**Special Publication No. 12-03**

# Instream Flow Protection in Alaska, 2010

**by**

**Joe Klein**

**March 2012**

**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, $\chi^2$, 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 |

*SPECIAL PUBLICATION NO. 12-03*

# INSTREAM FLOW PROTECTION IN ALASKA, 2010

by

Joe Klein
Division of Sport Fish, Anchorage

Alaska Department of Fish and Game
SF, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1565

March 2012

This investigation was partially financed by the Federal Aid in Sport Fish Restoration Act (16 U.S.C. 777-777K) under Project F-10-26, Job No. H-1.

The Special Publication series was established by the SF in 1991 for the publication of techniques and procedures manuals, informational pamphlets, special subject reports to decision-making bodies, symposia and workshop proceedings, application software documentation, in-house lectures, and became a joint divisional series in 2004 with the Division of Commercial Fisheries. Special Publications are intended for fishery and other technical professionals. Special Publications are available through the Alaska State Library, Alaska Resources Library and Information Services (ARLIS) and on the Internet: http://www.adfg.alaska.gov/sf/publications/. This publication has undergone editorial and peer review.

*Joe Klein*
*Alaska Department of Fish and Game,*
*Division of Sport Fish, Research and Technical Services*
*333 Raspberry Road, Anchorage, Alaska, USA*

*This document should be cited as:*
*Klein, J. 2012. Instream flow protection in Alaska, 2010. Alaska Department of Fish and Game, Special Publication No. 12-03, Anchorage.*

# TABLE OF CONTENTS

# LIST OF FIGURES



# LIST OF TABLES



# LIST OF APPENDICES

# ABSTRACT

This report summarizes instream flow protection and related activities of the Alaska Department of Fish and Game (ADF&G) in 2010. 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 428 applications for reservations of water from ADF&G, federal agencies, and the private sector as of December 2010. ADF&G completed reservation of water applications on 129 river systems and 1 lake and was granted certificates of reservations for 39 applications for rivers and one for a lake. During 2010, ADF&G filed 12 reservation of water applications and received certificates of reservation of water for 11 applications for rivers.

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.

In 2010, staff from the Statewide Aquatic Resources Coordination Unit (SARCU) performed hydrologic investigations on 10 sites. Investigations were generally performed to provide the necessary data to complete reservation of water applications.

SARCU staff monitored 72 existing and proposed hydroelectric and hydrokinetic projects in 2010 and served as ADF&G's representative for the Alaska Clean Waters Actions program, which directs a variety of funding sources toward the recovery and stewardship of Alaska's water bodies. SARCU staff also provided instream flow training, education and outreach activities 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, 17,575 water bodies in Alaska have been identified as supporting anadromous fish species (personal communication, J. Johnson, Fisheries Biologist, Alaska Department of Fish and Game, October 12, 2011). There are many other water bodies that may support fish that have yet to be investigated.

In 2010, an estimated 442,098 anglers fished 2,000,167 days and harvested approximately 2,566,595 of the approximately 5,941,817 fish caught in Alaska (Jennings et al. 2011). 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 hydrologic regimes that provide essential seasonal habitats utilized by the various life stages of each species. Varying seasonal quantities of flowing waters or lake volumes are needed by fish using freshwater and estuarine habitats for migration, spawning, incubation, and rearing. (Hynes 1970; Estes 1984; Hill et al. 1991; Poff et al. 1997; Bovee et al. 1998; Annear et al. 2004).

The Fish and Game Act 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). The act also enables ADF&G to use a variety of legal, regulatory and administrative options to quantify and acquire water rights 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) issued by the department are one of the tools that can be used to retain sufficient amounts of water to protect fish habitat in lotic and lentic fish-bearing systems. For decisions that have the potential to impact a fish-bearing water body, ADF&G and the Alaska Department of Natural Resources (DNR) have agreed to coordinate water right and fish habitat permits to ensure permit conditions are consistent.[3]

Alaska's 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 referred to as Alaska's instream flow law. Alaska's water law treats 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 resources and values. 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
- sanitary 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, an appropriation to retain water within a water body for any of these purposes may also be defined as a "*reservation of water*" (AS 46.15.145). 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 law expanded the meaning of *appropriation* in Alaska to represent all water right uses, including retention of water in lotic and lentic water bodies. 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. Further information related to Alaska's instream flow law can be found in Curran and Dwight (1979), White (1982), Anderson (1991), Harle and Estes (1993), Spence (1995), Estes (1984), and Burkardt (2000).

The Statewide Aquatic Resources Coordination Unit (SARCU) was created within the Division of Sport Fish (SF) in 1986 to acquire water rights for the protection of sport fish resources and related instream uses[5]. Initially, the focus for SARCU was quantifying and acquiring

[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 Habitat Division 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.

[5] This report focuses on activities associated with reservations of water for fish since funding sources for staff activities are related to this objective. Nonetheless, commercial, subsistence and other fish and wildlife resources and habitats benefit from this program.

reservations of water in priority fish-bearing water bodies to avoid over-appropriation of water resources. Over time, SARCU expanded to address other instream flow related issues such as hydroelectric licensing under the Federal Energy Regulatory Commission (FERC) and representation in the Alaska Clean Waters Action (ACWA) program. SARCU staff also developed the capacity to collect streamflow data for filing reservation of water applications. SARCU staff are 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). This report summarizes instream flow protection activities by SARCU in 2010. The status of reservation of reservation of water activities by other agencies and the private sector is also provided.

## 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.[6] Applications are prepared 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

ADF&G developed nomination work plans for SF Regions 1, 2, and 3 (Figure 1; Klein 2011). These work plans 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 selection of water bodies to be reserved was 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 hydrologic data, and the ability for other mechanisms[7] to provide instream flow protection.

### 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 biologic and hydrologic data to support reservations of water for the protection of fish habitat, migration, and propagation. ADF&G strives to collect and analyze all data according to accepted scientific methods and procedures that would meet evidentiary standards and any challenges[8] that may be filed.

---

[6] There is no charge to state agencies.

[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), permits from land management agencies, and the Federal Power Act.

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

### *Biologic 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* (Johnson and Blanche 2011). SARCU staff worked with ADF&G and other biologists as needed to compile fish use information.

### *Hydrologic 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 (NWIS) website.[10] When hydrologic data were limited or not available, SARCU collected streamflow data in accordance with USGS standards (Rantz and others 1982). Streamflow records were computed using the Water Information System Kisters Incorporated (WISKI)® hydrologic data management software after they were proofed for nonsensical data and transformed into a WISKI® compliant format. WISKI® is a Windows-based professional time series hydrologic management system that meets USGS standards for data computation. Streamflow records obtained from USGS or collected by SARCU were analyzed using the most current version of SAS® with support from SF biometricians.

Where less than 5 years of data were available, simple linear regression was used to extend or estimate streamflow data. Simple linear regression was used if a suitable, long term streamgage with a concurrent period of record was available.

### *Instream Flow Analysis*

Under Alaska law, applicants are not required to use a specific method for quantifying instream flow needs (11 AAC 93.142; 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 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 and timing of the natural flow regime to maintain seasonal use of fish habitat.

Hydrologic 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 Blanche 2011), ADF&G Freshwater Fish Inventory[11], and USGS National Hydrography Database[12]. Reach boundaries were based on documented fish use and selected to minimize

[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] See http://www.sf.adfg.state.ak.us/SARR/Surveys/index.cfm

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

differences in streamflow accretion. 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. 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 and issues 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. If DNR's decision is challenged, there is an administrative appeal process with the option to seek further remedy through Alaska's court system.

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 related issues.

# ACTIVITIES

## RESERVATIONS OF WATER

Overall, ADF&G completed reservation of water applications on 135 river systems[13] and 1 lake from a total of 428 applications received by DNR (Table 1 and Figures 2 and 3). Certificates of reservations of water were issued for 40 rivers and one lake application submitted by ADF&G (Table 1 and Figures 4 and 5), one river application submitted by BLM, and one river and lake under the water export provision[14] (Table 1).

During 2010, ADF&G filed 12 reservation of water applications (Table 2 and Figure 6) and received certificates of reservation of water for 11 applications (Table 3 and Figure 7).

## 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 ten projects in 2010 (Figure 8). Summaries of each investigation by SF regions[15] are provided below.

---

[13] Six reservation of water applications were filed with project partners (see Table 1).

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

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

## Region I

SF Region I covers Southeast Alaska from Cape Suckling to Dixon Entrance (Figure 1).

### *Sitkoh Creek*

Sitkoh Creek is located in Southeast Alaska on southeastern Chichagof Island across Chatham Strait from the community of Angoon (Figure 8). The creek supports coho (*Oncorhynchus kisutchz*), sockeye (*O. nerka*), chum (*O. keta*), and pink salmon (*O. gorbuscha*), cutthroat trout (*O. clarki*), rainbow and steelhead trout (*O. mykiss*), and Dolly Varden (*Salvelinus malma*).

ADF&G operated Streamgage Station 10303 at the outlet of Sitkoh Lake since 2006. Site visits were made to the gage five times during the year to download data, take discharge measurements, and for routine gage maintenance. To establish the relationship between streamflow at the gage and streamflow at the downstream end of the creek, instantaneous discharge measurements were taken at Discharge Station 10309 four times during the year. This gage will continue to operate until October 1, 2011 at which time five water years of stream flow data will have been collected.

Reservation of water applications were filed for two reaches in 2010 based on two years of streamflow records. After 5 years of streamflow records have been collected, the existing application will be amended, if needed.

### *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 8). 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.

ADF&G operated a streamgage (#11901) at the outlet of Chilkoot Lake since 2007. Site visits were made to the gage five times during 2010 to download data, take discharge measurements, and for routine maintenance. The gage will continue to operate until October 2012 to collect five years of streamflow records.

A reservation of water application was filed for the Chilkoot River in 2009 based on two years of streamflow records. After 5 years of streamflow records have been collected, the existing application will be amended, if needed.

### *Cowee Creek*

Cowee Creek is located approximately 40 miles north of Juneau within the temperate coastal rainforest of Southeast Alaska (Figure 8). It supports coho, chum, and pink salmon, cutthroat and steelhead trout, and Dolly Varden. 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.

ADF&G operated a streamgage (#11401) just below the Glacier Highway Bridge since 2007. Site visits were made to the gage 11 times during 2010 to download data, take discharge measurements, and for routine maintenance. This gage will remain operational until October 2012 to collect five water years of streamflow data. A reservation of water application was submitted to DNR in 2009 and will be amended after streamgaging is completed, if needed.

***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, and eulachon (Figure 8). ADF&G operated a streamgage (#11701) on the east fork of the Lost River since 2006 and plans to keep it operational until October 2011. ADF&G also established discharge measurement stations at the following sites: mainstem of the Lost River below the Lost River Road Bridge, East Fork of the Lost River, and Tawah Creek a tributary to the Lost River. During 2010, five instantaneous discharge measurements were taken at the gage site. These measurements were used to create a rating curve and compute mean daily flows for water year 2010. Four instantaneous discharge measurements were taken at each of the three discharge measurement stations. These measurements were used to define the relationship between their respective stations and the streamgage. A reservation of water application was submitted to DNR for the Lost River streamgage reach in 2009. Additional reservation of water applications will likely be filed other reaches of the Lost River and one reach of Tawah Creek.

***Turner, Eagle and Orchard Lakes***

ADF&G received funding provided by the National Fish Habitat Action Plan via a grant from the Western Native Trout Initiative (WNTI) in July 2010 to collect hydrologic data and prepare a reservation of water on three trophy cutthroat trout lakes in Southeast Alaska. Turner, Eagle, and Orchard were the three lakes chosen for this project.

Turner Lake is located in the upper portion of the Taku inlet, 16 miles east of Juneau (Figure 8). The lake is 8.6 miles long, has a surface elevation of approximately 72 feet above mean sea level, and a surface area of approximately 1,270 hectares. The lake is very steep sided and has a maximum depth of 706 feet. The lake outlet flows about one mile to Taku Inlet and is blocked to upstream fish passage by a barrier falls just below the lake (Harding et al. 2009).

Eagle Lake is located 48 miles south of the town of Wrangell (Figure 8). The lake has a surface area of 435 hectares, an elevation of approximately 328 feet above mean sea level, and a maximum depth of 148 feet. Most of the shoreline is low gradient with lots of large woody debris. Eagle Lake is blocked to upstream fish passage by a vertical falls located 4.5 miles downstream of the lake outlet. An electric transmission line runs along the west side of the watershed.

Orchard Lake is located 35 miles north of the town of Ketchikan (Figure 8). The lake has a surface of 390 hectares, an elevation of approximately 140 feet above sea level, and an estimated maximum depth of 200 feet. The lake is accessible from saltwater via a one mile trail from

Shrimp Bay. Much of the shoreline consists of steep sided bedrock cliffs. Orchard Lake is blocked to upstream fish passage by a barrier falls just below the lake.

A reconnaissance trip was made during June 2010 to each of the lakes to find suitable sites for the lake level gages and to take photos and GPS coordinates of the proposed gage sites. USFS ranger districts granted permits to install the lake gages and offered to assist with the project.

ADF&G installed lake level gages on all three lakes during the fall of 2010. This project is currently funded for three years. Two additional years of funding is anticipated through WNTI. After one year of water level data has been collected at each lake, reservation of water applications will be completed and submitted to DNR for each lake.

## 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 1).

### 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 (Figure 8). Meadow and Fish Creeks support salmon and resident fish populations and were deemed high priority for receiving instream flow protection by ADF&G and the MatSu Basin Salmon Conservation Partnership (MSCP). These creeks are predominately lake influenced and ground-water fed; therefore seasonal variation in streamflows is relatively low. Inter-annual variation may also be low for the same reasons. This drainage is a major wild sockeye salmon producing system that in the past was supplemented with hatchery fish. 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 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 the Alaska Clean Water Actions (ACWA) 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 flow 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 streamgages on lower Fish Creek and lower Meadow Creek, and established discharge measurement sites on upper Fish Creek and upper Meadow Creek.

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 in 2010. ADF&G provided training and assisted WSWCD staff as needed with streamflow data collection efforts.

### *Stariski Creek*

Stariski Creek is located on the Kenai Peninsula approximately 15 miles north of Homer (Figure 8). 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 (*O. tshawytscha*) and coho salmon, and steelhead trout. In 2006, the non-profit organization Cook Inletkeeper (CIK) was awarded several grants to monitor an Alaska Department of Transportation and Public Facilities project to construct a bridge over Stariski Creek in place of a culvert that was damaged by floods in 2002. This work included measuring streamflow, 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 hydrologic supplies, manage and analyze the data, and assist with field work as needed. A streamgage was installed approximately one quarter-mile upstream from the new Sterling Highway Bridge in June 2006.

Since 2006, ADF&G and CIK have jointly operated the streamgage. CIK obtained AKSSF funds to continue operating the streamgage through June 2011. ADF&G will continue operating the streamgage through October 2011 to complete the water year. Records collections prior to 2008 were limited to open water periods because of funding and staff limitations.

## 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[16] that specify how projects will be constructed and operated including 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).

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, requiring reviews and analyses specific to affected resources.

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 are 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 generally obtain a preliminary permit that gives them the exclusive right to study the project's feasibility for three years. If an applicant is still interested in pursuing the project, a license application is submitted before the end of the permit term. ADF&G plays an important role in assisting the applicant to obtain fish and wildlife information needed by regulatory agencies. 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.

SARCU currently monitors 36 existing FERC regulated hydroelectric and hydrokinetic projects (Table 4). Interest in hydroelectric power has increased recently and is expected to continue for

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

the foreseeable future as energy prices remain high and the state seeks solutions for the railbelt's aging power generation infrastructure.

## ALASKA CLEAN WATER ACTIONS PROGRAM

The ACWA program is a collaboration of Department of Environmental Conservation (DEC), ADF&G, and DNR to provide stewardship of Alaska's water bodies[17]. This is accomplished by identifying water bodies that need stewardship actions and directing funding toward the highest priorities. Each agency is responsible for participating in the ACWA water experts group (WEG) to assess information related to its expertise: ADF&G–aquatic habitat, DEC–water quality, and DNR–water quantity. SARCU is ADF&G's representative for the WEG.

ACWA partners pooled funding to create a combine fund for proposals[18]. In 2010, 17 projects were funded by ACWA (Appendix A). However, ADF&G will no longer be able to contribute AKSSF funds to the ACWA grant pool. DNR has been unable to contribute to the ACWA grant pool for several years. Without dedicated, long-term funding commitments to the ACWA grant pool, the ability to provide grant funding for ACWA stewardship priorities becomes diminished and risks future sustainability.

The WEG developed a plan for implementing ACWA objectives.[19] The first step is to nominate a water body, which any agency personnel or a member of the public can perform. WEG staff evaluate the information and assign a priority ranking based on specified criteria. To assist with this process, an inter-agency database was developed and is used to track each water body.

Based on the review by ACWA staff, the nominated water body is assigned to one of the following categories:

- Data Collection
- Recovery
- Protect and Maintain Water bodies at Risk
- Adequately Protected Water bodies

ACWA staff rank each water body as high, medium, or lower priority based on the information provided with the nomination and any additional data that is available. High priority water bodies may be eligible for project funding through the annual ACWA grant solicitation process.

## 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 streamgage installation. Outreach activities included public meetings, conferences, sportsman shows, brochures, and posters.

---

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

[18] Funding sources have included Clean Water Act-Nonpoint Source Pollution, Coastal Zone Management Act-Coastal Nonpoint Source Pollution, DEC Beach Grant, and AKSSF programs.

[19] For information on ACWA's plan see http://www.dec.state.ak.us/water/acwa/acwa_ranking.htm.

The goal of the program is to empower agency staff and the public to be successful stewards of Alaska's waters, which benefits fish and aquatic habitat. Klein (2011) contains further information about this program.

## HYDROLOGIC DATA NEEDS

The paucity of hydrologic data throughout most of Alaska limits ADF&G's ability to acquire reservations of water (Estes 1998; Brabets 1996). In Water Year 2010 (from October 1, 2009 to September 30, 2010), USGS operated 123 continuous streamgages in Alaska (D. Meyer, USGS Hydrologist, Anchorage, Alaska, October 17, 2010, personal communication; Table 5). This represents approximately one streamgage per 5,000 square miles, which contrasts significantly with the western United States where there is approximately one gage site per 400 square miles.

Baseline hydrologic data are needed by water resource agencies and water users for planning and management. Accurate estimates of available streamflows and water volumes are important information needed to meet these needs. 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 baseline hydrologic data, models must be used to estimate seasonal and long-term streamflow characteristics. 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[20]. Also, ADF&G, DNR, and USGS collaborated to implement a StreamStats[21] 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. After completion of the pilot project, USGS will evaluate the feasibility of statewide implementation.

## ADJUDICATIONS

Since the 2002 MOU was signed between DNR and ADF&G, significant progress has been made toward adjudicating reservation of water applications. However, DNR only has one position performing reservation of water related tasks and the backlog continues to grow, albeit more slowly, as more reservation of water applications are filed than adjudicated. Additional workloads or administrative challenges that arise can take substantial time, further reducing DNR's ability to perform adjudications.

---

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

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

# RECOMMENDATIONS

1) More streamgages are needed to increase hydrologic baseline data across Alaska, especially in southwest, northwest and arctic regions.
2) The linkage between instream flows/water volumes and fish productivity needs to be more extensively investigated. Ideally, 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 fish productivity. The amount of habitat available versus utilized in consideration of fish population dynamics should be monitored to better understand habitat preference and selection. Research on the effects and variability of ground water to fish productivity is also needed.
3) 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 also include monitoring fish population dynamics. If results indicate additional water should be reserved, a supplemental reservation of water application should be completed and filed.
4) Out-of-stream appropriations should be automatically reviewed by DNR once every 10 years, similar to reservations of water. This would allow DNR to better manage Alaska's water resources and potentially avoid water use conflicts.
5) ADF&G should review the status and adequacy of all water rights held by the department. The department should also evaluate whether all water uses are in compliance with existing permits and water rights. Out-of-stream water rights that are not being used may be transferred to reservation of water certificates with DNR's approval.
6) A fundamental goal commonly identified by educators is to achieve public recognition of the purpose and values for maintaining instream flows and lake volumes in Alaska to sustain healthy fish populations. 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.
7) For ACWA to be more effective within ADF&G, a full-time position and an alternative funding source for contributions to the ACWA grant pool is needed. This position would enhance ADF&G's capacity to address fish habitat issues related to water quality and quantity concerns. Information about aquatic habitat issues is also 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.

# ACKNOWLEDGMENTS

To Bob Clark who helped guide the program and this report. To Monte Miller, Shawn Johnson, Jarrod Sowa, Tom Cappiello, Jason Mouw, Stacie Hall, and Jason Hass for their contributions. To Allen Bingham, Adam Craig, and Anton Antonvich for biometric support. To the Division of Sport Fish biologist who responded to countless requests for information and to Joanne MacClellan for her expertise and patience throughout the writing process.

# 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.

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.

Harding, R. D., R. P. Marshall, and P. D. Bangs. 2009. Abundance, length, age, mortality, and maximum sustained yield of cutthroat trout at Turner and Baranof lakes, Southeast Alaska, 1994 through 2003. Alaska Department of Fish and Game, Fishery Data Series No. 09-69, 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. 2011. Estimates of participation, catch, and harvest in Alaska sport fisheries during 2010. Alaska Department of Fish and Game, Fishery Data Series No. 11-60, Anchorage.

Johnson, J., and P. Blanche. 2011. Catalog of waters important for spawning, rearing, or migration of anadromous fishes - Arctic region, effective June 1, 2011. Alaska Department of Fish and Game, Special Publication No. 11-04, Anchorage.

Klein, J. 2011. Instream flow protection in Alaska, 1999-2009. Alaska Department of Fish and Game, Special Publication No. 11-01, 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.

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).

# REFERENCES CITED (Continued)

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

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

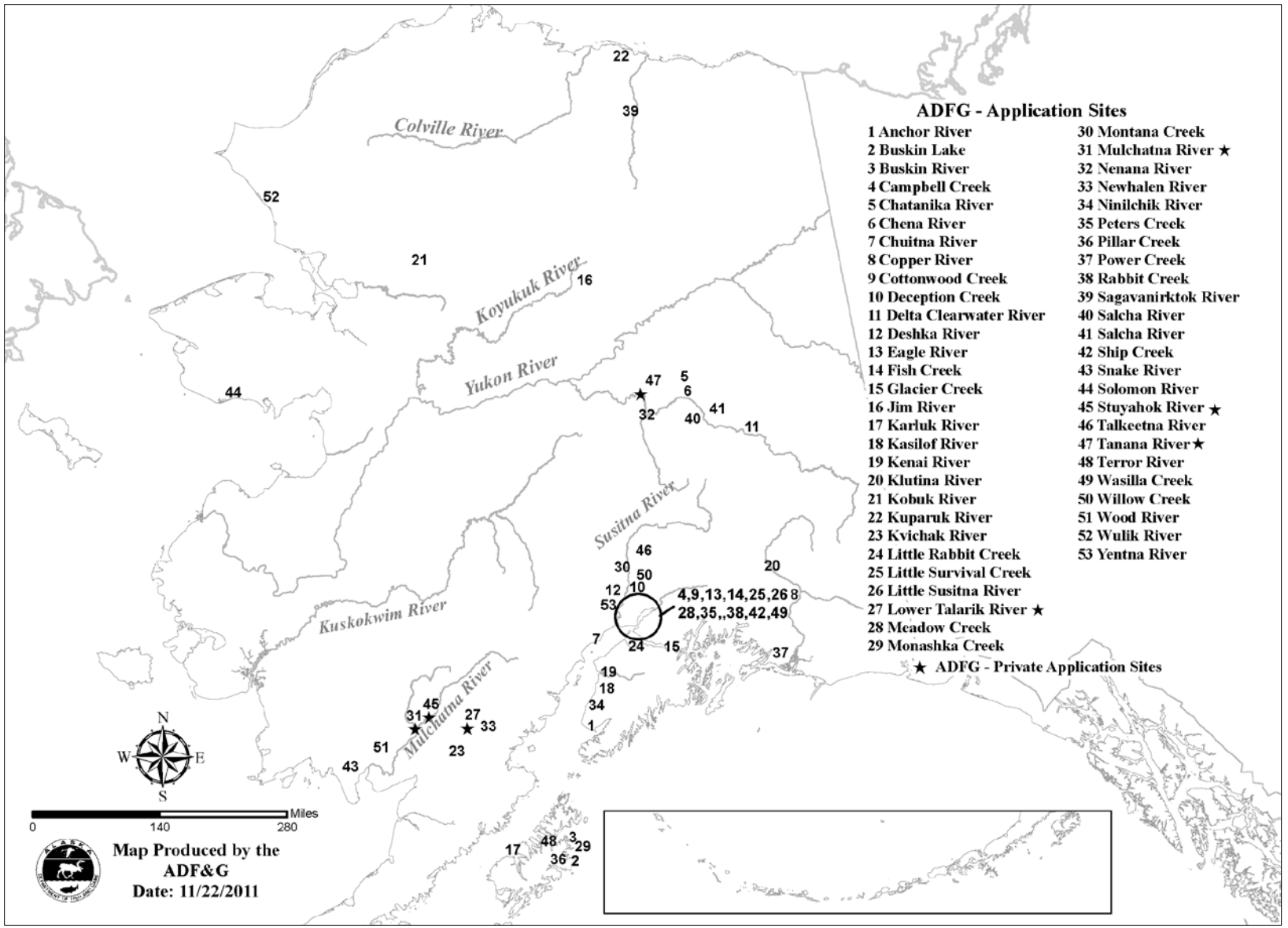


Figure 2.–Location of ADF&G reservation of water sites in Alaska except Southeast.

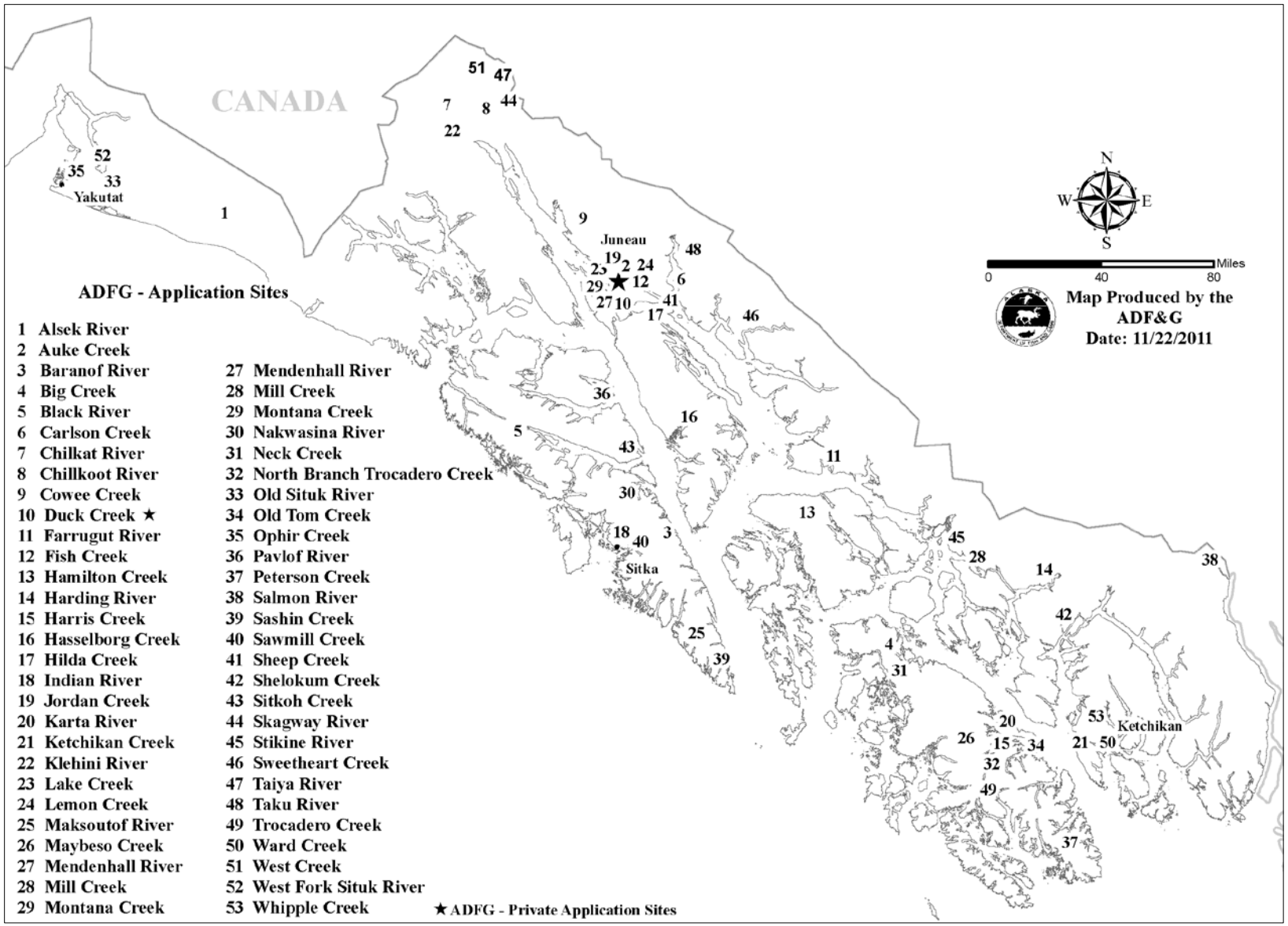


Figure 3.–Location of ADF&G reservation of water sites in Southeast Alaska.

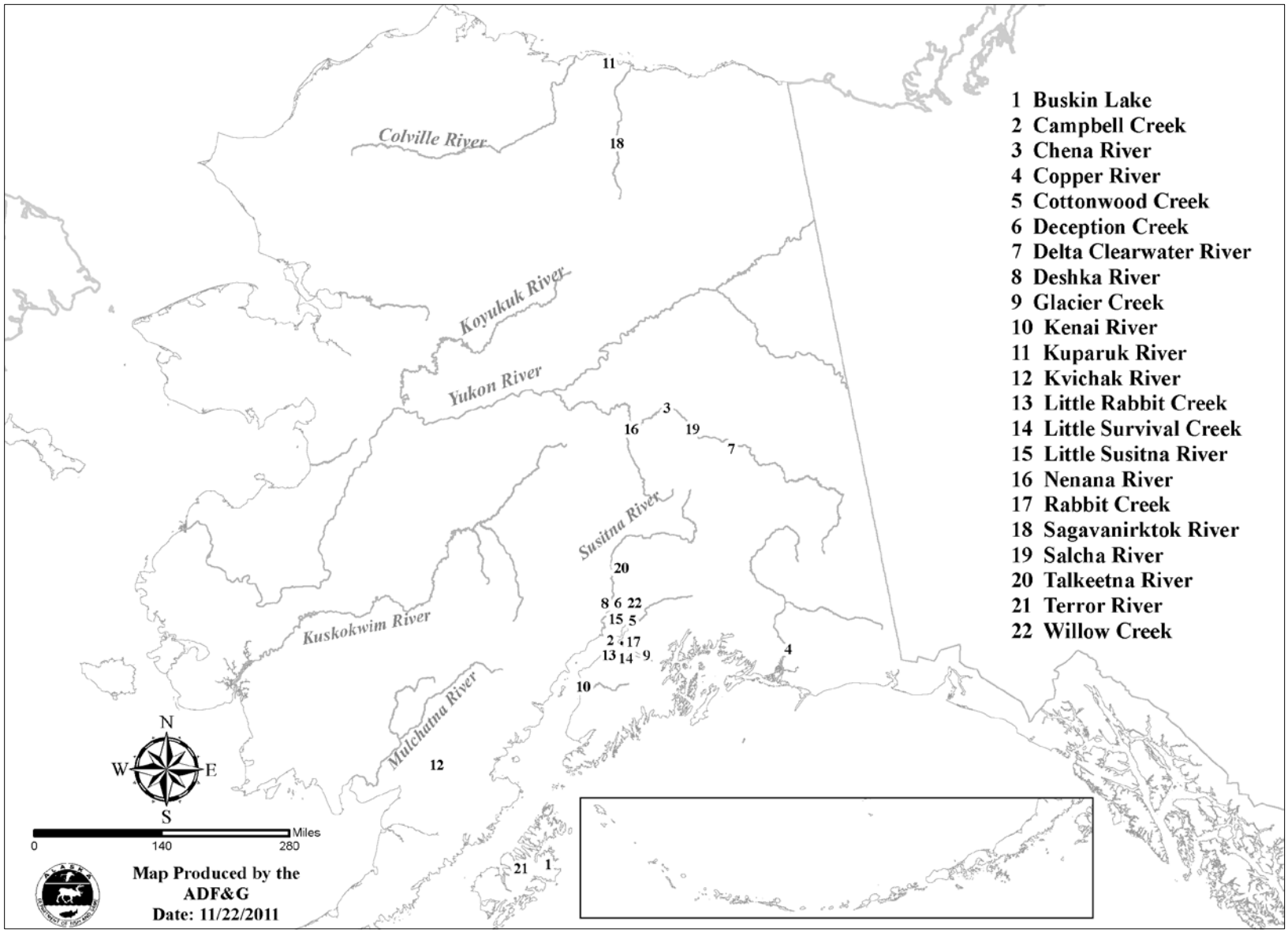


Figure 4.–Location of ADF&G certificates of reservation of water in Alaska except Southeast.

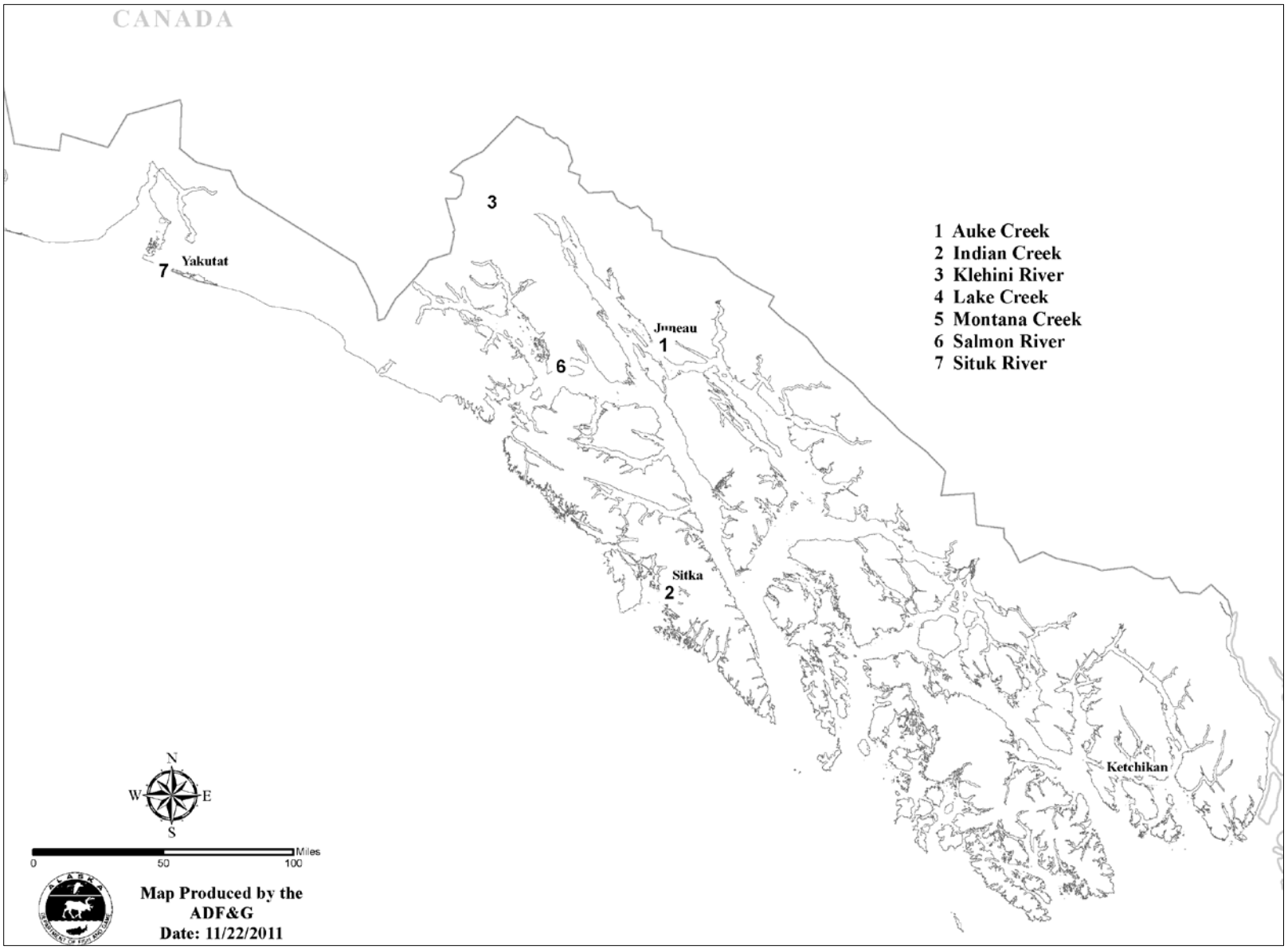


Figure 5.–Location of ADF&G certificates of reservation of water sites in Southeast Alaska.

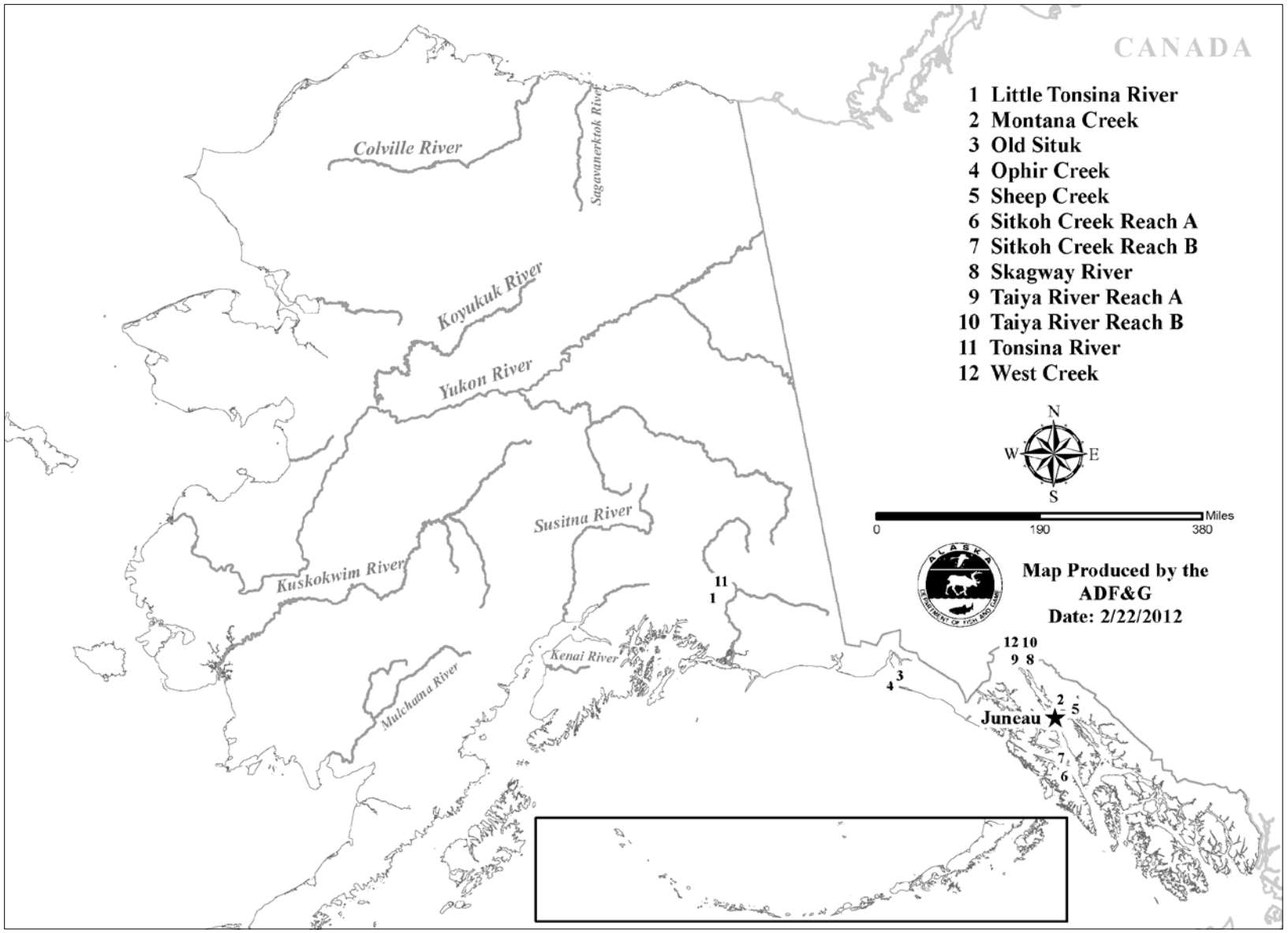


Figure 6.–Location of ADF&G reservation of water sites filed in 2010.

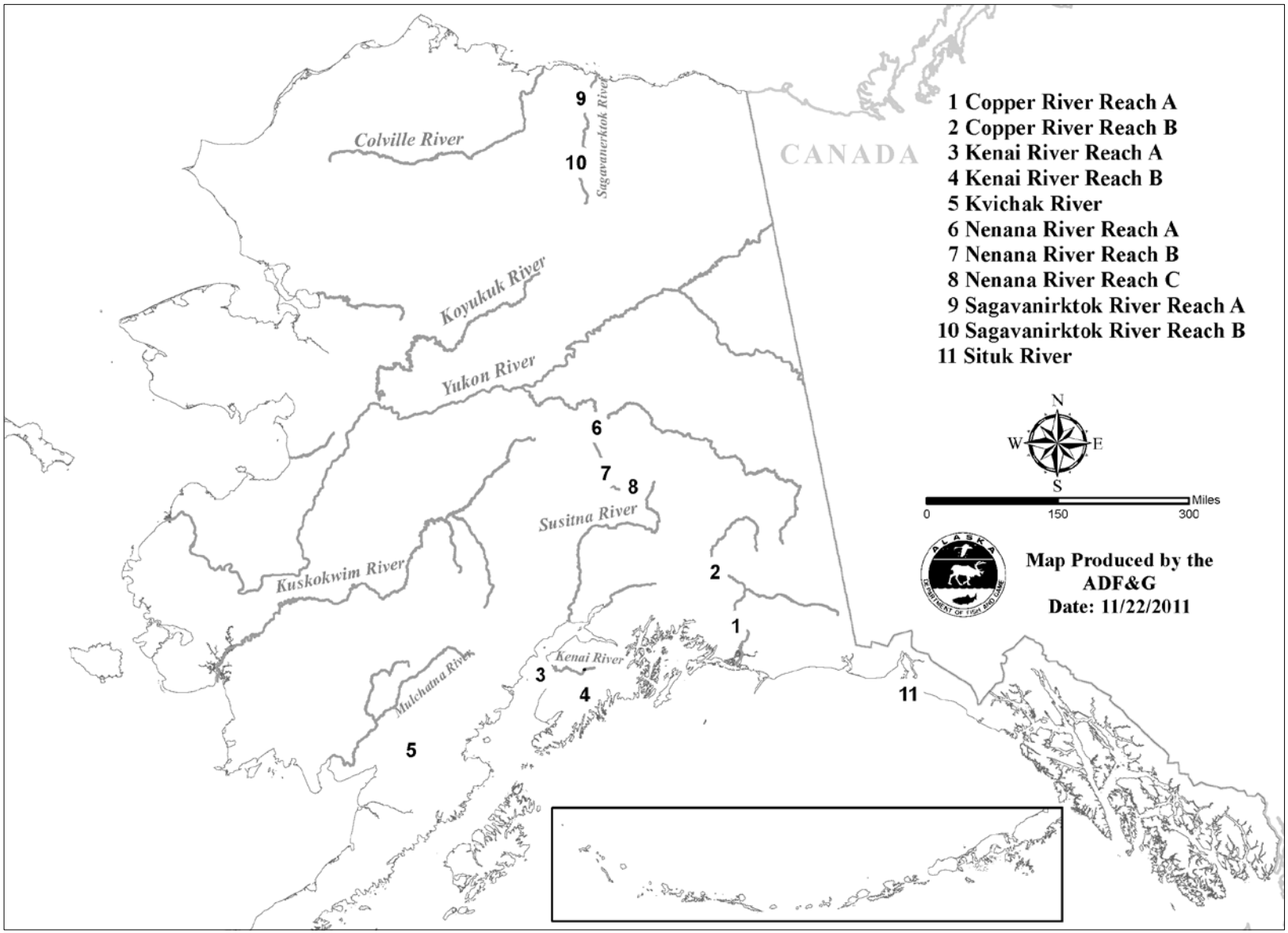


Figure 7.–Location of ADF&G certificates of reservation of water sites granted in 2010.

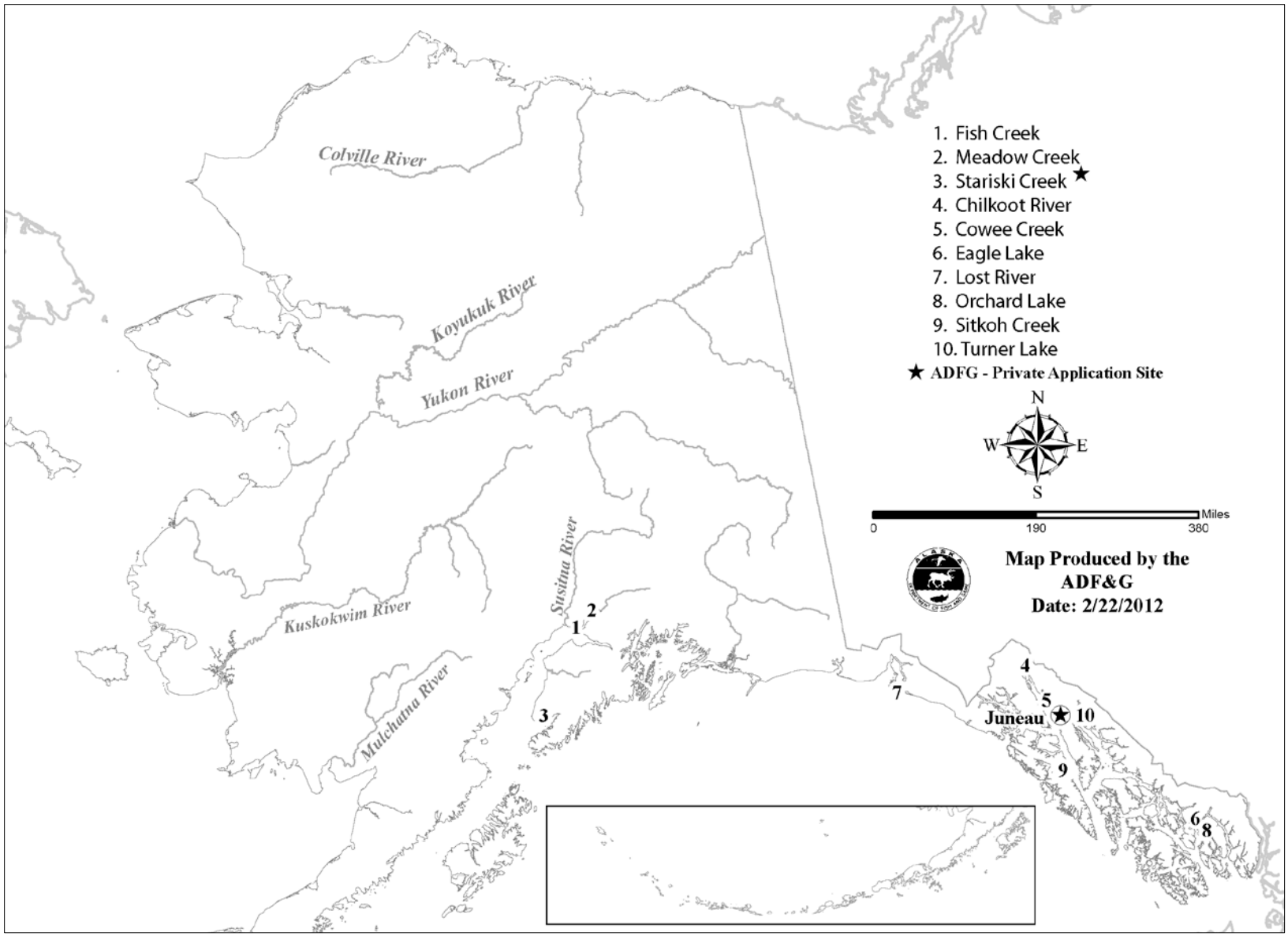


Figure 8.–Location of SARCU hydrologic projects in 2010.

Table 1.–Summary of all reservation of water applications filed and granted as of December 2010.

| Organization | Rivers/streams Filed | Lakes Filed | Adjudicated |
|---|---|---|---|
| ADF&G | 129 | 1 | 40 |
| U.S. Fish and Wildlife Service | 57 | 140 | |
| Bureau of Land Management | 17 | | 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 of the 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 | 1 | 2 |

*Source*: Kim Sager, Natural Resource Specialist, DNR, May 2, 2011.

Table 2.–Summary of ADF&G reservation of water applications filed in 2010.

| Map ID | DNR LAS No.[a] | Name | Date Application Received |
|---|---|---|---|
| 1 | 27844 | Little Tonsina River | 9/30/2010 |
| 2 | 27786 | Montana Creek | 8/13/2010 |
| 3 | 27904 | Old Situk River | 12/15/2010 |
| 4 | 27867 | Ophir Creek | 10/25/2010 |
| 5 | 27855 | Sheep Creek | 10/13/2010 |
| 6 | 27864 | Sitkoh Creek Reach A | 10/25/2010 |
| 7 | 27865 | Sitkoh Creek Reach B | 10/25/2010 |
| 8 | 27866 | Skagway River | 10/25/2010 |
| 9 | 27863 | Taiya River Reach A | 10/25/2010 |
| 10 | 27903 | Taiya River Reach B | 12/15/2010 |
| 11 | 27843 | Tonsina River | 9/30/2010 |
| 12 | 27868 | West Creek | 10/25/2010 |

*Note:* See figure 6 for site locations.

[a] The Land Administration System (LAS) is managed by DNR to provided case file summaries and abstracts of information depicted on the State Status Plat.

Table 3.–Summary of ADF&G reservation of water applications granted in 2010.

| Map ID | DNR LAS No. | Name | Priority Date | Adjudicated Date |
|---|---|---|---|---|
| 1 | LAS 22407 | Copper River Reach A | 12/28/1998 | 12/28/2010 |
| 2 | LAS 22405 | Copper River Reach B | 12/28/1998 | 12/28/2010 |
| 3 | LAS 12677 | Kenai River Reach A | 2/5/1990 | 2/1/2010 |
| 4 | LAS 12676 | Kenai River Reach B | 2/5/1990 | 2/2/2010 |
| 5 | LAS 24383 | Kvichak River | 7/28/2003 | 4/14/2010 |
| 6 | LAS 20285 | Nenana River Reach A | 5/9/1996 | 10/20/2010 |
| 7 | LAS 20283 | Nenana River Reach B | 5/9/1996 | 10/20/2010 |
| 8 | LAS 20277 | Nenana River Reach C | 5/9/1996 | 10/20/2010 |
| 9 | LAS 20644 | Sagavanirktok River Reach A | 2/3/1995 | 5/5/2010 |
| 10 | LAS 20645 | Sagavanirktok River Reach B | 2/3/1995 | 5/5/2010 |
| 11 | LAS 21291 | Situk River | 2/3/1995 | 2/1/2010 |

*Note:* See figure 7 for site locations.

Table 4.–Summary of Federal Energy Regulatory Commission hydroelectric and hydrokinetic projects in Alaska monitored by ADF&G during 2010.

| 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 | 12619 | Proposed hydroelectric |
| Gartina Falls | DI09-7 | Proposed hydroelectric |
| Baranof Warm Springs | DI09-14 | Proposed hydroelectric |
| Neck Lake | DI10-5 | 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 |
| Dry Spruce | 1432 | Licensed hydroelectric |
| Salmon Creek | 2307 | Licensed hydroelectric |
| Black Bear | 10440 | Licensed hydroelectric |
| Ketchikan Lakes | 420 | Licensed hydroelectric |
| Swan Lake | 2911 | Licensed hydroelectric |
| Lake Dorothy | 12379 | Licensed hydroelectric |
| Reynolds Creek | 11480 | Under construction hydroelectric |
| Whitman Lake | 11841 | Under construction hydroelectric |
| Tyee | 3015 | Licensed hydroelectric |
| Mahoney Lake | 11393 | Under construction hydroelectric |
| Jetty Lake | 3017 | Licensed hydroelectric |
| Burnett River Hatchery | 10773 | 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 |
| Port Fredrick | 13512 | Proposed hydokinetic-Tidal |
| Icy Passage Tidal | 13605 | Proposed hydokinetic-Tidal |

-continued-

Table 4.–Page 2 of 2.

| Project | FERC No. | Status |
|---|---|---|
| Killisnoo Tidal Energy | 13823 | Proposed hydokinetic-Tidal |
| Yeldagalga Creek | 14115 | Proposed hydroelectric |
| Moira Sound Hydroelectric | 14285 | Proposed hydroelectric |
| Sunrise Lake | 14296 | Proposed hydroelectric |
| Water Supply Creek | Not Determined | Proposed hydroelectric |
| Triangle Lake-Metlakatla | Not Determined | Proposed hydroelectric |
| ***Southcentral*** | | |
| Allison Lake | 13124 | Proposed hydroelectric |
| Old Harbor | 13272 | Proposed hydroelectric |
| Glacier Fork | 13327 | Proposed hydroelectric |
| Falls Creek | 13211 | Proposed hydroelectric |
| Grant Lake | 13212 | Proposed hydroelectric |
| Snyder Falls Creek | 13328 | Proposed hydroelectric |
| Chakachamna Lake | 12660 | Proposed hydroelectric |
| Power Creek | 11243 | Licensed hydroelectric |
| Bradley Lake | 8221 | Licensed hydroelectric |
| Solomon Gulch | 2742 | Licensed hydroelectric |
| Silver Lake | 13717 | Proposed hydroelectric |
| Chignik | 620 | Licensed hydroelectric |
| Terror Lake | 2743 | Licensed hydroelectric |
| Kvichak River-Igiugig | 13511 | Proposed hydrokinetic-river |
| Cooper Lake | 2170 | Relicensed |
| Humpback Creek | 8889 | Licensed-modifications under construction |
| Cook Inlet, #12679 | 12679 | Proposed hydrokinetic-tidal |
| Turnagain Arm #13509 | 13509 | Proposed hydrokinetic-tidal |
| East Forelands Tidal Energy | 13821 | Proposed hydrokinetic-tidal |
| Pedro Bay | Not-Determined | Proposed hydroelectric |
| Susitna-Watana | 14241 | Proposed hydroelectric |
| Chikuminuk | Not-Determined | Proposed hydroelectric |
| ***Interior*** | | |
| Kogoluktuk River | 13286 | Proposed hydroelectric |
| Shungnak River | 13299 | 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-Nenana | 13883 | Proposed hydrokinetic-river |
| Tanana River-Whitestone | 13305 | Proposed hydrokinetic-river |

Table 5.–Summary of U.S. Geological Survey streamgage sites in Alaska as of September 30, 2010.

| Number of streamgages | Period of Record (Years) |
|---|---|
| 26 | 0 < 1[a] |
| 132 | 1 to < 5 |
| 109 | 5 to < 10 |
| 123 | 10 to < 20 |
| 100 | 20 to < 50 |
| 13 | ≥ 50 |
| Total | 503 |
| Total active in Water Year 2010 | 120 |
| Total active in Southeast | 26 |
| Total active in Southcentral | 42 |
| Total active in Southwest, Northwest, Yukon and Arctic | 52 |

*Source:* D. Meyer, USGS Hydrologist, Anchorage, Alaska, February 23, 2012, personal communication.

[a] The number of streamgages with less than one year of record are difficult to enumerate with existing database.

# APPENDIX A
# ALASKA CLEAN WATER ACTIONS GRANTS – FY10
# PROJECT DESCRIPTIONS

Appendix A1.–Alaska Clean Water Actions Grants, FY10, and project descriptions.

Below are summaries of the Alaska Clean Water Actions (ACWA) Grants for projects starting in July 2009 and finishing in June 2010. The summaries are arranged by region of the state and include the contact information for the group conducting the project.

## Southeast Region

**Granite Creek Recovery and TMDL Implementation,** City and Borough of Sitka, $23,050

This project addresses an ACWA Waterbody Recovery priority. Granite Creek is an impaired waterbody from turbidity and suspended sediment resulting from gravel mining operations. Plans for recovery were approved in September 2002. This project will focus on several activities designed to continue improving the water quality of Granite Creek including riparian buffer protection, best management practices (BMP) installation and maintenance, and water quality monitoring. This project will also calculate sediment load reductions to Granite Creek and the effectiveness of sediment controls with the goal of having Granite Creek meet water quality standards and removing the impairment status. Project reports will be developed addressing results of described project tasks. Contact: Mark Buggins, 907- 966-2256.

**Juneau Stormwater Best Management Practices Demonstration Sites,** Juneau Watershed Partnership (JWP), $12,220

This project addresses an ACWA Waterbody Stewardship priority. The project will design and construct two stormwater "Best Management Practices" (BMPs) demonstration sites in Juneau in partnership with the City and Borough of Juneau. The type of stormwater treatment selected will be based on the site specific conditions at each of the demonstration site locations. Anticipated stormwater treatments for the sites include biofiltration swales, infiltration basins and rain gardens. The JWP will use the sites to help educate local developers and landowners on ways to effectively treat stormwater. The JWP will conduct long-term maintenance and monitoring of the sites for effectiveness. Contact: Beverly Schoonover, 907-586-6853.

**Onemile (Holgate) Creek Discharge Project** (Haines), Takshanuk Watershed Council (TWC), $14,256

This project addresses an ACWA Waterbody Protection priority. This project will protect and maintain anadromous fish and wildlife habitat through conducting stream gauging to establish an instream flow reservation with ADF&G's Sport Fish Division. TWC will continue to collect discharge measurements using USGS protocols to capture the flow characteristics at the range of flows during all seasons, download gauge data, and provide it to the ADF&G to be used for an instream flow reservation. This will be the third of the five years required for filing an instream flow reservation. Contact: Emily Seward, 907-766-3542.

**Sawmill Creek Discharge and Sediment Study** (Haines), Takshanuk Watershed Council (TWC), $18,248

This project addresses an ACWA Waterbody Restoration priority. This project will continue to work in partnership with ADF&G Sport Fish Division to conduct stream gauging to establish an instream flow reservation. TWC will continue to collect discharge measurements using USGS protocols to capture the flow characteristics at the range of flows during all seasons, download gauge data, and provide it to the ADF&G to be used for an instream flow reservation. This will be the third of the five years required for filing an instream flow reservation. The project will also focus on removing previously identified sediment sources to the creek. Removal of sand piles from adjacent stream banks, using sediment traps to measure direct inputs and monitoring of changes to snow plow routes are anticipated. Contact: Emily Seward, 907-766-3542.

**Trends Monitoring of Fish Habitat Conditions on Private Timberlands in SE Alaska**, Sealaska Corp., $24,400

This project addresses an ACWA Stewardship priority. This ongoing project will aid in determining how well forestry practices protect fish habitat in SE Alaska timberlands. The objectives of this project are to: 1) continue the status and trend monitoring of fish habitat conditions that was initiated by the forest industry during the 1990s and reestablished jointly with the State and the forest industry through the ACWA program during 2003-2009; 2) continued maintenance of an existing long-term database (15 year period) on private timberlands in Southeast Alaska that is transparent and accessible to all interested parties and; 3) provide data for a continued evaluation of the effectiveness of the Forest Resources and Practices Act (FRPA) buffer zones to protect aquatic habitat. This project will directly benefit the FRPA adaptive management program by providing long-term monitoring data and analyses for evaluating the effectiveness of FRPA best management practices (BMPs) to protect fish habitat and water quality in streams. Results will facilitate a state resource agency evaluation of forestry BMP effectiveness. Contact: Nathan Soboleff, (907) 586-9278.

**Water Quality Monitoring Sandy Beach**, (Juneau) City and Borough of Juneau (CBJ), $15,641

This project addresses an ACWA Stewardship priority. Sandy Beach is located in Douglas, in a popular recreation area across Gastineau Channel from Juneau. Sandy Beach is the site of many passive and active recreational activities, including dog walking and swimming during sunny weather events. The City and Borough of Juneau (CBJ) will monitor Sandy Beach for fecal coliform and enterococci bacteria indicators of fecal contamination. CBJ and ADEC will cooperate in collecting samples and will meet with ADEC periodically to review data and discuss opportunities for controlling potential fecal contamination that may be detected during water quality monitoring. The CBJ will notify the public through signage to protect the health and safety of users when sampling results indicate bacteria contamination. Contact: Kevin Brady, 907-364-3388.

## South Central Region

**Developing a Clean Harbor Certification Program,** Cook Inletkeeper, **$**49,124

This project addresses an ACWA Stewardship priority. The project designs and implements a pilot Clean Harbor Certification Program for Alaska. Based on examples of similar programs in the Lower 48 and abroad, this project will protect water quality and living marine resources by: (1) designing a pilot Clean Harbor Program using a certification process incorporating Best Management Practices (BMPs); (2) developing and distributing outreach and education materials for the Clean Harbor Certification process; (3) implementing the Certification process as a pilot Certification Program in Homer and Seldovia harbors; and (4) assessing the transferability of the pilot Clean Harbor Certification Program to a statewide program. Contact: Rachel Lord: 907-235-4068 ext. 29.

**FRPA Region II Effectiveness Monitoring**, Aquatic Restoration & Research Institute (ARRI), $34,605

This project addresses an ACWA Stewardship priority. This project continues Forest Resources and Practices Act (FRPA) effectiveness monitoring within Forestry Region II. Effectiveness monitoring will be conducted by obtaining pre-timber harvest stream data at four locations within the Matanuska-Susitna Borough (MSB). The sampling plan includes measures of stream physical, chemical, and biological characteristics. Pre and post-timber harvest conditions within a stream are compared for a paired sampling approach. Previous sampling has provided a description of reference conditions in small upland stream systems, but these data cannot be used to assess impacts to other stream types. Pre – timber harvest sampling will provide a full season of data for small lowland stream systems subject to future logging. Contact: Jeff Davis, (907) 733-5432.

**Jewel Lake Fecal Coliform Assessment**, Anchorage Waterways Council (AWC), $33,776

This project addresses an ACWA Waterbody Recovery priority. Jewel Lake is in need of recovery from fecal coliform bacteria due to urban runoff pollution. Preliminary data from the 2008-2009 sampling season suggest concentrations have improved. This project will serve as the second year of data collection needed to verify whether Jewel Lake is meeting the fecal coliform water quality standard and can potentially be delisted as an impaired waterbody. Sampling will begin in July 2009 and will consist of a minimum of 207 randomly generated sampling points, with 9 points being sampled each week, for approximately 5 months (23 weeks) of ice-free conditions. In addition to fecal coliform assessment, AWC will work to identify potential bacteria sources and assess the use of best management practices along the lakeshore to improve water quality. Contact: Kate Malloy, (907) 272-7335 ext 2.

**Kenai River Agency Baseline Water Quality Monitoring**, Kenai Watershed Forum (KWF), $23,015

This project addresses an ACWA Waterbody Protection priority. The Kenai River is one of the premier commercial and sportfish rivers in southcentral Alaska. The river was determined to be impaired in 2006 for petroleum hydrocarbons from outboard motor boat activity. Understanding the extent of hydrocarbons throughout the river system is needed. Significant monitoring has been conducted ; data from this project will provide a comprehensive picture of the level of hydrocarbons in the Kenai River watershed. Contact: James Czarnezki, (907) 260-5478.

**Little Susitna River Hydrocarbon Evaluation**, Aquatic Restoration & Research Institute (ARRI), $85,727

This project addresses an ACWA Waterbody Protection priority. Located in the Matanuska-Susitna Borough, the Little Susitna River is an important recreational and sportfish river. Through a previous ACWA grant, ARRI sampling in 2007 and 2008 found elevated levels of petroleum hydrocarbon and possibly turbidity that exceeded state standards. Further study is needed to better understand the influence of boat motor type and operation to water quality. Project tasks include: (1) further quantifying the spatial and temporal distribution of total aromatic hydrocarbon (TAH) concentrations adjacent to the boat launch and campground (Public Use Facility)and to determine the relationship between 2-stroke motor use, stream flow, and TAH concentrations in the Little Susitna; (2) measuring stream water turbidity effects from boat use and potential impacts to the biological community. . A project report will be completed that analyzes, evaluates and makes recommendations based upon the data collected. Contact: Jeff Davis, (907) 733-5432.

**Monitoring Bacteria Levels on Homer Beaches**, Cook Inlet Keeper (CIK), $21,602
This project addresses an ACWA Stewardship priority. Beaches in the Homer area experience heavy recreation use during the summer months by local residents and tourists. This project will monitor the bacteria levels at Mariner Park during its peak-use and institute a public notification system when bacteria levels raise public health concerns. This will ensure protection of public health by all Homer beach users. Contact: Rachel Lord, (907) 235-4068 ext, 29.

**Rescue Me: Water's Message to the Community,** Friends of Mat-Su, $31,775
This project addresses an ACWA Protection priority for Wasilla Lake. The project will conduct a lakeshore restoration demonstration project and a targeted year-long outreach campaign to residents and commercial property owners on ways to protect water quality and reduce runoff pollution to the lake. The project also works with local government officials to draft water quality ordinances for adoption. The project partners include the City of Wasilla, the Wasilla Soil and Water Conservation District and the Mat-Su Borough. Increased awareness on the benefits of water quality protection will help to ensure best management practices are implemented. Contact: Mimi Peabody, 907-746-0128.

**Stream Temperature Monitoring Network – Cook Inlet**, Cook Inlet Keeper (CIK), $69,680

This project addresses an ACWA Stewardship priority and will collect the second year of 5 years of data for this project. Water temperature is one of the most significant factors in the health of stream ecosystems. For salmon specifically, temperature affects survivorship of eggs and fry, rate of respiration and metabolism, timing of migration, and resistance to disease and pollution. There is an urgent need to assess rising temperatures in Alaska salmon habitats because temperature plays a critical role in salmonid habitat protection, reproduction and survivorship; and because wild, healthy salmon support vital sport, commercial, subsistence and personal use fisheries across Alaska. Recently, a partnership of state, federal and nonprofit organizations has developed recommended protocols for collecting stream temperature data as well as a system for selecting temperature monitoring sites. The main objectives of this project are to 1) continue implementing a Stream Temperature Monitoring Network to collect consistent, comparable temperature data for Cook Inlet's salmon streams; 2) analyze collected data to establish natural conditions and generate GIS maps of the Cook Inlet basin to illustrate temperature patterns; and 3) provide a user-friendly template to transfer water temperature protocols to other salmon-bearing systems across the state. The Stream Temperature Monitoring Network in Cook Inlet will allow fisheries managers and land-use planners to identify watershed characteristics with the greatest potential to buffer salmon habitats from rising air and water temperatures, and provide the knowledge and data needed to prioritize sites for future research, protection and restoration actions. Contact: Sue Mauger, (907) 235-4068 ext, 24.

**Watermelon Trail Upgrade at Beaver Creek Crossing,** Homer Soil and Water Conservation District, $26,825

This project addresses an ACWA Protection priority. This project will protect the Anchor River watershed by installing a bridge and re-rerouting the existing ATV trail out of the stream to reduce sediment pollution. The old stream crossing will be rehabilitated and signs installed to apprise users of the new approach. Contact:  Alder Seaman, (907) 235-8177 x5.

## Western Region

**Dillingham Beach Monitoring Program**, Bristol Bay Coastal Resource Service Area, $10,000
This project addresses an ACWA Stewardship priority. Kanakanak Beach is heavily used for salmon subsistence and general recreation including beach combing, picnics, and boat-launching. The area of concern has nine subdivisions with forty three older on-site septic systems on lots of less than one acre in size that drain into Squaw Creek which is near Kanakanak Beach. This project will fund a monitoring program for Kanakanak Beach including a public notification and advisory program coordinated with the DEC Beach Grant Manager. The summer 2009 sampling will provide a better picture of the persistence of the bacteria pollution previously documented as compared to State Water Quality Standards for protection of human health and the environment. Contact: Andrew deValpine, (907) 842-2666.

**Stormwater Collection-Sediment Separators,** City of Unalaska, $45,000

This project addresses an ACWA Stewardship priority. The project will complete the engineering and install three (3) sediment separators in the City's stormwater collection system. The purpose of the project is to protect a local salmon stream that runs through the City of Unalaska by reducing sediment laden stormwater from directly discharging to the stream. This is the first year of a two year project. The second year conducts the actual installation of the sediment separators. Contact: J.R. Pearson, 907-581-1260.