of-channel flow requirements. Rivers 2(3):198-210.

Hynes, H. B. N. 1970. The ecology of running waters. University of Toronto Press, Toronto.

Jennings, G. B., K. Sundet, and A. E. Bingham. 2010. Estimates of participation, catch, and harvest in Alaska sport fisheries during 2008. Alaska Department of Fish and Game, Fishery Data Series No. 10-22, Anchorage.

Johnson, J., and K. Klein. 2009. Catalog of waters important for spawning, rearing, or migration of anadromous fishes – Arctic Region, Effective June 1, 2009. Alaska Department of Fish and Game, Special Publication No. 09-01, Anchorage.

Poff, N. L., J. D. Allan, M. B. Bain, J. R. Karr, K. L. Prestergaard, B. D. Richter, R. Sparks, and J. Stromberg. 1997. The natural flow regime: a paradigm for river conservation and restoration. BioScience 47(11):769-784.

Rantz, S. E., and others. 1982. Measurement and computation of streamflow: Volume 1 and 2. Geological Survey Water-Supply Paper 2175, Reston, Va.

REFERENCES CITED (Continued)

Roos-Collins, R., and J. Gantenbein. 2005. Citizen toolkit for effective participation in hydropower licensing. Hydropower Reform Coalition. http://www.hydroreform.org/hydroguide/hydropower-licensing/citizen-toolkit-for-effective-participation (accessed June 29, 2010).

Spence, L. E. 1995. The natural flow regime: a paradigm for river conservation and restoration. Rivers 5(3):222-226.

Suchanek, P. M., and A. E. Bingham. 1990. Harvest estimates for selected enhanced roadside sport fisheries near Juneau, Alaska during 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-38, Anchorage.

Tennant, D. L. 1976. Instream flow regimes for fish, wildlife, recreation, and related environmental resources. Pages 359-373 [in] J. F. Orsborn and Allman, C. H. Editors. , Volume II. Instream flow needs. American Fisheries Society, Bethesda, Maryland.

White, M. R. 1982. Opportunities to protect instream flows in Alaska. U.S. Department of the Interior, Fish and Wildlife Service Office of Biological Services, Western Energy and Land Use Team, FWS/OBS-82/33, Washington, D. C.

FIGURES AND TABLES

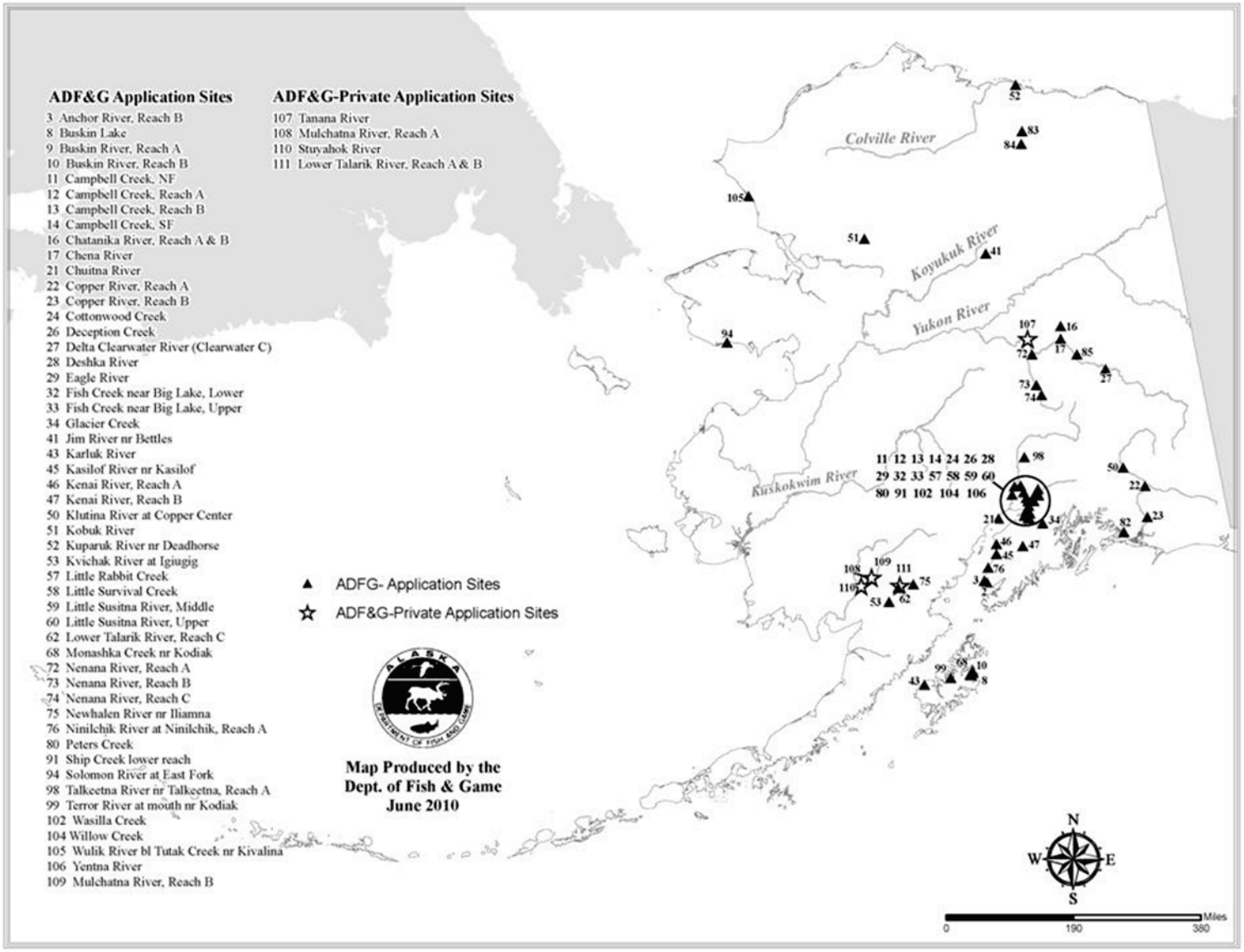

Figure 1.–Location of ADF&G reservation of water sites in Alaska except Southeast.

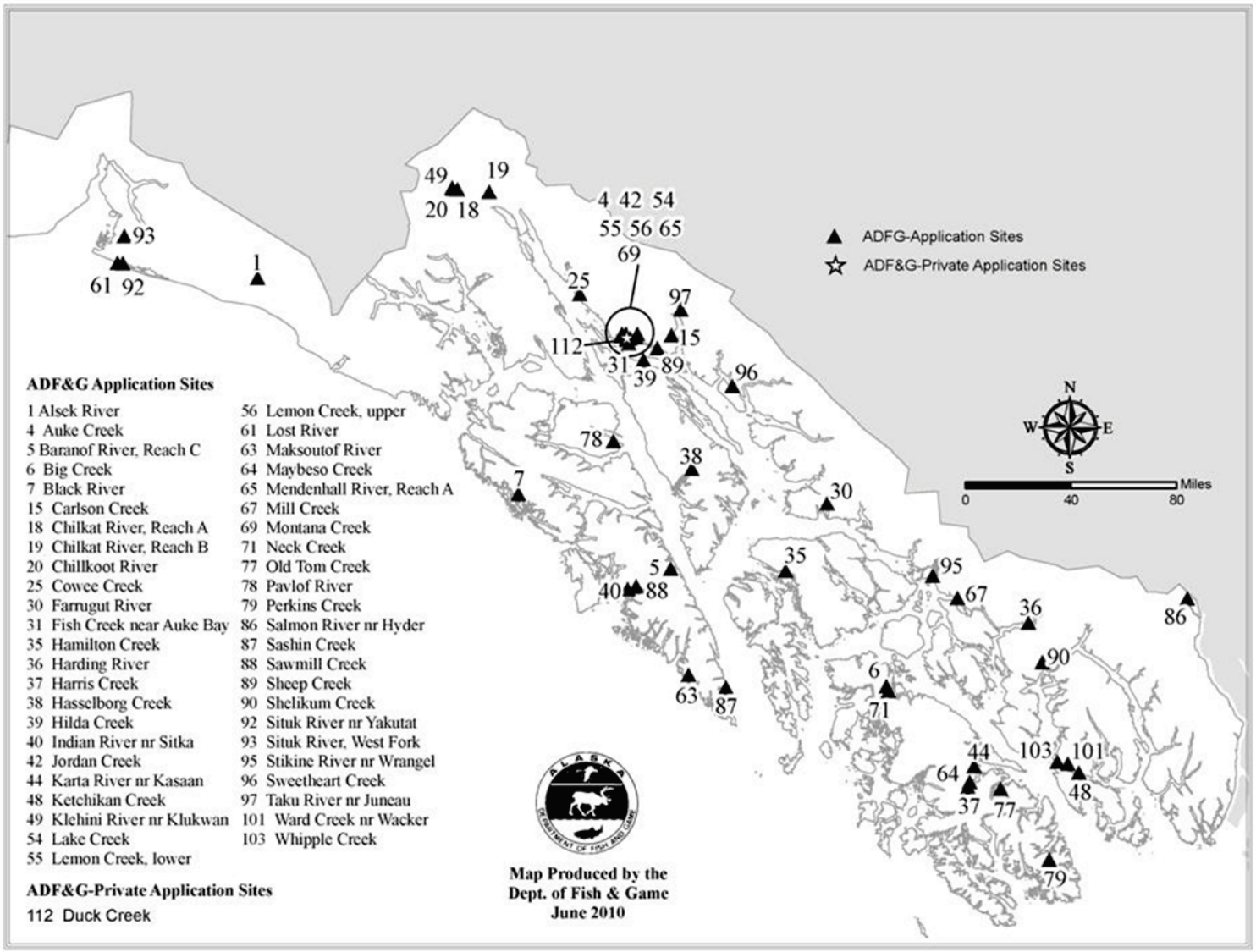

Figure 2.–Location of ADF&G reservation of water sites in Southeast Alaska.

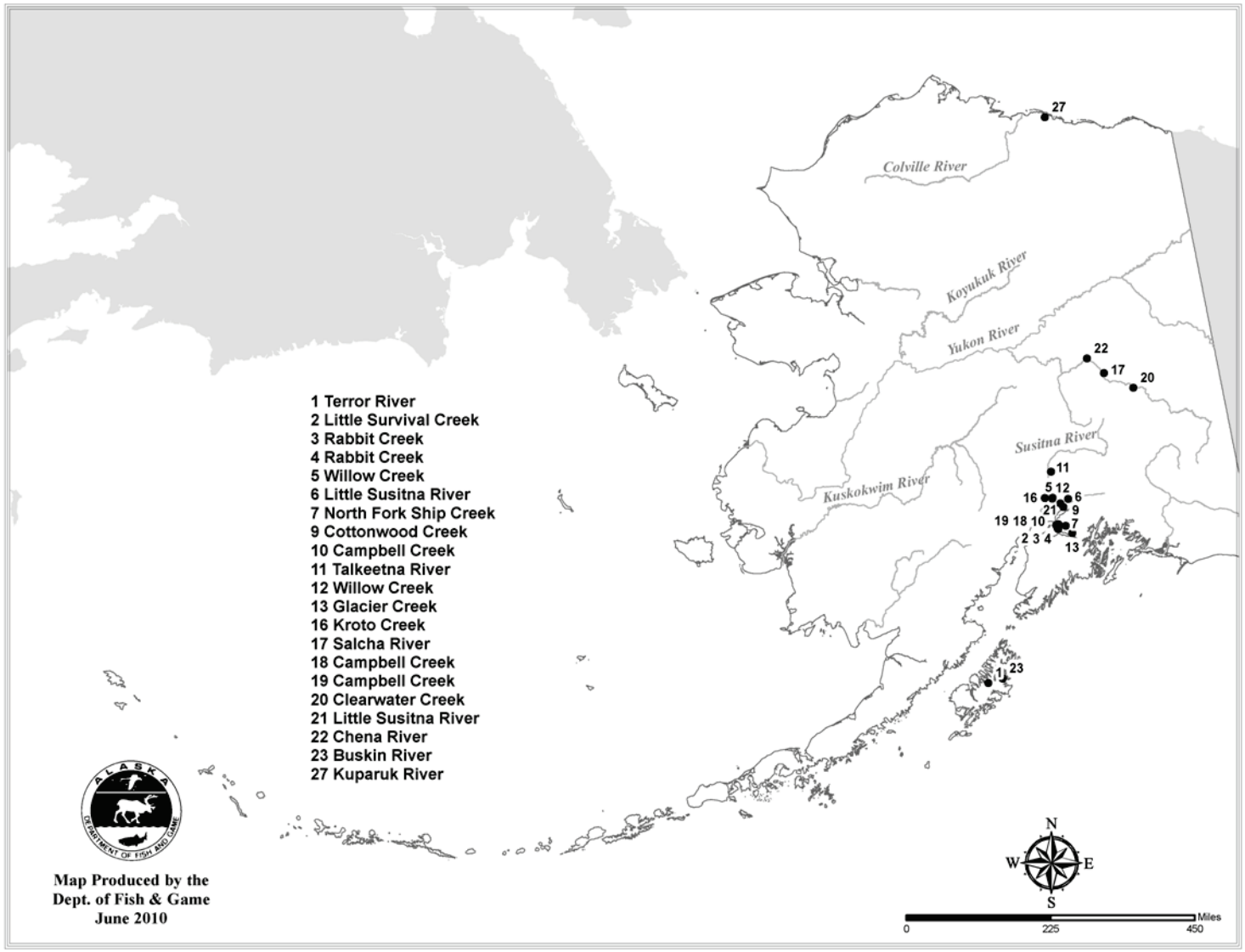

Figure 3.–Location of ADF&G certificates of reservation in Alaska except Southeast.

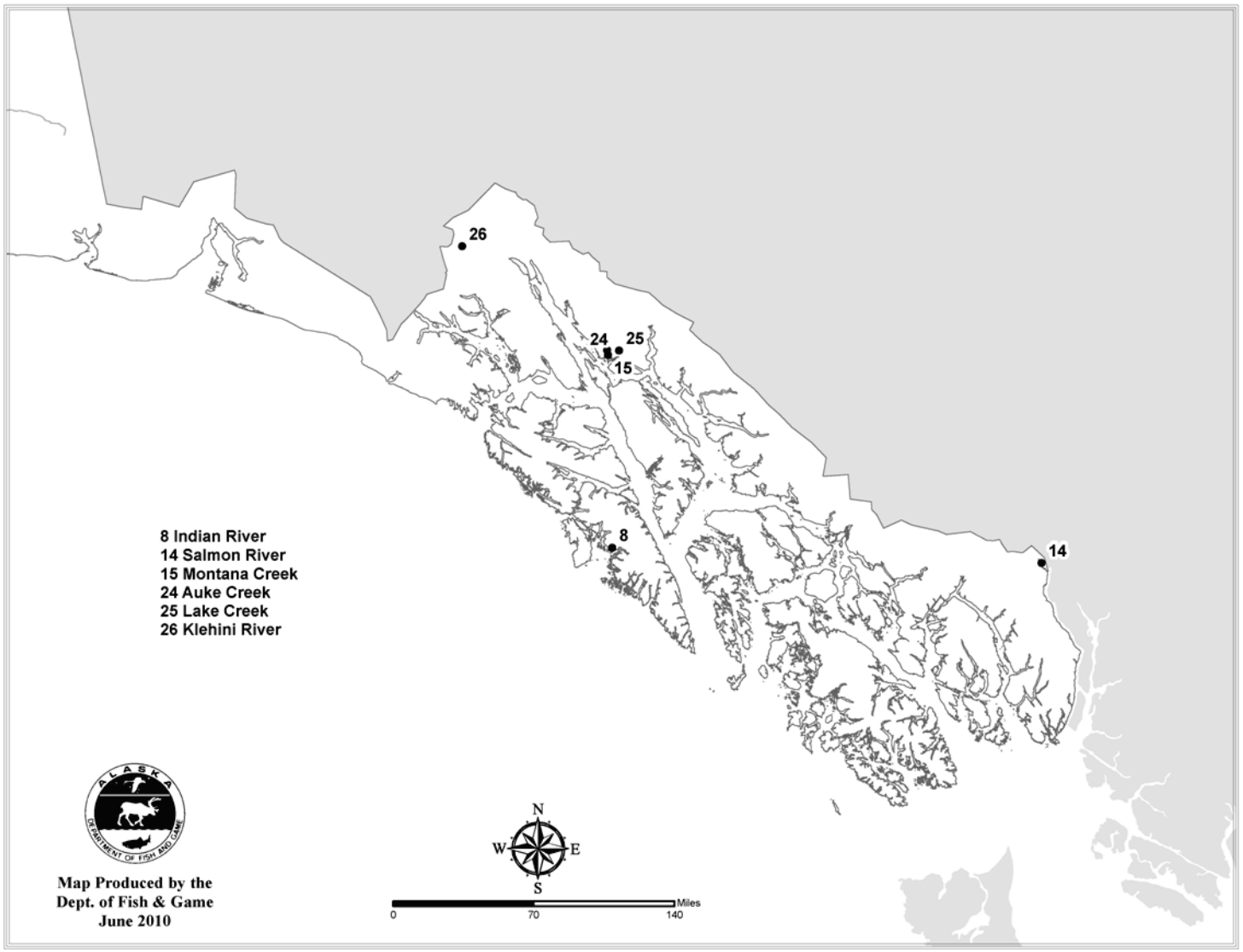

Figure 4.–Location of ADF&G certificates of reservation sites in Southeast Alaska.

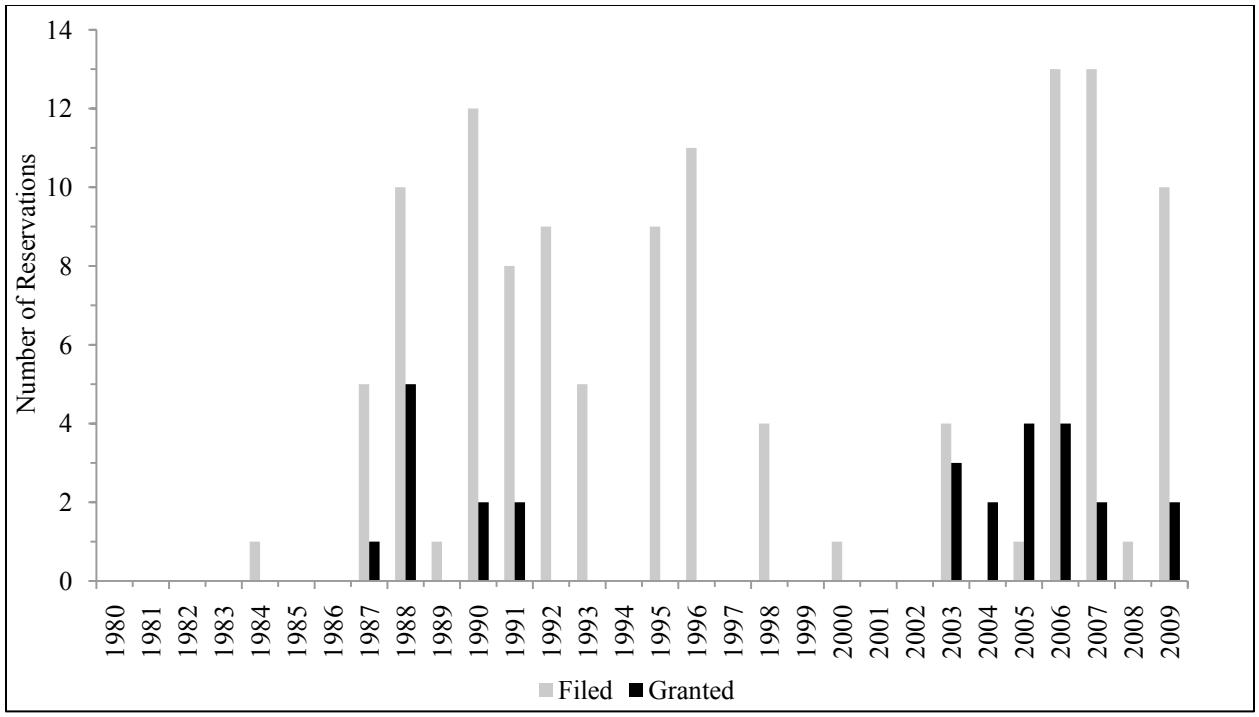

Figure 5.–Summary of ADF&G reservation of water applications filed and granted from 1980–2009.

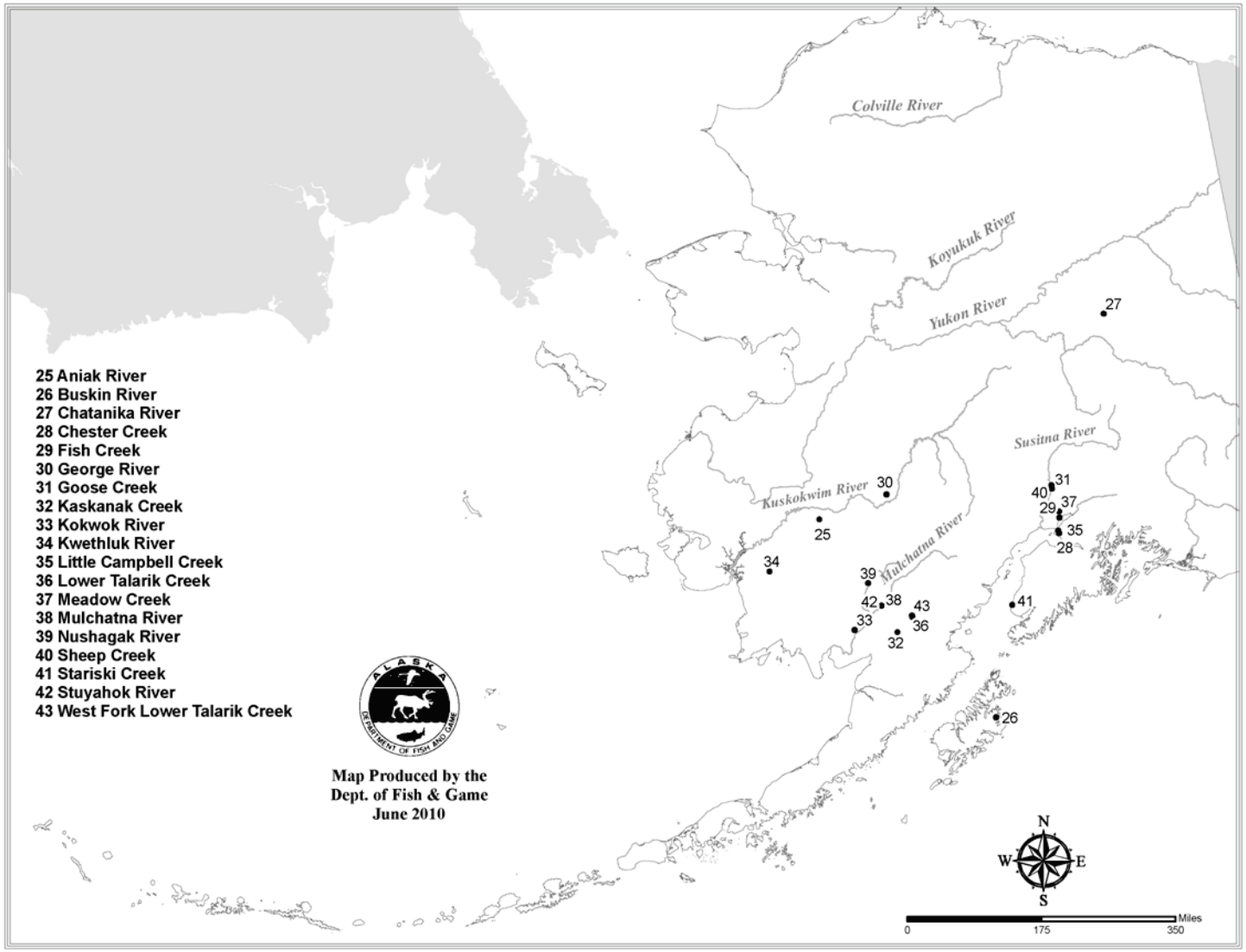

Figure 6.–Location of Statewide Aquatic Resources Coordination Unit hydrologic projects in Alaska except Southeast.

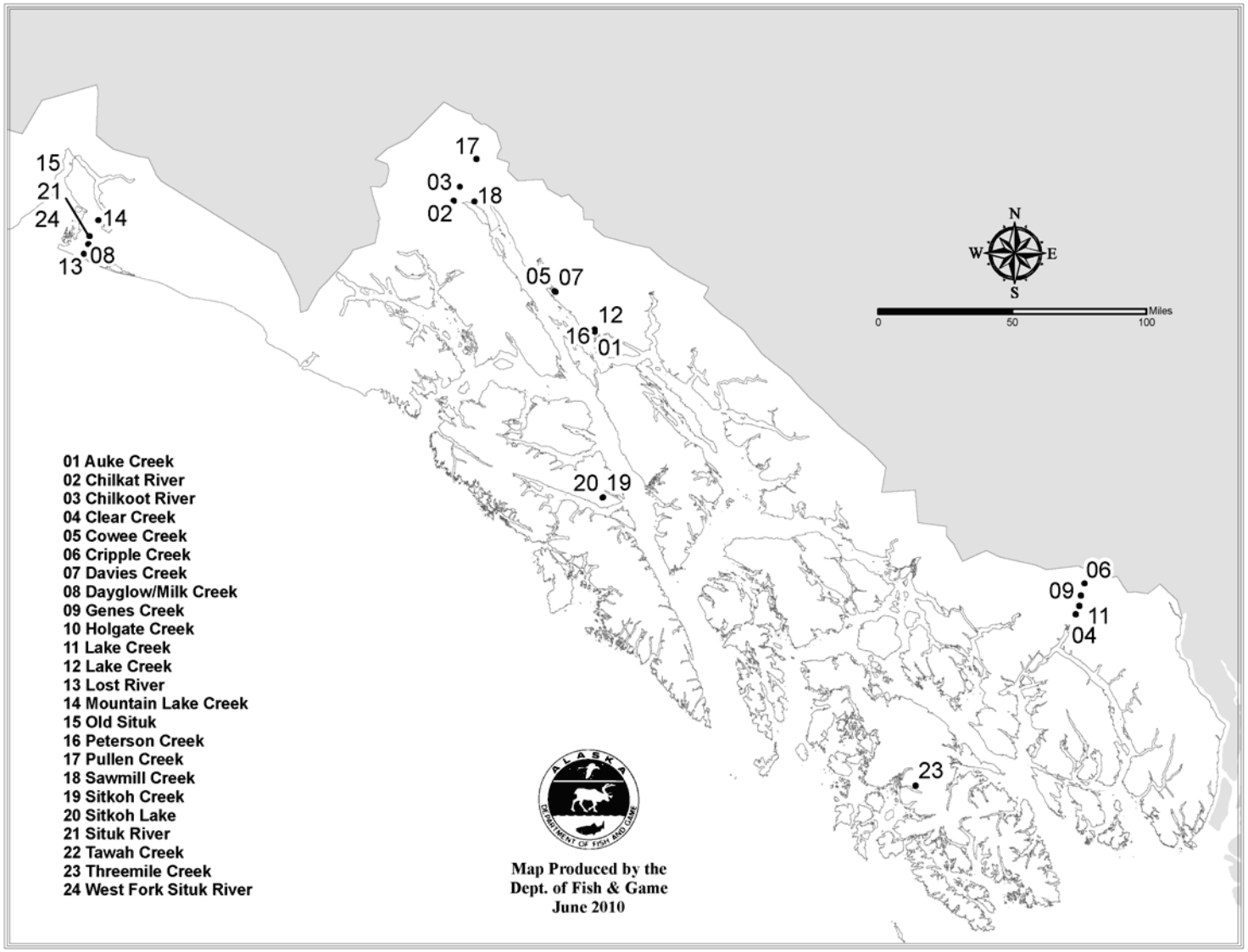

Figure 7.–Location of Statewide Aquatic Resources Coordination Unit hydrologic projects in Southeast Alaska.

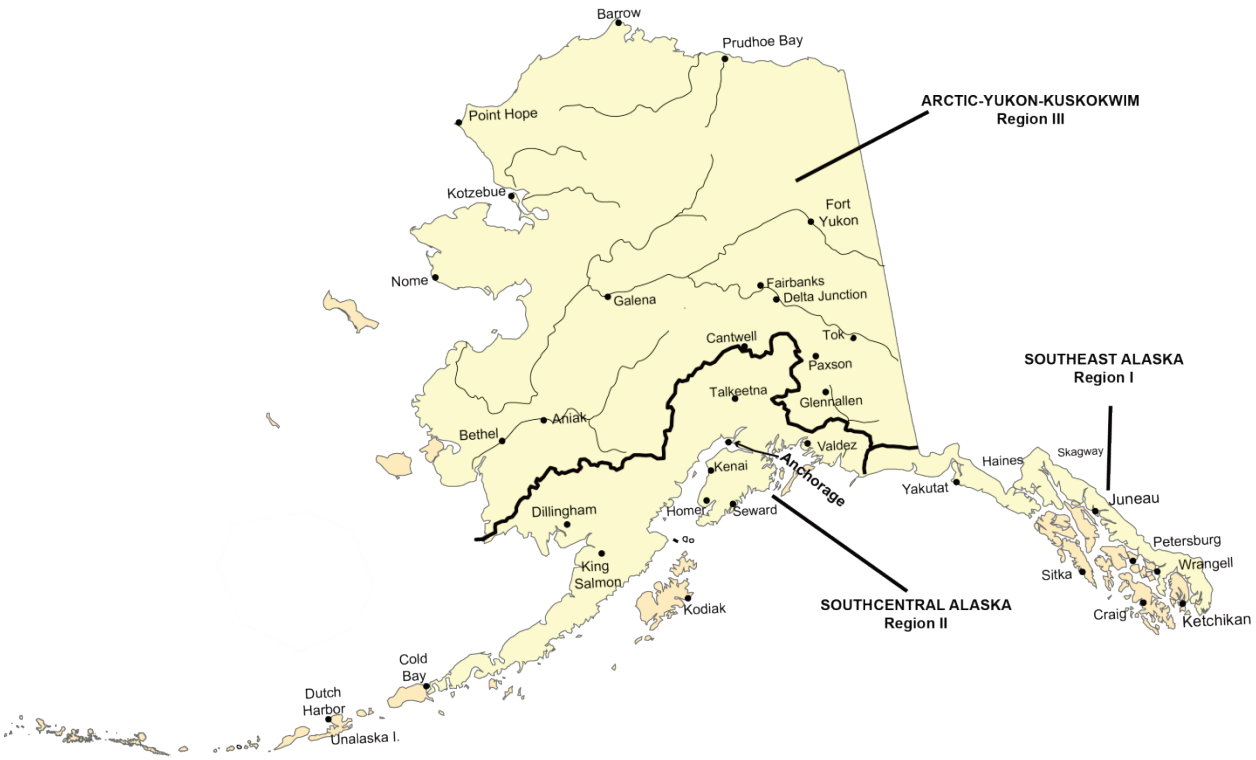

Figure 8.–Alaska Department of Fish and Game Division of Sport Fish regions.

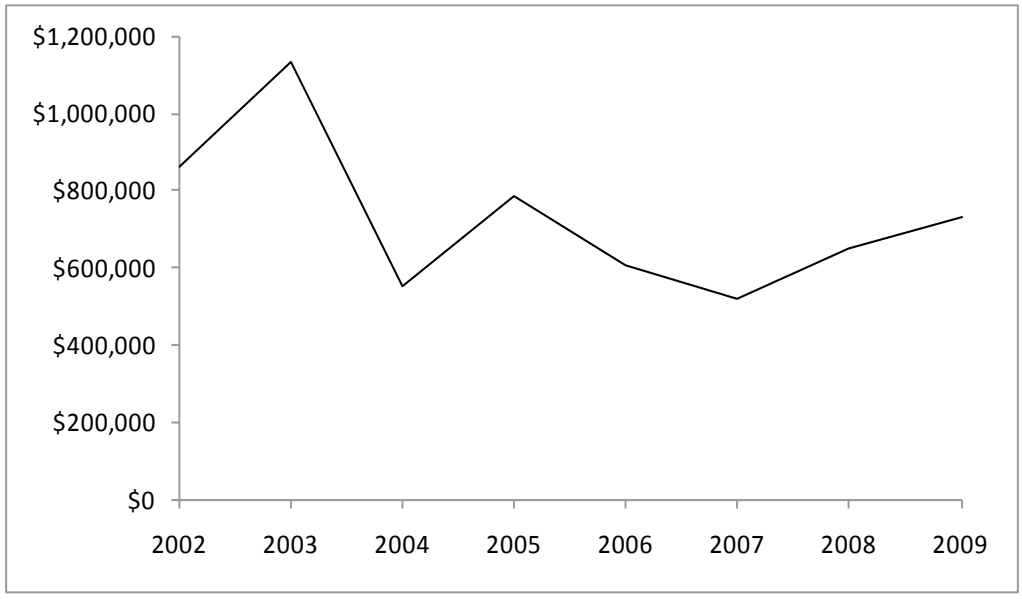

Figure 9.–Annual Alaska Clean Water Actions grant funds provided for state fiscal years 2002-2009.

Table 1.–Summary of reservation of water applications filed with the Department of Natural Resources as of December 2009.

Organization	Rivers/streams filed	Lakes filed	Adjudicated
ADF&G	117	1	27
U.S. Fish and Wildlife Service	57	140	
Bureau of Land Management	13		1
Trout Unlimited	12		
Curyong Tribal Council-Trout Unlimited	10		
Chuitna Citizens NO-COALition-Trustees for Alaska	3		
Eklutna Native Village	3		
Southwest Alaska Salmon Habitat Partnership-ADF&G	3		
The Nature Conservancy-ADF&G	1		
Arctic Unit , Alaska Chapter of the American Fisheries Society-ADF&G	1		
Trout Unlimited-ADF&G	1		
Cheesh-na Tribal Council	1		
Chickaloon Native Village	1		
DNR (per AS 46.15.035)	1	1	2

Source: Kim Sager, Natural Resource Specialist, DNR, February 1, 2010, personal communication.

Table 2.–Summary of ADF&G reservation of water applications filed with the Department of Natural Resources as of December 2009.

Map ID	DNR LAS File No.	Applicant Name	Source Name	Application Status	Date Application Received	Date Certificate Issued
1	26362	ADF&G	Alsek River	Application Accepted	3/29/2007	
2	12680	ADF&G	Anchor River - Reach A	Application Accepted	2/5/1990	
3	12683	ADF&G	Anchor River - Reach B	Application Accepted	2/5/1990	
4	13808	ADF&G	Auke Creek	Certificate Issued	4/10/1992	1/15/2007
5	13805	ADF&G	Baranof River, Reach C	Application Accepted	4/10/1992	
6	27352	ADF&G	Big Creek (on Prince of Wales Island)	Application Accepted	7/14/2009	
7	26387	ADF&G	Black River	Application Accepted	4/12/2007	
8	12685	ADF&G	Buskin Lake	Certificate Issued	2/5/1990	8/21/2006
9	12682	ADF&G	Buskin River, Reach A	Application Pending	2/5/1990	
10	13231	ADF&G	Buskin River, Reach B	Application Pending	3/19/1991	
11	12681	ADF&G	Campbell Creek, North Fork	Certificate Issued	2/5/1990	11/21/2005
12	11981	ADF&G	Campbell Creek, Reach A	Certificate Issued	7/25/1988	6/29/1990
13	11973	ADF&G	Campbell Creek, Reach B	Certificate Issued	7/14/1988	5/15/1991
14	13222	ADF&G	Campbell Creek, South Fork	Certificate Issued	3/19/1991	11/21/2005
15	25880	ADF&G	Carlson Creek	Application Accepted	10/12/2006	
16	13578	ADF&G	Chatanika River, Reach A & B	Application Accepted	10/28/1991	
17	11998	ADF&G	Chena River	Certificate Issued	7/14/1988	5/15/1991
18	21258	ADF&G	Chilkat River, Reach A	Application Accepted	6/4/1993	
19	21245	ADF&G	Chilkat River, Reach B	Application Accepted	6/4/1993	
20	27349	ADF&G	Chilkoot River	Application Accepted	7/14/2009	
21	20335	ADF&G	Chuitna River	Application Pending	5/9/1996	
22	22407	ADF&G	Copper River, Reach A	Application Accepted	12/28/1998	
23	22405	ADF&G	Copper River, Reach B	Application Accepted	12/28/1998	
24	11972	ADF&G	Cottonwood Creek	Certificate Issued	7/14/1988	5/15/1991
25	27485	ADF&G	Cowee Creek	Application Accepted	12/11/2009	
26	13652	ADF&G	Deception Creek	Certificate Issued	4/10/1992	12/18/2003
27	13577	ADF&G	Delta Clearwater (Clearwater Creek)	Certificate Issued	3/19/1991	6/5/2006
28	13654	ADF&G	Deshka River	Certificate Issued	4/10/1992	1/25/2005
29	14315	ADF&G	Eagle River	Application Accepted	6/4/1993	
30	26386	ADF&G	Farragut River	Application Accepted	4/12/2007	

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Table 2.–Page 2 of 4.

Map ID	DNR LAS File No.	Applicant Name	Source Name	Application Status	Date Application Received	Date Certificate Issued
31	13225	ADF&G	Fish Creek near Auke Bay	Application Accepted	3/19/1991	
32	11974	ADF&G	Fish Creek near Big Lake, Lower	Application Accepted	7/14/1988	
33	11976	ADF&G	Fish Creek near Big Lake, Upper	Application Accepted	7/14/1988	
34	20895	ADF&G	Glacier Creek	Certificate Issued	12/31/1996	12/18/2003
35	26385	ADF&G	Hamilton Creek	Application Accepted	4/12/2007	
36	26360	ADF&G	Harding River	Application Accepted	3/29/2007	
37	26462	ADF&G	Harris Creek	Application Accepted	6/1/2007	
38	25696	ADF&G	Hasselborg Creek	Application Accepted	5/11/2006	
39	25883	ADF&G	Hilda Creek	Application Accepted	10/12/2006	
40	12236	ADF&G	Indian River	Certificate Issued	1/12/1989	8/3/1990
41	13700	ADF&G	Jim River	Application Accepted	5/15/1992	
42	26358	ADF&G	Jordon Creek	Application Accepted	3/29/2007	
43	24380	ADF&G	Karluk River	Application Accepted	7/28/2003	
44	21287	ADF&G	Karta River	Application Accepted	12/27/1995	
45	20334	ADF&G	Kasilof River	Application Accepted	5/9/1996	
46	12677	ADF&G	Kenai River, Reach A	Certificate Issued	2/5/1990	2/1/2010
47	12676	ADF&G	Kenai River, Reach B	Certificate Issued	2/5/1990	2/1/2010
48	11996	ADF&G	Ketchikan Creek	Review	7/14/1988	
49	21243	ADF&G	Klehini River	Certificate Issued	12/31/1996	8/18/2009
50	22408	ADF&G	Klutina River	Application Accepted	12/28/1998	
51	21134	ADF&G	Kobuk River	Application Accepted	12/31/1996	
52	20646	ADF&G	Kuparuk River	Certificate Issued	2/3/1995	12/21/2009
53	24383	ADF&G	Kvichak River	Review	7/28/2003	
54	21289	ADF&G	Lake Creek	Certificate Issued	6/4/1993	3/7/2007
55	21260	ADF&G	Lemon Creek, Lower	Application Accepted	12/31/1996	
56	21261	ADF&G	Lemon Creek, Upper	Application Accepted	12/31/1996	
57	11489	ADF&G	Little Rabbit Creek	Certificate Issued	6/30/1987	2/19/1988
58	11488	ADF&G	Little Survival Creek	Certificate Issued	6/30/1987	2/19/1988
59	11977	ADF&G	Little Susitna River, Middle	Certificate Issued	7/14/1988	8/3/2006
60	11561	ADF&G	Little Susitna River, Upper	Certificate Issued	7/31/1987	11/1/1988

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Table 2.–Page 3 of 4.

Map ID	DNR LAS File No.	Applicant Name	Source Name	Application Status	Date Application Received	Date Certificate Issued
61	27486	ADF&G	Lost River	Application Accepted	12/11/2009	
62	26030	ADF&G	Lower Talarik Creek, Reach C	Application Accepted	12/28/2006	
63	25694	ADF&G	Maksouthof River	Application Accepted	5/11/2006	
64	27351	ADF&G	Maybeso Creek	Application Accepted	7/14/2009	
65	11975	ADF&G	Meadow Creek	Application Accepted	7/14/1988	
66	13806	ADF&G	Mendenhall River, Reach A	Application Accepted	4/10/1992	
67	13807	ADF&G	Mendenhall River, Reach B	Application Accepted	4/10/1992	
68	26357	ADF&G	Mill Creek	Application Accepted	3/29/2007	
69	12679	ADF&G	Monashka Creek	Application Accepted	2/5/1990	
70	13226	ADF&G	Montana Creek	Certificate Issued	3/19/1991	9/21/2004
71	26363	ADF&G	Nakwasina River	Application Accepted	3/29/2007	
72	26388	ADF&G	Neck Creek	Application Accepted	4/12/2007	
73	20285	ADF&G	Nenana River, Reach A	Review	5/9/1996	
74	20283	ADF&G	Nenana River, Reach B	Review	5/9/1996	
75	20277	ADF&G	Nenana River, Reach C	Review	5/9/1996	
76	24379	ADF&G	Newhalen River	Application Accepted	7/28/2003	
77	13223	ADF&G	Ninilchik River	Application Accepted	3/19/1991	
78	26461	ADF&G	Old Tom Creek	Application Accepted	6/1/2007	
79	26359	ADF&G	Pavlof River	Application Accepted	3/29/2007	
80	26460	ADF&G	Perkins Creek	Application Accepted	6/1/2007	
81	25695	ADF&G	Peter's Creek	Application Accepted	5/11/2006	
82	26817	ADF&G	Peterson Creek	Application Accepted	3/17/2008	
83	12684	ADF&G	Pillar Creek	Application Accepted	2/5/1990	
84	19476	ADF&G	Power Creek	Application Accepted	2/3/1995	
85	11490	ADF&G	Rabbit Creek	Certificate Issued	6/30/1987	2/19/1988
86	20644	ADF&G	Sagavanirtok River, Reach A	Review	2/3/1995	
87	20645	ADF&G	Sagavanirtok River, Reach B	Review	2/3/1995	
88	12675	ADF&G	Salcha River	Certificate Issued	2/5/1990	6/8/2005
89	21272	ADF&G	Salmon River near Hyder	Certificate Issued	5/9/1996	8/11/2004
90	25693	ADF&G	Sashin Creek	Application Accepted	5/11/2006	

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Table 2.–Page 4 of 4.

Map ID	DNR LAS File No.	Applicant Name	Source Name	Application Status	Date Application Received	Date Certificate Issued
91	11995	ADF&G	Sawmill Creek	Application Accepted	7/14/1988	
92	25879	ADF&G	Sheep Creek	Application Accepted	10/12/2006	
93	25881	ADF&G	Shelokum Creek	Application Pending	10/12/2006	
94	12678	ADF&G	Ship Creek	Application Accepted	2/5/1990	
95	21291	ADF&G	Situk River	Certificate Issued	2/3/1995	2/1/2010
96	27488	ADF&G	Situk River, West Fork	Application Accepted	12/11/2009	
97	20068	ADF&G	Snake River	Application Accepted	12/27/1995	
98	22406	ADF&G	Solomon River	Application Accepted	12/31/1998	
99	21292	ADF&G	Stikine River	Application Accepted	12/27/1995	
100	25882	ADF&G	Sweetheart Creek	Application Accepted	10/12/2006	
101	21275	ADF&G	Taku River	Application Accepted	12/27/1995	
102	13228	ADF&G	Talkeetna River	Certificate Issued	3/19/1991	12/18/2003
103	1824	ADF&G	Terror River	Certificate Issued	7/6/1984	5/20/1987
104	27353	ADF&G	Trocadero Creek, North Branch	Application Accepted	7/14/2009	
105	12719	ADF&G	Ward Creek	Application Accepted	2/5/1990	
106	27487	ADF&G	Wasilla Creek	Application Accepted	12/11/2009	
107	25884	ADF&G	Whipple Creek	Application Accepted	10/12/2006	
108	11562	ADF&G	Willow Creek	Certificate Issued	7/31/1987	7/8/1988
109	24381	ADF&G	Wood River	Application Accepted	7/28/2003	
110	20067	ADF&G	Wulik River	Application Accepted	12/27/1995	
111	25692	ADF&G	Yentna River	Application Accepted	5/11/2006	
112	13897	Arctic Unit Alaska Chapter American Fisheries Society-ADF&G	Tanana River	Application Accepted	11/18/1992	
113	27309	Southwest Alaska Salmon Habitat Partnership-ADF&G	Mulchatna River Reach A	Application Accepted	6/15/2009	
114	27516	Southwest Alaska Salmon Habitat Partnership-ADF&G	Mulchatna River Reach B	Application Accepted	6/15/2009	
115	27310	Southwest Alaska Salmon Habitat Partnership-ADF&G	Stuyahok River	Application Accepted	6/15/2009	
116	23051	The Nature Conservancy-ADF&G	Lower Talarik Creek, Reach A & B	Application Accepted	2/7/2000	
117	21290	Trout Unlimited-ADF&G	Duck Creek	Application Accepted	6/28/1993	

Note: See figures 2 and 3 for site locations.

Source: Kim Sager, Natural Resource Specialist, DNR, February 1, 2010, personal communication.

Table 3.–Summary of ADF&G reservation of water applications that have been adjudicated by the Department of Natural Resources as of December 2009.

	DNR File No.	Name	Priority Date	Effective Date / Adjudicated
1	LAS 1824	Terror River	7/6/1984	5/20/1987
2	LAS 11488	Little Survival Creek	6/30/1987	2/19/1988
3	LAS 11489	Little Rabbit Creek	6/30/1987	2/19/1988
4	LAS 11490	Rabbit Creek	6/30/1987	2/19/1988
5	LAS 11562	Willow Creek	7/31/1987	7/8/1988
6	LAS 11561	Little Susitna River - upper reach	7/31/1987	11/1/1988
7	LAS 11981	Campbell Creek - lower reach	6/25/1988	6/29/1990
8	LAS 12236	Indian River	1/12/1989	8/3/1990
9	LAS 11972	Cottonwood Creek	7/14/1988	5/15/1991
10	LAS 11973	Campbell Creek - upper reach	7/14/1988	5/15/1991
11	LAS 13228	Talkeetna River	3/19/1991	12/18/2003
12	LAS 13652	Deception Creek	4/10/1992	12/18/2003
13	LAS 20895	Glacier Creek	12/31/1996	12/18/2003
14	LAS 21272	Salmon River near Hyder	5/9/1996	8/11/2004
15	LAS 13226	Montana Creek near Auke Bay	3/19/1991	9/21/2004
16	LAS 13654	Deshka River	4/10/1992	1/25/2005
17	LAS 12675	Salcha River	2/7/1990	6/8/2005
18	LAS 12681	North Fork Campbell Creek	2/5/1990	11/7/2005
19	LAS 13222	South Fork Campbell Creek	3/19/1991	11/7/2005
20	LAS 13577	Delta Clearwater	5/19/1991	6/5/2006
21	LAS 11977	Little Susitna - middle reach	7/14/1988	1/11/2006
22	LAS 11998	Chena River	7/14/1988	7/27/2006
23	LAS 12685	Buskin Lake	2/5/1990	9/3/2006
24	LAS 13808	Auke Creek	4/10/1992	1/18/2007
25	LAS 21289	Lake Creek	6/4/1993	3/7/2007
26	LAS 21243	Klehini River	12/31/1996	8/18/2009
27	LAS 20646	Kuparuk River	2/3/1995	12/21/2009

Table 4.–Summary of hydrologic investigations performed by the Statewide Aquatic Resources Coordination Unit as of December 2009.

SF Region	Station Name	Station Number	Station Type	Active
1	Peterson Creek tributary 1 near Juneau	10101	Stream Gage	N
1	Peterson Creek near Juneau tributary 3	10102	Stream Gage	N
1	Peterson Creek near Juneau mainstem above tributary 4	10103	Stream Gage	N
1	Peterson Creek near Juneau mainstem above tributary 3	10104	Stream Gage	N
1	Peterson Creek near Juneau mainstem above tributary 8	10105	Gage	N
1	Sitkoh Creek mainstem 0.5 miles upstream of weir	10301	Stream Gage	N
1	Sitkoh Creek mainstem 1 mile upstream of weir	10302	Stream Gage	N
1	Sitkoh Lake outlet	10303	Stream Gage	Y
1	Sitkoh Creek tributary 1	10304	Discharge	N
1	Sitkoh Creek mainstem above tributary 1	10305	Discharge	N
1	Sitkoh Creek logjam tributary	10306	Discharge	N
1	Sitkoh Lake east cabin tributary	10307	Discharge	N
1	Sitkoh Lake Anniversary tributary	10308	Discharge	N
1	Sitkoh Creek at mouth	10309	Discharge	Y
1	Lake Creek at Auke Lake near Juneau	10401	Stream Gage	N
1	Auke Creek below Auke Lake near Juneau	10501	Stream Gage	N
1	Sawmill Creek near Haines	10601	Stream Gage	Y
1	Sawmill Creek near Haines restoration reach	10602	Discharge	N
1	West Fork Situk River	10701	Stream Gage	N
1	Situk River below Situk Lake outlet	10702	Discharge	N
1	Mountain Lake Creek above Situk Lake	10703	Discharge	N
1	Situk River mainstem above Old Situk	10704	Discharge	N
1	Dayglow/MiLake Creek	10705	Discharge	N
1	Old Situk near confluence with Situk River	10706	Discharge	N
1	Situk River mainstream above weir	10707	Discharge	N
1	Pullen Creek mainstem above tailrace near Skagway	10901	Stream Gage	N
1	Pullen Creek tributary near Skagway	10902	Discharge	N
1	Pullen Creek mainstem above tributary near Skagway	10903	Discharge	N
1	Threemile Creek near Klawock	11001	Stream Gage	N
1	Threemile Creek near Klawock below bridge	11002	Discharge	N
1	Chilkat River below Kelsall River	11301	Stage	N
1	Cowee Creek near Juneau at Glacier Hwy	11401	Stream Gage	Y
1	Davies Creek near Echo Cove	11402	Discharge	N
1	Cowee Creek above Davies Creek	11403	Discharge	N
1	Holgate Creek mainstem	11501	Stream Gage	Y
1	Holgate Creek mainstem above tributary	11502	Discharge	N
1	Holgate Creek tributary	11503	Discharge	N
1	Lost River near Yakutat below railroad bridge	11701	Stream Gage	Y
1	Lost River near Yakutat below road bridge	11702	Discharge	Y
1	Lost River near Yakutat West Fork above confluence	11703	Discharge	Y
1	Tawah Creek near Yakutat	11704	Discharge	Y
1	Chilkoot River near Haines	11901	Stream Gage	Y
1	Cripple Creek tributary Unuk River	12201	Discharge	N
1	Genes Creek tributary Unuk River	12202	Discharge	N
1	Lake Creek tributary Unuk River	12203	Discharge	N

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SF Region	Station Name	Station Number	Station Type	Active
1	Clear Creek tributary Unuk River	12204	Discharge	N
2	Lower Talarik Creek near Iliamna	10201	Stream Gage	N
2	East Fork Lower Talarik Creek below lake outlet	10202	Discharge	N
2	West Fork Lower Talarik Creek below lake outlet	10203	Stream Gage	N
2	East Fork Lower Talarik Creek above confluence	10204	Discharge	N
2	Sheep Creek near Willow	11101	Stream Gage	Y
2	Nushagak River near Koliganek	11201	Discharge	N
2	Nushagak River below Nuyakuk	11202	Discharge	N
2	Nushagak River near Ekwok	11203	Discharge	N
2	Nushagak River below King Salmon	11204	Discharge	N
2	Kokwok River	11205	Discharge	N
2	Stariski Creek	11601	Stream Gage	Y
2	Kaskanak Creek near Igiugig	11801	Stream Gage	N
2	Fish Creek lower near Big Lake	12001	Stream Gage	Y
2	Fish Creek upper near Big Lake	12002	Discharge	Y
2	Meadow Creek upper near Big Lake	12101	Stream Gage	Y
2	Meadow Creek lower near Big Lake	12102	Discharge	Y
2	Goose Creek	12301	Discharge	N
2	Little Campbell Creek	12401	Stream Gage	N
2	Buskin River Lower Weir Site	12501	Discharge	N
2	Buskin River Upper Weir Site	12502	Discharge	N
2	Stuyahok River	12701	Discharge	N
2	Mulchatna River	12801	Discharge	N
3	George River	12601	Stream Gage	Y
3	Chatanika River	12901	Discharge	N
3	Aniak River	13001	Discharge	N
3	Kwethluk River	13101	Discharge	N

Table 5.–Summary of Federal Energy Regulatory Commission hydroelectric and hydrokinetic projects in Alaska monitored by ADF&G as of December 2009.

Project	FERC No.	Status
Southeast		
Blue Lake	2230	Relicensed hydroelectric-license amendment
Cascade Creek	12495	Proposed hydroelectric
Scenery Lake	12621/13365	Proposed hydroelectric
Ruth Lake/Delta Creek	12619	Proposed hydroelectric
Connelly Lake	DI09-9	Proposed hydroelectric
Gartina Falls	DI09-7	Proposed hydroelectric
Baranof-Warm Springs	DI09-14	Proposed hydroelectric
Neck Lake	DI10-5	Proposed hydroelectric
Indian River	DI10-8	Proposed hydroelectric
Soule River	12615	Proposed hydroelectric
Lake 3160	12661	Proposed hydroelectric
Takatz Lake	13234	Proposed hydroelectric
Lake Shelokum	13281	Proposed hydroelectric
Sweetheart Lake	13563	Proposed hydroelectric
Schubee Lake	13645	Proposed hydroelectric
Silver Lake	13717	Proposed hydroelectric
Thayer Creek	USFS	Proposed hydroelectric
Black Bear	10440	Licensed hydroelectric
Ketchikan Lakes	420	Licensed hydroelectric
South Fork Black Bear	Non-FERC	Licensed hydroelectric
Swan Lake	2911	Licensed hydroelectric
Lake Dorothy	12379	Under construction hydroelectric
Reynolds Creek	11480	Under construction hydroelectric
Whitman Lake	11841	Under construction hydroelectric
Tyee	3015	Licensed hydroelectric
Blind Slough	201	Licensed hydroelectric
Kasidaya	11588	Licensed hydroelectric
Goat Lake	11077	Licensed hydroelectric
Dewey Lakes	1051	Licensed hydroelectric
Falls Creek	11659	Licensed hydroelectric
Green Lake	2818	Licensed hydroelectric
Pelican	10198	Licensed hydroelectric
Beaver Falls	1922	Licensed hydroelectric
Snettisham	Non-FERC	Licensed hydroelectric
Port Fredrick	13512	Proposed hydrokinetic-Tidal
Southcentral		
Allison Lake	13124	Proposed hydroelectric
Waterfall Creek	Non-FERC	Proposed hydroelectric
Old Harbor	13272	Proposed hydroelectric
4th of July Creek	Non-FERC	Proposed hydroelectric
Fishhook Creek	Non-FERC	Proposed hydroelectric
Glacier Fork	13327	Proposed hydroelectric
Falls Creek	13211	Proposed hydroelectric
Grant Lake	13212	Proposed hydroelectric

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Table 5.–Page 2 of 2.

Project	FERC No.	Status
Elva & Grant Lakes	Non-FERC	Proposed hydroelectric
Snyder Falls Creek	13328	Proposed hydroelectric
Chakachamna Lake	12660	Proposed hydroelectric
Power Creek	11243	Licensed hydroelectric
Bradley Lake	8221	Licensed hydroelectric
Chignik	620	Licensed hydroelectric
Terror Lake	2743	Licensed hydroelectric
Kvichak River-Igiugig	13511	Proposed hydrokinetic-river
Cooper Lake	2170	Relicensed
Chuniisax Creek	Non-FERC	Under construction hydroelectric
Humpback Creek	8889	Licensed-modifications under construction
Cook Inlet, #12679	12679	Proposed hydrokinetic-tidal
Turnagain Arm #13509	13509	Proposed hydrokinetic-tidal
Eklutna	Non-FERC	Licensed hydroelectric
Ouzinkie	Non-FERC	Licensed hydroelectric
Larsen Bay	Non-FERC	Licensed hydroelectric
Interior		
Kogoluktuk River	13286	Proposed hydroelectric
Shungnak River	13299	Proposed hydroelectric
Nenana River	Non-FERC	Proposed hydroelectric
Dry Creek	Non-FERC	Proposed hydroelectric
Yerrick Creek	Non-FERC	Proposed hydroelectric
Yukon River-Eagle	13600	Proposed hydrokinetic-river
Yukon River-Ruby	Not Determined	Proposed hydrokinetic-river
Tanana River-Nenana	13233	Proposed hydrokinetic-river
Tanana River-Whitestone	13305	Proposed hydrokinetic-river

Table 6.–Summary of U.S. Geological Survey stream gage sites in Alaska from 1908 to September 30, 2009 and for Water Year 2009.

Number of stream gages	Period of Record (Years)
19	0 < 1
137	1 to < 5
113	5 to < 10
122	10 to < 20
98	20 to < 50
13	≥ 50
116	Estimated number of active stream gages for the period October 1, 2008 to September 30, 2009

Source: D. Meyer, USGS Hydrologist, Anchorage, Alaska, March 23, 2010, personal communication.

APPENDIX A
DIVISION OF SPORT FISH REGION I PRIORITIZATION PROCESS

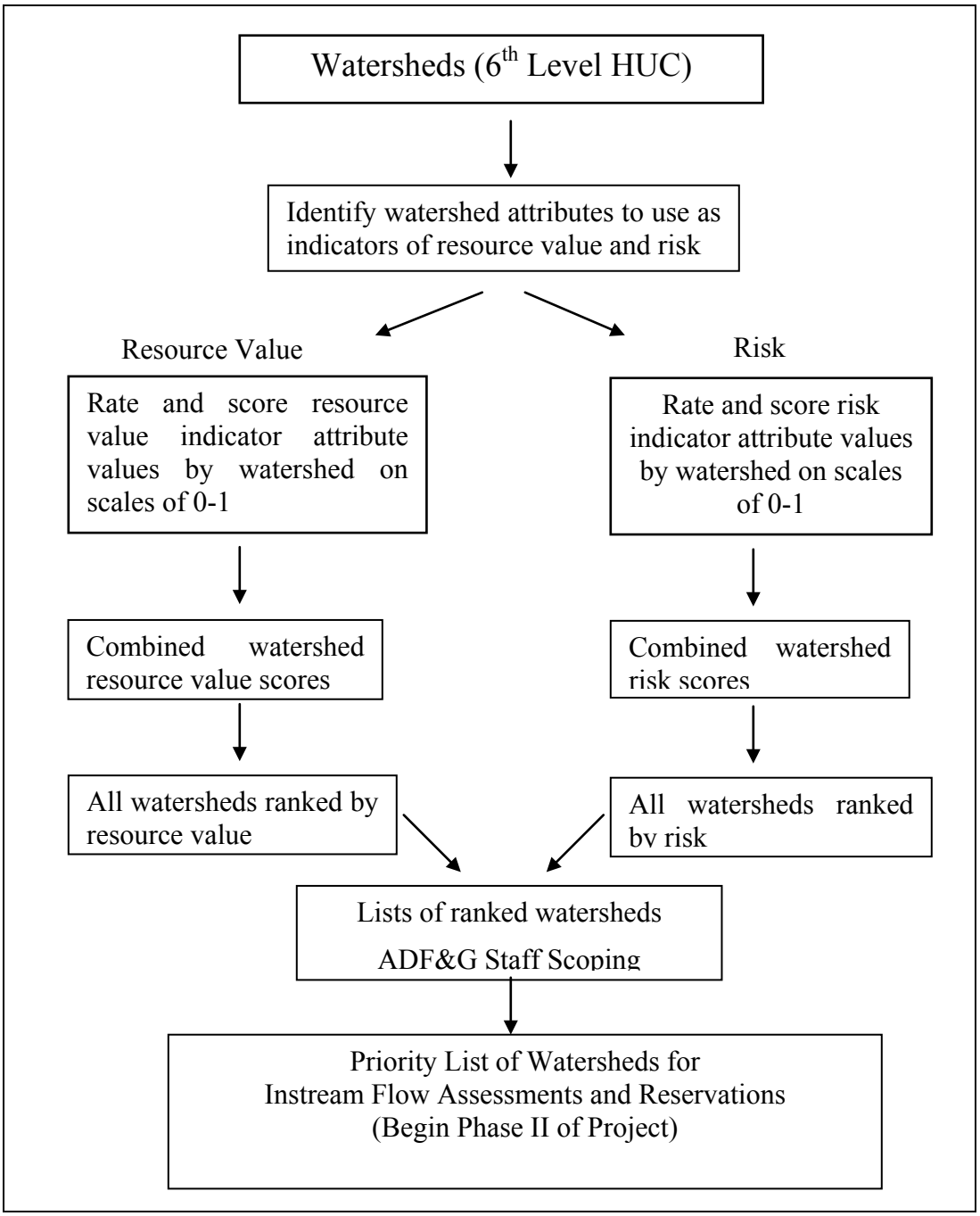
Appendix A1.–Division of Sport Fish Region I prioritization process.

Alaska's instream flow law (AS 46.15.035, .037 and .145) allows the private sector and government agencies to legally acquire water rights, called reservations of water, to maintain instream flow rates in rivers or water levels/volumes in lakes for various purposes, including protecting fish habitat, migration, and propagation. A knowledge-based decision system was developed to prioritize the more than 5000 salmon-producing water bodies in Southeast Alaska for submitting instream flow reservations to protect salmon habitat and sustain salmon productivity (Appendix Figure A1).

A total of 4597 Southeast Alaska watersheds were identified at the sixth level, 14-digit, hydrologic unit (HUC) scale, as defined by the US Geological Survey. These watersheds were ranked based on an assessment of the salmon resource and instream flow dependent values within each watershed. They were also ranked based on an assessment of risks by existing and potential developments to sustaining sufficient instream flows in salmon producing rivers and lakes within each watershed. Eight watershed attributes were identified to use as indicators of resource value and eight attributes were used for risk assessment (Appendix Table A1). Attribute information used to assign resource values and risks were acquired and analyzed from existing data sources. Resulting attribute values were aggregated and summarized using a geographic information system (GIS). Algorithms were defined to rate and score attribute values scales of 0-1 based on the range of values encountered in the data.

Final resource values and risk scores for each watershed were calculated as the average of the individual scores for each attribute. The result of this assessment was a list of all watersheds ranked by resource values and a list of all watersheds ranked by risk. Both were summarized using a combination of spreadsheets and printed maps. Departmental and other natural resource professionals were asked to use these maps and spreadsheets from this broad-scale watershed assessment, along with their own finer-scale knowledge of resource values and risks, to identify the salmon producing watersheds in their areas most in need of instream flow protection.

Final priorities for instream flow assessments and reservations of water were established by SARCU. These priorities were used to prepare and submit instream flow reservation applications to protect and sustain salmon production in high priority water bodies selected using the system developed by this project. This framework has been updated as new information has been available.



Appendix Figure A1. Decision system used to prioritize watersheds in Southeast Alaska.

Appendix Table A1.–Attributes used to prioritize salmon producing water bodies for instream flow assessment and reservations of water.

ATTRIBUTE	SOURCE	FILE ARCHIVE	DATA TYPE
	Watershed Scale Assessment		
6th level HUCs	USFS/ECOTRUST	huc56_4645_se_sp83.shp	Polygon shapefile
	Resource Value		
Coarse Scale			
Miles of anadromous water bodies			
1) AWC	ADF&G	awc_se_sp27.shp	Polyline shapefile
2) Class 1	USFS	ahmu_class1streams_tongass_sp27.shp	Polyline shapefile
Fine Scale			
Number of salmon species present	ADF&G	Core_Data\sea2002d	Point shapefile
Chinook & sockeye salmon presence	ADF&G	Core_Data\sea2002d	Point shapefile)
Personal use harvest	ADF&G	Data Query RIR 1J00-XX	Alexander (ADF&G)
Sport fish effort	ADF&G	swhs_se_sp27.shp	Polyline shapefile
Presence/absence of ADF&G Index and stock assessment streams	ADF&G	Data Query (Staff)	Alexander (ADF&G)
	Risk Analysis		
Coarse Scale			
Land ownership	USFS ADNR	land_ownership_tongass_sp27.shp	Polygon shapefile
Acres of timber harvest	USFS USGS ADNR	timber_harvest2001_se_sp27.shp	Polygon shapefile
Miles of road	USFS ADNR	allrds_huc56	Polyline shapefile
Urban areas	USFS	urban_se_sp27.shp	Polygon coverage
Fine Scale			
Presence/absence of dams and hydroelectric projects		rural_hydro_se_sp27.shp	Point shapefile
Division of H&R Coarse Assessment	ADF&G	coarse_assessment_02_hucs_sp27.shp	Polygon shapefile
DEC List of Impaired Waters	ADEC	impaired_fw_se_sp27.shp	Polyline shapefile
Aquaculture Facilities	ADF&G	hatcheries_se_sp27.shp	Point shapefile

Appendix Table A2.–Top 100 regionally ranked watersheds for instream flow priorities in Southeast Alaska.

Mainstem River System	Resource Value Rank	Risk Rank
Chilkat River	1	3
Situk River	2	884
East Alsek River	3	588
Taku River	4	1931
Unuk River	5	2005
Italio River	6	674
Stikine River	7	2609
Alsek River	8	1582
Klahini River	9	2839
Akwe River	10	684
Chickamin River	11	2049
Thorne River	12	1063
Ahrnklin River	13	1005
Doame River	14	1653
Karta River	15	1934
East Fork Bradfield River	16	1675
Neka River	17	1451
Harding River	18	2052
Farragut River	19	2030
Naha River	20	1958
Blossom River	21	1944
Sitkoh Creek	22	1086
Wolverine Creek	23	2018
Anan Creek	24	2095
Sylvia Creek	25	1319
Ketchikan Creek	26	60
Tom Creek	27	3134
Marten River	28	2964
Sweetheart Creek	29	2246
Eagle Creek	30	793
Hatchery Creek	31	900
Chilkoot River	32	32
Bradfield Canal	33	1978
Keta River	34	1859
Klawock River	35	1
Farragut Bay	36	800
Carroll Creek	38	1345
King Salmon River	39	2061
Auke Creek	40	41
Berners River	41	2134
Chuck Creek	42	251
Short Creek	43	2841
Lost River	44	452
Kunayosh Creek	45	1900
Williams Creek	46	563
Chichagof Creek	47	1289
Thoms Creek	48	1245
Ford Arm	49	2394
Kutlaku Creek	50	1693
Kegan Creek	51	1781
Seal River	52	1827

-continued-

Appendix Table A3.–Page 2 of 2.

Mainstem River System	Resource Value Rank	Risk Rank
Gut Bay	53	2721
Salmon Creek	54	1864
Geek Creek	55	1158
Kook Creek	56	1104
Klakas Creek	57	3541
Shipley Creek	58	3203
Mendenhall River	59	240
Petersburg Creek	60	1855
Eva Creek	61	2453
Alecks Creek	62	2083
Politofsky Creek	63	1470
Oerns Creek	64	3131
Dog Salmon Creek	65	649
Pavlof River	66	1129
Hetta Creek	67	512
Emile Creek	68	1044
Cabin Slough	69	1041
Tuneheah Creek	70	1804
Hunter Bay	71	3610
Muddy Creek	72	1329
Wheeler Creek	73	1574
North Fork Freshwater Creek	74	1348
Mud Bay River	75	1592
Harris River	76	174
Maybeso Creek	77	924
Salt Chuck	78	2436
Kah Sheets Creek	79	1889
Lisianski River	80	2316
Southern tip Kuiu Island	81	1935
Neva Creek	82	1277
Kushneahin Creek	83	2046
Golding Creek	84	2313
Eagle River	85	2078
Lucky Cove	86	1882
Nutkwa Creek	87	2072
Saginaw Creek	88	874
Black Creek	89	50
Ratz Creek	90	794
Salt Creek	91	1091
Nawkwasina River	92	277
Bartholomew Creek	93	2966
Margaret Creek	94	701
Old Tom Creek	95	2036
Big Creek	96	311
South Arm	97	3586
Badger Creek	98	2026
Crab Creek	99	49
Shrew Creek	100	3057

APPENDIX B DIVISION OF SPORT FISH REGIONS II AND III PRIORITIZATION PROCESS

Appendix B1.–Division of Sport Fish Regions II and III Prioritization Process.

INTRODUCTION

The Statewide Aquatic Resources Coordination Unit (SARCU) was established by the department for addressing growing demands for water and meeting its mandate of sustaining healthy fish and wildlife production. One tool used by SARCU to achieve this goal is to quantify instream flow needs for fish and wildlife and to file and defend reservation of water applications to leave a portion of water in rivers and lakes.

For providing the hydrologic analyses needed to support a reservation of water application, Alaska Department of Natural Resources (DNR) recommends, and SARCU agrees, that a minimum of 5 years of continuous mean daily flow data be collected or synthesized to reduce bias associated with inter-annual hydrologic variability. Historical USGS flow records are readily available to support the needed hydrologic analyses. SARCU requests support and approval from Sport Fish Division Regions 2, 3 and 5, to develop a prioritized list to determine the order in which to proceed to use USGS gaging sites to prepare reservation of water applications and to identify candidate ungaged water bodies for future stream gaging efforts.

METHODS

A list of all past and current USGS stream gaging stations was acquired from the USGS web site http://nwis.waterdata.usgs.gov/ak/nwis/sw . This list was then reduced to only those gage stations that meet instream flow needs and data availability criteria. Gage sites that were excluded included those that:

- have less than 5 years of continuous streamflow data; and/or
- already have a granted or pending reservation of water application on the gaged reach.

The gaged streams were evaluated based on risks (potential for water extraction and future development) and fishery values. Risks included water development uses such as mining, oil and gas, road construction and maintenance, agriculture, water export or sale, and hydropower. Value was based on quality or quantity of fish produced, or uniqueness of habitat. After some internal review, staff felt that this evaluation process would be simple, effective, and could be based on existing and readily available information or professional judgment. A three-point rating system for Values and Risks was used:

Fishery Value:

1 = Low: Few fish produced or depend on this water.

2 = Medium: Some fish values but not significantly so. (e.g. has some fish, but few people do or would want to fish here, overall fish productivity is moderate.)

3 = High: Produces a lot of anadromous and/or resident fish, supports major or high quality fisheries.

Risks:

1 = Low: Risks not imminent are unknown or there is some level of existing instream flow protection[1]

2 = Medium: Risks are narrow in scope or severity, or may be a long ways off.

3 = High: Risks are imminent and known, and potentially severe.

The following additional qualitative information was also noted:

Surrounding Land Status = ownership by State, Federal, Native, private or combination, and associated management status (e.g., National Park, Refuge, Special Areas); and

Hydropower Status = future or existing hydropower project in watershed.

SARCU forwarded a draft prioritized list to Region 2 and 3 instream flow liaisons. SARCU requested input on this list from Sport Fish Division Region 5, and from DNR Water Resources Section. The liaisons requested their regional or area staff to double check if the quality rankings seem appropriate and to make any changes.

Appendix Table B1 below shows the overall rank designation based on the various permutations. Categories 1 through 3 were considered high priority for filing a reservation of water application. Categories 4 through 6 were considered medium; these streams to be considered on a case by case basis. If a stream was a medium priority that didn't necessarily mean that SARCU will not seek instream flow protection for it, once all the high priority streams have been addressed. The remaining categories 7 through 9 were considered low priority but could be addressed on a case by case basis or their overall rank elevated if additional information or circumstances warrant.

Appendix Table B1.–Overall rank designation assigned to selected USGS gage locations with no reservation of water and greater than 5 years of period of record.

Category	Fishery Value	Risk	Overall Rank
1	High	High	High
2	High	Medium	High
3	Medium	High	High
4	High	Low	Medium
5	Medium	Medium	Medium
6	Low	High	Medium
7	Medium	Low	Low
8	Low	Medium	Low
9	Low	Low	Low

[1] In addition to reservations of water, other opportunities for instream flow protection include conditions on regulatory permits/licenses, such the Federal Energy Regulatory Commission project licenses, water permits, fish habitat permits, CWA 401 & 404 permits, ACMP stipulations, U.S. Forest Service Special Use permits, etc. along with the Public Trust Doctrine.

Final selection of streams on which to file a reservation of water will be based on the ranking described above, adequacy of existing hydrological or biological data, and whether other state and/or federal legal mechanisms would provide better or more cost effective instream flow protection than a reservation of water. Exceptions to this process could occur based on specific requests from the regions or senior leadership. A region may request priority filing for a specific water body due to unique circumstances, regardless of the overall rank.

The regions will be formally requested to review this list every 3 years, however, the regional instream flow liaison can submit new information or request changes at any time. Communications between the regional instream flow liaisons and SARCU should occur if either party becomes aware of additional information that could affect the priority status of a particular stream.

A summary of the high and medium prioritized list of USGS gaged streams categorized by overall rank is shown in Appendix Tables B2 and B3.

Appendix Table B2.–Summary of high and medium prioritized USGS gaged streams for instream flow protection in Division of Sport Fish Region 2.

Site Name	Years Record	SF Mgmt Area	Land Status	Fishery Values	Values Description	Threats	Threats Description	Overall Rating	Notes
Chakachatna R. near Tyonek	13	NCI	state	2	moderate salmon producer	3	hydropower preliminary license filed	3	large hydropower project planned, prelim. license filed; reservation filed by Trout Unlimited.
Chester Cr at Anchorage	18	ANC	state; private	2	some salmon; Dolly Varden and rainbow trout	3	urbanization, wells; water quality	3	small but unique urban fishery, high priority for restoration by Anchorage Muni.
Chester Cr at Arctic Boulevard	42	ANC	state; private	2	some salmon; Dolly Varden and rainbow trout	3	urbanization, wells; water quality	3	small but unique urban fishery, high priority for restoration by Anchorage Muni.
Crescent Cr near Cooper Landing	17	UKP	federal	3	salmon producer; rainbow trout and Dolly Varden; Kenai trib., Chinook present, Grayling come out of lake to use this stream	3	possible water supply for residents, possible hydropower	3	mostly federal lands; hydropower potential
Grant Cr near Moose Pass	11	SEW	state; private; federal?	2	moderate salmon, Chinook present	3	possibly hydropower but depends on location	3	connects 2 important salmon producing lakes; mostly federal, planned hydropower
Knik R near Palmer	47	NCI	state	3	Passage and habit for sockeye, coho, chum (major coho fishery at Jim C. and stocked Chinook and coho at Eklutna Tailrace)	1	minimal; some temporary water use permits for road work	3	
Nushagak R at Ekwok	16	BB	state; private; federal	3	important salmon producer; huge sport fishery also resident spec present	2	mining; water quality	3	
Ptarmigan Cr at Lawing	11	UKP	state; federal	3	sockeye, coho, Dolly Varden, Rainbow, Chinook present (popular sport fishery)	3	potential hydropower	3	mostly US Forest Service land; preliminary hydro license filed
Skwentna R near Skwentna	23	NCI	state; private	3	important salmon producer (Judd L, Shell L large sockeye runs; Tal R. large Chinook, coho, rainbow fisheries)	2	hydropower, oil and gas potential	3	potential hydropower development; updated threat from 1 to 2 jan, 21, 2009

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Appendix Table B2.–Page 2 of 3.

Site Name	Years Record	SF Mgmt Area	Land Status	Fishery Values	Values Description	Threats	Threats Description	Overall Rating	Notes
Susitna R at Gold Cr	58	NCI	state; private	3	important salmon producer	3	hydropower potential	3	
Susitna R at Sunshine	5	NCI	state; private	3	important salmon producer	3	hydropower potential	3	
Susitna R at Susitna Station	18	NCI	state; private	3	important salmon producer	3	hydropower potential	3	
Susitna R near Cantwell	25	NCI	state; private	3	important salmon producer	3	hydropower potential	3	potential hydropower development; uppermost gage
Susitna R near Denali	29	NCI	state; private	3	important salmon producer	3	hydropower potential	3	
Beaver Cr near Kenai	11	UKP	state; private; federal	2	salmon producing tributary of Kenai R.	2	urban development; size vulnerable	2	parts in Kenai National Wildlife Refuge
Chulitna R near Talkeetna	29	NCI	state; private	3	important salmon producer	2	possible, hydro, oil and gas other development	2	
Eskimo Cr at King Salmon	11	BB	federal; private; state	2	some coho and king production	3	possible domestic and industrial source (King Salmon); water quality	2	within military lands, headwaters in park lands
Fritz Cr near Homer	7	LCI	state; private	2	some pink salmon (pinks are only at the mouth, however the stream also has Dolly Varden)	2	urbanization and water supply	2	drains state wildlife habitat refuge
Grouse Cr near Seward	11	SEW	state; federal	2	moderate coho, sockeye producer and overwintering for Dolly Varden	1	threats unknown; private wells	2	stream overwinters a good number of Dolly Varden
Iliamna R near Pedro Bay	12	BB	state; private	3	important salmon producer (large Dolly Varden and rainbow trout population)	1	unknown (possible road development associated with Pebble)	2	
Kizhuyak R near Port Lions, Kodiak	15	KOD	state; borough and Native	2	moderate salmon producer of pinks, coho and chum	2	unknown (existing hydro facility)	2	existing hydropower

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Appendix Table B2.–Page 3 of 3.

Site Name	Years Record	SF Mgmt Area	Land Status	Fishery Values	Values Description	Threats	Threats Description	Overall Rating	Notes
Little Campbell Cr at Nathan Dr, Anchorage	12	ANC	state; private	1	some salmon; Dolly Varden and rainbow trout	3	urbanization, wells; water quality	2	Some salmon, rainbow trout, and Dolly Varden; Anchorage Muni has watershed plan includes monitoring
Lowell Cr at Seward	28	SEW	state; private	2	release site by ADF&G	2	domestic and industrial water supply	2	coho and Chinook fishery, hatchery release site
Myrtle Cr near Kodiak	23	KOD	state	2	moderate salmon producer (on the road system, pinks and coho)	2	proposed logging	2	
Nuyakuk R near Dillingham	52	BB	state	3	recreational; important salmon producer (has resident spp. as well, falls is passable by fish)	2	minimal; within state park; potential hydro; changed threat from 1 to 2 on Jan 21, 2009	2	important fishery, and state park
Russian R near Cooper Landing	7	UKP	federal	3	important sockeye salmon producer	1	unknown	2	US Forest Service land
Tazimina R near Nondalton	6	BB	federal (NPS)	3	important salmon producer; rainbow fishery (High value sport fishery)	1	potential additional hydro?	2	existing Hydro; within National Park
Twentymile R near Portage	6	ANC	federal	3	important coho and hooligan fisheries	1	unknown	2	fishery value between 2 and 3; U.S Forest Service lands
Upper Thumb R near Larsen Bay, Kodiak	8	KOD	federal	3	important salmon producer (part of the Karluk drainage)	1	unknown	2	within Kodiak National Wildlife Refuge
Matanuska R at Palmer	59	NCI	state; private	2	moderate salmon producer	1	mining, diversion, but minimal	1	

Notes: SF=Division of Sport Fish; ANC=Anchorage Area; BB=Bristol Bay; KOD=Kodiak/Aleutians; LCI=Lower Cook Inlet (Kenai);NCI=Northern Cook Inlet Area (MatSu); PWS=Prince William Sound Area; SEW=Seward North Gulf Coast; UKP=Upper Kenai Peninsula.

Appendix Table B3.–Summary of high and medium prioritized USGS gaged streams for instream flow protection in Division of Sport Fish Region 3.

Site Name	Years Record	SF Mgmt Area	Land Status	Fishery Values	Values Description	Threats	Threats Description	Overall Rating	Notes
Chena River below Hunts Creek	15	LTR	state; private	3	important interior salmon and grayling	1	mining	2	
Chena River near Two Rivers	40	LTR	state; private	3	important interior salmon and grayling	1	mining	2	
Colville River at Umiat	5	NS	federal, state, private	3	chum, pink, Dolly Varden, whitefish important subsistence fisheries	2	oil and gas; mining; winter water withdrawals	3	within National Petroleum Reserve; was on 1984 list; high wildlife value as well
Goodpaster River near Big Delta	10	UTR	state, private	3	grayling, pike, king producer	2	mining	3	1984 priority; Pogo Mine in drainage, high value for interior stream
Kobuk River at Ambler	13	NW	Federal, state, private	3	important salmon and resident fish	1	unknown if any	2	
Kuskokwim River at Crooked Creek	57	KUK	state; private; federal	3	important salmon producer	1	unknown if any	2	
Kuskokwim River at McGrath	10	KUK	federal, state, private	3	important salmon producer	2	mining but mostly in tribs	3	navigability, major AK waterway
Melozitna River near Ruby	12	YUK	federal, state, private	3	chum, king, sheefish, whitefish, pike, grayling	1	unknown	2	high subsistence, recreational, wildlife values
Noatak River at Noatak	6	NW	federal, private	3	important subsistence fisheries salmon, charr	1	much of it in National Park and Preserve	2	
Tanana River at Big Delta	9	UTR	state; federal; private	3	major salmon producer for interior; major waterway	1	unknown	3	major salmon producing river
Tanana River at Fairbanks	35	LTR	state; federal; private	3	major salmon producer for interior; major waterway	1	unknown	3	

-continued-

Appendix Table B3.–Page 2 of 3.

Site Name	Years Record	SF Mgmt Area	Land Status	Fishery Values	Values Description	Threats	Threats Description	Overall Rating	Notes
Tanana River near Tanacross	38	UTR	state; federal; private	3	major salmon producer for interior; major waterway	1	unknown	3	major salmon producing river
Tazlina River near Glennallen	23	COP	federal, private	3	important Chinook salmon producer	1	unknown	2	on 1986 priority list
Yukon River at Eagle	58	YUK	federal; private;	3	important king, chum, coho, whitefish, sheefish producer	2		3	largest river in state, transboundary; potential hydropower; water export
Yukon River at Pilot Station	32	YUK	federal; private;	3	important king, chum, coho, whitefish, sheefish producer	2	potential hydropower; water export	3	largest river in state, transboundary;
Yukon River at Rampart	13	YUK	federal, private, state	3	important king, chum, coho, whitefish, sheefish producer	2	potential hydropower; water export	3	largest river in state, transboundary
Yukon River at Ruby	22	YUK	federal, private, state	3	important king, chum, coho, whitefish, sheefish producer	2	potential hydropower; water export	3	largest river in state, transboundary
Yukon River near Kaltag	10	YUK	federal, private, state	3	important king, chum, coho, whitefish, sheefish producer	2	potential hydropower; water export	3	largest river in state, transboundary
Yukon River near Stevens Village	31	YUK	federal, private	3	important king, chum, coho, whitefish, sheefish producer	2	potential hydropower; water export	3	largest river in state, transboundary
Kisaralik River near Akiak	8	KUK	federal	3	important salmon producer	1	unknown if any	2	US Fish and Wildlife Service
Mead River at Atkasuk	31	NS	federal	2	chum, whitefish, cisco, probably imp. subsistence	2	unknown but probably oil and gas	2	Anadromous Waters Catalog probably incomplete for this stream
Anvik River near Anvik	5	YUK	federal; state; private	3	important salmon stream	1	unknown	2	
Crater Creek near Nome	10	NW	federal, state, private	2	coho, Dolly Varden, probably grayling	2	mining	2	extensive past mining; land status needs clarification

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Appendix Table B3.–Page 3 of 3.

Site Name	Years Record	SF Mgmt Area	Land Status	Fishery Values	Values Description	Threats	Threats Description	Overall Rating	Notes
Eldorado Creek near Teller	10	NW	federal, state, private	3	all salmon plus Dolly Varden, Whitefish, maybe more	1	mining	2	
Koyukuk River at Hughes	23	YUK	federal, private	3	salmon and residents	1	unknown	2	
Kuzitrin River near Nome	11	NW	state, federal, private	3	salmon and residents	1	unknown, probably some mining	2	
Liese Creek near Big Delta	5	UTR		1	unknown	3	mining	2	Pogo mine nearby
North Fork Red Dog Creek near Kivalina	15	NW	Private (Native Corp.)	1	Dolly Varden , grayling	3	Red Dog Mine	2	AWC 331-00-10060-2120-3280-4021; Red Dog Mine

Notes: SF=Division of Sport Fish; COP=Upper Copper Upper Susitna Drainage; KUK=Kuskokwim River Drainage; LTR=Lower Tanana River Drainage; NS=North Slope; NW=Northwest; UTR=Upper Tanana River Drainage; YUK=Yukon River Drainage.

APPENDIX C
LITTLE CAMPBELL CREEK

Appendix C1.–Little Campbell Creek Mean Daily Flows in cubic feet per second for Water Year 2006 (October 1, 2005 – September 30, 2006).

Day	May	Jun	Jul	Aug	Sep
1	e7.8	10	3.8	1.7	10
2	e8.0	9.8	3.1	1.4	9.6
3	e8.2	7.2	2.7	1.4	9.4
4	e9.2	6.4	2.3	1.5	9
5	e10	5.4	1.9	1.4	11
6	e9.2	4.4	1.9	1.4	9.4
7	e11	3.8	1.9	1.5	8.7
8	e12	4.4	1.9	1.5	7.9
9	e8.7	4.1	1.8	1.5	7.2
10	e9.0	4.8	1.5	2.3	6.6
11	e9.1	5.6	1.4	11	6.1
12	e9.5	9.4	0.93	4.8	5.4
13	e10	9.2	0.93	4.1	4.9
14	e10	7.7	3.8	10	9.6
15	e10	7.7	13	12	11
16	e9.8	12	8.1	11	10
17	e9.8	9.8	3.8	10	7
18	9.6	8.7	2.7	13	6.1
19	9.2	6.8	2.1	16	5.6
20	9.8	5.4	2.5	16	5.6
21	9.5	4.4	2.3	15	5.1
22	9.6	10	2.5	15	13
23	10	6.1	2.1	15	10
24	10	4.4	2.3	15	8.5
25	10	3.8	2.3	17	8.3
26	10	5.6	1.9	15	11
27	9.8	4.1	1.5	14	13
28	9	3.7	2.3	13	13
29	7.7	3.5	1.5	12	14
30	6.8	3.8	3.5	11	12
31	8.5		3.7	11	
TOTAL	129.5	192	87.96	276.5	268
MEAN	4.18	6.40	2.84	8.92	8.93
MAX	10	12	13	17	14
MIN	6.8	3.5	0.93	1.4	4.9

Note: e=estimated.

Appendix C2.–Little Campbell Creek Mean Daily Flows in cubic feet per second for Water Year 2007 (October 1, 2006 – September 30, 2007).

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1	11	5.1	e2.0	e2.1	e1.9	e1.2	e4.5	10	5.6
2	10	e4.8	e1.9	e2.0	e2.0	e1.2	e7.0	10	5.4
3	11	e4.6	e1.8	e2.0	e1.8	e1.2	10	10	5.1
4	12	e4.4	e1.7	e2.1	e1.7	e1.2	13	10	5.6
5	11	e4.2	e1.6	e2.2	e1.6	e1.1	14	10	6.6
6	10	e4.0	e1.5	e2.3	e1.6	e1.1	15	10	6.4
7	10	e3.8	e1.4	e2.4	e1.6	e1.1	19	11	5.6
8	10	e3.6	e1.3	e2.4	e1.7	e1.1	18	10	5.1
9	12	e3.4	e1.2	e2.3	e1.6	e1.2	17	10	4.4
10	12	e3.7	e1.3	e2.3	e1.6	e1.3	15	10	4.4
11	12	e3.5	e1.3	e2.2	e1.5	e1.3	12	9.6	3.8
12	11	e3.2	e1.4	e2.1	e1.5	e1.2	12	9.5	3.8
13	10	e3.0	e1.5	e1.9	e1.4	e1.2	11	9.2	3.7
14	9.6	e2.8	e1.6	e1.8	e1.3	e1.1	10	8.8	4.4
15	9.2	e2.6	e1.6	e1.7	e1.3	e1.1	11	9	3.7
16	9	e2.5	e1.4	e1.6	e1.4	e1.2	11	9.1	3.3
17	9.4	e2.4	e1.6	e1.5	e1.3	e1.2	11	9	3.1
18	9.4	e2.5	e1.7	e1.5	e1.3	e1.2	11	8.5	2.7
19	8.7	e2.3	e1.9	e1.6	e1.2	e1.2	11	8.1	2.7
20	8.1	e2.2	e2.0	e1.6	e1.2	e1.3	11	8.1	2.5
21	7.9	e2.2	e2.0	e1.5	e1.1	e1.3	9.5	7.9	2.3
22	7.7	e2.1	e1.9	e1.5	e1.1	e1.3	10	7.4	1.9
23	7.2	e2.1	e1.8	e1.5	e1.1	e1.2	11	7.7	2.3
24	6.8	e2.0	e1.7	e1.4	e1.1	e1.2	12	7.4	5.6
25	6.8	e1.9	e1.7	e1.4	e1.0	e1.1	11	7.2	8.3
26	6.6	e1.9	e2.0	e1.3	e1.1	e1.2	11	7.2	3.8
27	6.1	e2.0	e2.3	e1.3	e1.1	e1.3	12	6.8	3.1
28	5.1	e2.0	e2.2	e1.4	e1.1	e1.5	12	6.4	2.3
29	6.6	e2.1	e2.4	e1.5		e1.7	11	6.4	1.8
30	5.8	e2.1	e2.4	e1.7		e2.0	11	6.1	1.7
31	5.6		e2.3	e1.8		e2.5		5.8	
TOTAL	277.6	89	54.4	55.9	39.2	40	354	266.2	121
MEAN	8.95	2.97	1.75	1.80	1.40	1.29	11.80	8.59	4.03
MAX	12	5.1	2.4	2.4	2	2.5	19	11	8.3
MIN	5.1	1.9	1.2	1.3	1	1.1	9.5	5.8	1.7

Note: e=estimated.

Appendix C3.–Water Quality Results for Little Campbell Creek at site LCC1.

Constituent	Result	PQL	Units
Aluminum	ND	100	ug/L
Antimony	ND	1	ug/L
Arsenic	ND	10	ug/L
Barium	23.7	3	ug/L
Beryllium	ND	1	ug/L
Bismuth	ND	2	ug/L
Cadmium	ND	2	ug/L
Calcium	46900	1000	ug/L
Chromium	6.79	4	ug/L
Cobalt	ND	1	ug/L
Copper	ND	6	ug/L
Iron	ND	1000	ug/L
Lead	ND	1	ug/L
Phosphorus	ND	500	ug/L
Potassium	1230	1000	ug/L
Selenium	ND	10	ug/L
Silver	ND	2	ug/L
Sodium	7140	1000	ug/L
Thallium	ND	1	ug/L
Vanadium	ND	20	ug/L
Zinc	ND	25	ug/L
Magnesium	10600	1000	ug/L
Manganese	97.8	2	ug/L
Molybdenum	ND	5	ug/L
Nickel	2.49	2	ug/L
Nitrate/Nitrite-N	2.32	0.1	mg/L
Phosphorus	ND	0.1	mg/L
Gasoline Range Organics	ND	0.1	mg/L
Benzene	ND	0.5	ug/L
Toluene	ND	2	ug/L
Ethylbenzene	ND	2	ug/L
o-Xylene	ND	2	ug/L
Diesel Range Orgfanics	ND	0.333	mg/L
Residual Range Organics	ND	0.556	mg/L
gamma-Chlordane	ND	0.0326	ug/L
alpha-Chlordane	ND	0.0326	ug/L
alpha-BHC	ND	0.0326	ug/L
beta-BHC	ND	0.0326	ug/L
gamma-BHC	ND	0.0326	ug/L
delta-BHC	ND	0.0326	ug/L
Heptachlor	ND	0.0326	ug/L
Aldrin	ND	0.0326	ug/L
Heptachlor epoxide	ND	0.0326	ug/L
Endosulfan	ND	0.0326	ug/L
4,4'-DDE	ND	0.0326	ug/L
Dieldrin	ND	0.0326	ug/L
Endrin	ND	0.0326	ug/L
Endosulfan II	ND	0.0326	ug/L
4,4'-DDD	ND	0.0326	ug/L
Endrin aldehyde	ND	0.0326	ug/L
4,4'-DDT	ND	0.0326	ug/L
Endosulfan sulfate	ND	0.0326	ug/L
Endrin ketone	ND	0.0326	ug/L
Methoxychlor	ND	0.0326	ug/L
Toxaphene	ND	1.09	ug/L
Cyanide	ND	0.005	mg/L

-continued-

Notes:

PQL	Practical Quantitation Limit (reporting limit).
U	Indicates the analyte was analyzed for but not detected.
F	Indicates value that is greater than or equal to the MDL.
J	The quantitation is an estimation.
ND	Indicates the analyte is not detected.
B	Indicates the analyte is found in a blank associated with the sample.
*	The analyte has exceeded allowable regulatory or control limits.
GT	Greater Than
D	The analyte concentration is the result of a dilution.
LT	Less Than
!	Surrogate out of control limits.
Q	QC parameter out of acceptance range.
M	A matrix effect was present.
JL	The analyte was positively identified, but the quantitation is a low estimation.
E	The analyte result is above the calibrated range.

Appendix C4.–Water Quality Results for Little Campbell Creek at site LCC2.

Constituent	Result	PQL	Units
Aluminum	ND	100	ug/L
Antimony	ND	1	ug/L
Arsenic	ND	10	ug/L
Barium	24.2	3	ug/L
Beryllium	ND	1	ug/L
Bismuth	ND	2	ug/L
Cadmium	ND	2	ug/L
Calcium	48600	1000	ug/L
Chromium	5.06	4	ug/L
Copper	ND	6	ug/L
Iron	ND	1000	ug/L
Lead	ND	1	ug/L
Phosphorus	ND	500	ug/L
Potassium	1260	1000	ug/L
Selenium	10.3	10	ug/L
Silver	ND	2	ug/L
Sodium	7250	1000	ug/L
Thallium	ND	1	ug/L
Vanadium	ND	20	ug/L
Zinc	ND	25	ug/L
Cobalt	ND	1	ug/L
Magnesium	11100	1000	ug/L
Manganese	98.2	2	ug/L
Molybdenum	ND	5	ug/L
Nickel	2.62	2	ug/L
Nitrate/Nitrite	2.34	0.1	mg/L
Phosphorus	ND	0.1	mg/L
Gasoline Range Organics	ND	0.1	mg/L
Benzene	ND	0.5	ug/L
Toluene	ND	2	ug/L
Ethylbenzene	ND	2	ug/L
o-Xylene	ND	2	ug/L
Diesel Range Organics	ND	0.326	mg/L
Residual Range Organics	ND	0.543	mg/L
gamma-Chlordane	ND	0.0316	ug/L
alpha-Chlordane	ND	0.0316	ug/L
alpha-BHC	ND	0.0316	ug/L
beta-BHC	ND	0.0316	ug/L
gamma-BHC	ND	0.0316	ug/L
delta-BHC	ND	0.0316	ug/L
Heptachlor	ND	0.0316	ug/L
Aldrin	ND	0.0316	ug/L
Heptachlor epoxide	ND	0.0316	ug/L
Endosulfan	ND	0.0316	ug/L
4,4'-DDE	ND	0.0316	ug/L
Dieldrin	ND	0.0316	ug/L
Endrin	ND	0.0316	ug/L
Endosulfan II	ND	0.0316	ug/L
4,4'-DDD	ND	0.0316	ug/L
Endrin aldehyde	ND	0.0316	ug/L
4,4'-DDT	ND	0.0316	ug/L
Endosulfan sulfate	ND	0.0316	ug/L
Endrin ketone	ND	0.0316	ug/L
Methoxychlor	ND	0.0316	ug/L
Toxaphene	ND	1.05	ug/L
Cyanide	ND	0.005	mg/L

-continued-

Notes:

PQL	Practical Quantitation Limit (reporting limit).
U	Indicates the analyte was analyzed for but not detected.
F	Indicates value that is greater than or equal to the MDL.
J	The quantitation is an estimation.
ND	Indicates the analyte is not detected.
B	Indicates the analyte is found in a blank associated with the sample.
*	The analyte has exceeded allowable regulatory or control limits.
GT	Greater Than
D	The analyte concentration is the result of a dilution.
LT	Less Than
!	Surrogate out of control limits.
Q	QC parameter out of acceptance range.
M	A matrix effect was present.
JL	The analyte was positively identified, but the quantitation is a low estimation.
E	The analyte result is above the calibrated range.

Appendix C5.–Water Quality Results for North Fork Campbell Creek at site NFLCC.

Constituent	Result	PQL	Units
Aluminum	ND	100	ug/L
Antimony	ND	1	ug/L
Arsenic	ND	10	ug/L
Barium	27.8	3	ug/L
Beryllium	ND	1	ug/L
Bismuth	ND	2	ug/L
Cadmium	ND	2	ug/L
Calcium	43100	1000	ug/L
Chromium	6.41	4	ug/L
Cobalt	ND	1	ug/L
Copper	ND	6	ug/L
Iron	ND	1000	ug/L
Lead	ND	1	ug/L
Phosphorus	ND	500	ug/L
Potassium	1060	1000	ug/L
Selenium	11.3	10	ug/L
Silver	ND	2	ug/L
Sodium	5730	1000	ug/L
Thallium	ND	1	ug/L
Vanadium	ND	20	ug/L
Zinc	ND	25	ug/L
Magnesium	9810	1000	ug/L
Manganese	162	2	ug/L
Molybdenum	ND	5	ug/L
Nickel	3.23	2	ug/L
Nitrate/Nitrite-N	1.62	0.1	mg/L
Phosphorus	ND	0.1	mg/L
Gasoline Range Organics	ND	0.1	mg/L
Benzene	ND	0.5	ug/L
Toluene	ND	2	ug/L
Ethylbenzene	ND	2	ug/L
o-Xylene	ND	2	ug/L
Diesel Range Organics	ND	0.326	mg/L
Residual Range Organics	ND	0.543	mg/L
gamma-Chlordane	ND	0.0319	ug/L
alpha-Chlordane	ND	0.0319	ug/L
alpha-BHC	ND	0.0319	ug/L
beta-BHC	ND	0.0319	ug/L
gamma-BHC	ND	0.0319	ug/L
delta-BHC	ND	0.0319	ug/L
Heptachlor	ND	0.0319	ug/L
Aldrin	ND	0.0319	ug/L
Heptachlor epoxide	ND	0.0319	ug/L
Endosulfan	ND	0.0319	ug/L
4,4'-DDE	ND	0.0319	ug/L
Dieldrin	ND	0.0319	ug/L
Endrin	ND	0.0319	ug/L
Endosulfan II	ND	0.0319	ug/L
4,4'-DDD	ND	0.0319	ug/L
Endrin aldehyde	ND	0.0319	ug/L
4,4'-DDT	ND	0.0319	ug/L
Endosulfan sulfate	ND	0.0319	ug/L
Endrin ketone	ND	0.0319	ug/L
Methoxychlor	ND	0.0319	ug/L
Toxaphene	ND	1.06	ug/L
Cyanide	ND	0.005	mg/L

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Notes:

PQL	Practical Quantitation Limit (reporting limit).
U	Indicates the analyte was analyzed for but not detected.
F	Indicates value that is greater than or equal to the MDL.
J	The quantitation is an estimation.
ND	Indicates the analyte is not detected.
B	Indicates the analyte is found in a blank associated with the sample.
*	The analyte has exceeded allowable regulatory or control limits.
GT	Greater Than
D	The analyte concentration is the result of a dilution.
LT	Less Than
!	Surrogate out of control limits.
Q	QC parameter out of acceptance range.
M	A matrix effect was present.
JL	The analyte was positively identified, but the quantitation is a low estimation.
E	The analyte result is above the calibrated range.

APPENDIX D. SARCU INSTREAM FLOW EDUCATION, TRAINING, AND OUTREACH PROGRAM

Appendix D1.–SARCU Instream Flow Education, Training, and Outreach Program.

Applied Environmental Education Program Evaluation
Pre-evaluation Report

By

Stacie Hall

August 2006

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Program Description

Overview

The Instream Flow Training program is a technical support service provided SARCU. This program works with other ADF&G programs and divisions, other state and federal government agencies, private, non-profit organizations and private citizens throughout the state to provide instream flow education, outreach and training. The purpose of the Instream Flow Training Program is both to educate about the importance and value of instream flow and to provide skills, training, and support services necessary to empower people to be successful in protecting water resources in Alaska. SARCU provides partners with support services such as lending equipment and technical guidance for instream flow related studies and projects. Special emphasis has been given to pilot projects with local watershed groups, which involves training members of the public to take stream discharge measurements as part of a citizen science environmental monitoring program.

Program Rationale

In 1980 the Alaska legislature amended state water laws in recognition of the economic and social benefits that would be derived from retaining sufficient water in rivers and lakes (Estes 1998). Those and subsequent amendments make it possible for anyone to file for a water right called an instream flow reservation, or reservation of water (Estes 1998). Reservations of water allow any individual or entity to retain a sufficient volume or quantity of good quality water in Alaskan rivers, lakes, estuaries, wetlands, groundwater and other water bodies to support and sustain fish and wildlife production, waterway access to these resources, associated recreational opportunities, navigation and transportation, sanitation and water quality. The Alaska statutes are somewhat unique as most water law in the U.S is based on the premise that water is only useful and important once you remove it from its source, divert it, or impound it with a dam. Even states that formally recognize instream values of water often only allow a specific government agency to file for this type of water right.

In 1986 the ADF&G Division of Sport Fish's Research and Technical Services branch formed the Statewide Aquatic Resources Coordination Unit (SARCU) whose primary purpose was to support the division's mission by acquiring instream flow water rights for sport fishery resources and related instream uses of water. In 1991, SARCU, recommended in its, "Annual Summary of Alaska Department of Fish and Game Instream Flow Reservation Applications", that additional attention should be paid to alerting the public to the opportunity of reserving water for instream uses. It was suggested that: "An instream flow methods and application handbook should be prepared by the ADFG to provide sufficient guidance for the public and other interested parties to file for instream flow reservations" (Estes 1991). By 1993, the first official recommendation for an education program came: "A formal instream flow education program should be funded to encourage public participation in the instream flow reservation process" (Estes 1993). The need for public education about instream flow was repeatedly pointed out in SARCU's annual reports until in 2003 additional staff and funding was dedicated to creating SARCU's formal education and information programs.

While Alaska's Instream Flow Law has been in existence for over 25 years, there is still a lack of awareness of this opportunity in both the professional and public realms of the state. Conservatively, there are an estimated 60,000 river reaches and thousands of lakes in Alaska that

support fish. However, between 1980 and 1996, there were only 92 applications for reservations of water submitted to the state's Department of Natural Resources for review (Estes 1996). Considering the economic, environmental, recreational, and social benefits that Alaska receives from its free flowing waters, which is unparalleled elsewhere in the U.S.; maintaining adequate instream flows in its waters is one way to ensure the valued Alaskan way of life can continue well into the future.

Goals and Objectives

The goal of the Instream Flow Training Program is to educate and empower participants with sufficient instream flow awareness, knowledge, attitudes and skills to be willing and capable to educate others about instream flow; and perform instream flow data collection either as a contribution to current citizen science volunteer efforts, or as part of a formal research project.

Program goals:

1. Recognize, apply, and integrate instream flow concepts and value into management decisions, especially as it relates to fish and wildlife.
2. Recognize, apply, and integrate instream flow protection tools that exist under state and federal laws into their current activities or research.
3. Recognize, apply, and integrate instream flow concepts and values into their educational programs and materials, especially as it relates to fish and wildlife.
4. Support the ADF&G programs that protect instream flows under state and federal laws, and the core activities associated with these programs
5. Demonstrate the technical skill, ability, and understanding of instream flow to be capable of correctly informing, educating, and training other individuals and groups about the importance and value of instream flow issues and concerns.

The **objectives** of the program are:

After attending a topical instream flow workshop, participants will be able to:

- Define "instream use of water", and "out of stream use of water" and list 2 examples of each.
- Explain 3 of the 4 purposes for which water can be reserved, and who is allowed to apply for reservations of water.
- Explain the importance of instream flow to water quality.
- Explain the relationship between hydrologic variability and fish and wildlife.
- Name three legal "tools" for protecting instream flow.
- Acknowledge the need for balance between instream and out of stream uses of water.
- Report an increased awareness of instream flow issues in Alaska.
- Recognize the following: staff gage, flow meter, wading rod, and digitizer; and be able to briefly describe the function of each.

After attending a skills training workshop, participants will be able to:

- Demonstrate the proper assembly of a Price AA meter.
- Calibrate a flow meter with a spin test.
- Set a top-set wading rode to the appropriate depth in the water column.
- Choose a location appropriate for taking reliable long-term instream flow measurements.
- Measure flow using a flow meter using a digitizer, headphones, and tally counter
- Convert flow measurements into total discharge using the excel spreadsheet form provided.

Audiences:

There are multiple statewide target **audiences** for the Instream Flow Training Program. SARCU will prioritize efforts in the following order based on time and resources available:

1. ADF&G Information and Education Staff
2. ADF&G Research and Management staff
3. Watershed Organizations' Staff involved in pilot projects
4. Volunteers of Watershed Organizations involved in pilot projects
5. Watershed Organizations' Staff not involved in pilot projects
6. Volunteers of Watershed Organizations not involved in pilot projects
7. Other state and federal agency staff
8. Other private or non-profit groups and organizations

Logic Model

The logic model below shows the chain of events that will facilitate change in our target audiences and achieve the Instream Flow Training Program's goals and objectives. It depicts the relationship between the program's:

- **Inputs** (what we will invest)
- **Outputs** (the activities we will do and who we will reach)

The program's **outcomes**, which fall along a time and scope continuum, and can also be called results:

- Short-term outcomes: generally an increase in learning, or what the participant gains at the end of the workshop
- Medium-term outcomes: broader, with participants often integrating knowledge and behaviors from the training program into their daily work and life
- Long-term outcomes: Larger and lasting positive changes in participants that will make a difference in the issue the training program seeks to address.

Reproduced from *Instream Flow Training Program applied environmental education program evaluation pre-evaluation report*, prepared in August 2006 by Stacie Hall, program biologist, Alaska Department of Fish and Game.

Inputs	**Outputs**		**Outcomes**		
	Activities	**Participants**	**Short**	**Medium**	**Long-Term**
<u>Staff:</u> *Hydrologist *Fish Biologist *Wildlife Biologist *Education Coordinator <u>Budget:</u> *Operating budget *Materials budget <u>Equipment:</u> *Four flow measurement "kits" for lending *One education flow kit for events *Eight staff gages for long-term lending	*On-site technical assistance *Power Point presentations at watershed council or community meetings, or conferences. *Topical workshops: - offered 1 to 2 times a year - 4 to 5 hours in length *Skills workshops: - offered 1 to 2 times a year	*ADF&G staff *Other agency staff *Watershed council staff *Watershed council volunteers	<u>Participants will:</u> *Report increased awareness of instream flow issues around the state *Report and demonstrate increased knowledge about: -instream vs. out of stream uses of water -reservations of water -other legal tools to protect instream flow -relationship between fish and wildlife and instream flow -relationship between water quality and instream flow *Report and demonstrate increased skills and knowledge	<u>Participants will:</u> *Engage in instream flow data collection at individual project sites such as fish weirs *Report feeling comfortable seeking technical assistance or support from SARCU[1] *Demonstrate increased support for instream flow related funding and resources by contributing $ to collaborative gaging projects. *(ADF&G staff) Demonstrate increased coordination with SARCU on instream flow issues related to	<u>Participants will:</u> *Report valuing Alaska's free-flowing waters *Report regular participation in instream flow data collection efforts *Complete appropriate data collection and file for a reservation of water. *Utilize an instream flow protection tool other than water reservations *Report the ability to critically analyze potential instream

Materials: *Brochures *Fact sheets *Power Points *Website *Participant manual *CD of resources Partners: *ADF&G Division of Commercial Fisheries *AK Dept Natural Resources *Anchorage Waterways Council *Cook Inlet Keepers *Kenai Watershed Forum *The Nature Conservancy	-7 to 8 hours in length		about: -instream flow data collection techniques -site selection -flow measurement equipment and its maintenance *Report increased acknowledgement of the need for balance between instream and out of stream uses of water. *Report interest in participating in additional trainings or workshops *Report interest in participating in instream flow data collection *Report feeling comfortable using appropriate instream flow data collection techniques and equipment. *Report that they intend to utilize new knowledge and skills in the scope of their jobs, or volunteer work	fish and wildlife. *Utilize SARCU's equipment lending system *Re-write or modify one educational activity or product to include instream flow topics *Assess which water bodies in their regions have or will soon have (>3 years) instream flow conflicts *Train additional volunteers to collect instream flow data *Participate in additional trainings or workshops	flow impacts or trade-offs for proposed developments or projects in the state

Purpose of the Evaluation

The evaluation of the Instream Flow Training program will determine to what extent our stated program goals and objectives are being met, and to measure the effectiveness of our efforts. The information gained from these evaluations will determine program impacts, help inform a marketing and communications strategy to attract new participants, and improve our current training efforts. The evaluation will also allow us to quantify our contributions to measures and targets that exist under our division's umbrella education program, the Division of Sport Fish Education Program.

In the long-term, we are interested in whether the training influences changes in behavior, and if the participants carry on their learning by incorporating it into their own education, information, and research efforts. In the future, we plan on examining the extent and quality of instream flow activities and research that are carried out as a result of the workshop.

Methods

Data will be collected with the following instruments, from these sources, at the following times:

Name of instrument/method	Source of Information	Timeline
Pre-Workshop Questionnaire	All Participants	Beginning of topical and skills workshops
Content test	All Participants	Beginning and end of skills workshops
Observations	Participant subsample	During hands-on skill practice portion of skills workshop
Alternative Assessment questionnaire	All Participants	Before and after site selection unit of skills workshop
Post-Workshop Questionnaire	All Participants	End of topical and skills workshops
Follow-up Questionnaire	All Participants	6 months after topical and skills workshops

Limitations

The potential biases and limitations of this evaluation plan include:

- Testing threats: The evaluation plan uses several pre- and posttests, which means that there is potential for testing biases to occur. We will attempt to minimize this threat by re-writing questions so they are not identical on the pre-and posttests.
- Limited sample size: The number of trainings provided each year is restricted due to staff size. The number of people allowed to attend workshops is also capped to ensure that adequate one-on-one instruction and feedback can be given to participants.
- Observations: Staff will be non-participant covert observers; however, if participants realize they are being watched and scored it may affect their behavior and execution of skills.

- Selection bias: Participants self-select so there is the possibility that participants tend to be of certain demographics. We will attempt to minimize this threat by gathering demographic data on our questionnaires and examining potential patterns that occur in groups' evaluation results.
- History bias: The participants in the training program have varied characteristics and experience with instream flow. We will attempt to minimize this threat by gathering some baseline demographic data and information on the prior knowledge and experiences of our participants.
- Maturation effects: Since we will be tracking participant knowledge, attitudes, and skills over time, evaluation results may be affected by changes in participants.

Results

The results of the evaluations will be interpreted and the conclusions will be used to help us understand:

1. **The effectiveness of our workshops:**
    i. Content test: % of participants whose mean score increased from the pre- to posttest
    ii. Mean scores or patterns on individual questions on content tests to indicate areas that may need to be revised or taught differently.
    iii. Photo evaluation: % of participants whose mean score increased from the pre to posttest
    iv. % of participants who indicate a greater level of confidence with instream flow related topics
    v. Responses about appropriateness of workshop length
    vi. Responses about appropriateness of level of detail in which topics were covered
    vii. Responses about appropriateness of workshop facilities and streamside location
    viii. Mean scores and important themes from observations of participants during hands-on skills practice

2. **Whether the workshops influence participant behavior:**
    i. % participants who indicate that they became involved in instream flow data collection efforts because of the workshop
    ii. % participants who indicate that they integrated instream flow information into their education and information programs and materials because of the workshop
    iii. % participants who indicate being more aware of instream flow issues after the workshop

iv. % increase in participants that report utilizing SARCU's equipment lending system, or other support services

3. **Barriers to participation:**
    i. Summary of quantitative data shared by participants, including illustrative quotes to help us attract new participants, and increase participation in the program
    ii. Summary of quantitative data shared by participants which might indicate changes needed to remove barriers

4. **Demographics of individuals who participate in instream flow research projects, or volunteer data collection efforts:**
    i. Patterns and trends in participation that might inform a marketing and communications strategy

Results from the evaluation of the Instream Flow Training Program will be communicated to the **stakeholders** as:

1. A **Fact sheet** that will convey key findings and recommendations to staff
2. An **executive summary for divisional leadership** to provide additional details for those who would like more than the fact sheet
3. A **case study** including photos and participant quotes that can be shared at appropriate conferences and venues with findings, lessons learned, and recommendations for others who might be interested in pursuing similar efforts.

Comprehensive Evaluation Matrix

Focusing the evaluation				Collecting the information		Analyzing and Reporting	
Logic model link	**Evaluation Questions**	**Indicators**	**Sources**	**Methods**	**Managing**	**Analysis**	**Reporting**
	What do you want to know?	*How will you know it?*	*Who will have the information?*	*How will you gather the data?*	*When will the information be collected?*	*How will the data be analyzed and displayed?*	*To whom and how will the results be communicated? How will you use the results?*
Outcomes (short-term)	Do our workshops increase participant flow data collection skills?	#, % participants demonstrating proper flow collection techniques	Participants	Observation form and numeric rating of participant technique	During the hands-on and in-field portions of all workshops	Percentages, means as bar graph	Included in program evaluation report for staff; program documentation; executive summary for divisional leadership indicating contribution to divisional education targets and measures
Outcomes (short-term)	Do our workshops increase participant knowledge of instream flow topics?	% increase in knowledge about instream flow related topics	Participants	Pre and post tests	At beginning and end of workshops	Percentages & means of quantitative data in tables and bar graph	Included in program evaluation report for staff for program documentation; executive summary for divisional leadership showing contribution to divisional education targets and measures
Outcomes (short-term)	Do our workshops change attitudes about instream flow issues?	% change in attitudes/values about instream flow related issues	Participants	Questionnaires	Pre-workshop; 6 and 12 months after workshop as a follow-up	Percentages & means of quantitative data in tables and bar charts	Included in program evaluation report for staff for program documentation; executive summary for divisional leadership indicating contribution to divisional education targets and measures
Outcomes (short-term)	Do our workshops increase participant awareness of instream flow issues?	% change in awareness of instream flow related issues around the state	Participants	Questionnaires (pre-post)	Pre-workshop; 6 and 12 months after workshop as a follow-up	Percentages & means of quantitative data in tables and bar charts	Included in program evaluation report for staff for program documentation; executive summary for divisional leadership indicating contribution to divisional education targets and measures
Output (participation)	What barriers are there to participation in workshops	Responses from participants;	Staff Supervisors Participants	Questionnaire (post)	Pre-workshop survey; Post workshop questionnaire and survey	Percentages & means of quantitative data in tables; content analysis of qualitative responses with finding summarized as bullet points	Staff summary of results which will be used to help form a marketing strategy and possible strategies for overcoming barriers for future workshops
Outcome (medium, long-term)	What is the primary barrier that prevents people from collecting flow data before and after workshops?	Feedback from staff and participants	Participants Supervisors	Questionnaires; open discussion	Survey at beginning of workshop; open ended response questions and discussion at end of workshops	Percentages & means of quantitative data in tables; content analysis of qualitative responses w/bullet point summary	Incorporated into evaluation report; executive summary for internal use. Power point, article for sharing with EE, and instream flow community

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Focusing the evaluation				Collecting the information		Analyzing and Reporting	
Logic model link	**Evaluation Questions**	**Indicators**	**Sources**	**Methods**	**Managing**	**Analysis**	**Reporting**
Outcomes (medium, long)	Does participation in our workshops influence participation in flow data collection?	# participants collecting flow data; % change in flow data being collected; Responses; # , % change in projects including flow data; # of participants utilizing equipment lending system	Participants Supervisors Staff	Questionnaires that include open-ended questions; literature search of ADF&G reports	Pre-workshop; 6 and 12 months after workshop as a follow-up	Percentages, means, ranges displayed in line graph	Incorporated into evaluation report; executive summary for internal use. Case study. Power point, article for sharing with EE, and instream flow community
Inputs (power points, participant manual, CD of resources)	How effective are the materials at contributing to participant learning?	Responses from participants; % who utilize materials after workshop	Participants	Questionnaire	At end of workshop; 6 months after workshop as a follow-up	Percentages & means in tables	Summary of findings for program staff; incorporated into larger evaluation report for program documentation; use to improve products
Outcomes (medium)	Did the program influence participants to incorporate instream flow info into current programs or materials?	# materials incorporating instream flow; % change	Participants, staff, supervisors, other program coordinators	Questionnaires	12 months after workshop	Quantitative data as percentages & means in table format	Incorporated into evaluation report; executive summary for internal use. Power point, article for sharing with EE, and instream flow community
Outcome (long-term)	How does the program influence staff coordination with SARCU?	% change in coordination requests/emails/ phone calls; Feedback; Interviews	Staff Supervisors	Questionnaires that include open-ended questions; literature search of ADF&G reports	18 months after workshop	Percentages & means of quantitative data in tables; content analysis of qualitative responses w/bullet point summary	Incorporated into evaluation report; executive summary for internal use.
Outcome (long-term)	How did the program influence participation levels in volunteer monitoring programs?	Responses; % change in # participants, counts	Watershed staff Participants Volunteers	Questionnaires that include open-ended questions; literature search of ADF&G reports	18 months after workshop	Quantitative data displayed with line graphs; qualitative data content analyzed and summarized as bullet points	Incorporated into evaluation report; executive summary for internal use. Part of case study. Power point, article for sharing with EE, and instream flow community
Outcome (long-term)	How does the program influence support for instream related resources and funding such as SARCU?	% change in attitudes; % change in $ contributions to collaborative gaging projects	Supervisors Project or budget managers	Questionnaires; Project and FY summarization reports	18 months after workshop	Percentages & means of quantitative data in tables, and line graphs; content analysis of qualitative responses w/ bullet points	Incorporated into evaluation report; executive summary for internal use.