Fishery Data Series No. 12-58

Salmon and Salmon Habitat Surveys in Prioritized Waters of Southeast Alaska (2001–2003)

by

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and

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October 2012

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

Symbols and Abbreviations

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Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

Measures (fisheries)

fork length	FL
mideye to fork	MEF
mideye to tail fork	METF
standard length	SL
total length	TL

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

FISHERY DATA SERIES NO. 12-58

SALMON AND SALMON HABITAT SURVEYS IN PRIORITIZED WATERS OF SOUTHEAST ALASKA (2001–2003)

by

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ABSTRACT

A prioritization strategy involving evaluation of information needs, expert input, and landscape features was used to direct aquatic habitat surveys and fish distribution mapping efforts in 12 high priority watersheds in Southeast Alaska. During 2001–2003 over 3,600 GPS waypoints were captured while mapping 171.5 km of stream, river, side channel, and lake or pond habitat. Habitats were classified into distinct reaches according to fluvial process group and channel type. The average gradient, total length, and density of large woody debris and macro pools were calculated for prioritized waters within watersheds. Mapping of salmonid distribution patterns often occurred concurrently with surveys to map and classify stream networks, depending on individual watershed information needs. A total of 385 GPS waypoints allowed mapping of over 450 instances of fish capture or effort. Nearly 1,800 anadromous and resident salmonids were captured or observed during these efforts. The collection of spatially specific fish and fish habitat data would provide updated information helpful in addressing a variety of salmon and salmon habitat issues.

Key words: anadromous, aquatic, anadromous waters catalog, channel type, fluvial, GIS, GPS, habitat, large woody debris, macro-pools, process group, salmon, Southeast Alaska, stream habitat survey, watershed.

INTRODUCTION

Southeast Alaska (SEAK) encompasses one of the most significant areas of temperate rain forest in the world, including a unique assemblage of intact coastal watersheds and associated fresh water, estuarine, and marine habitats. Cumulatively, these watered habitats support abundant populations of 5 species of Pacific salmon: Chinook salmon *Oncorhynchus tshawytscha*, coho salmon *O. kisutch*, sockeye salmon *O. nerka*, pink salmon *O. gorbuscha*, and chum salmon *O. keta*. Individually, they provide a diverse array of habitats supporting critical life history stages of salmon including spawning, rearing, and migration. Salmon are often considered keystone species in ecosystems where they are abundant (Wilson and Halupka 1995; Hyatt and Godbout 2000; Helfield and Naiman 2006). The significant production of salmonids in SEAK contributes substantially to the complex food webs, sustaining healthy ecosystems, as well as the economic and social linkages important to the surrounding communities. In this regard, salmon in SEAK may be keystone species both ecologically as well as socially and economically.

Habitat degradation continues to be one of the leading factors in the decline of salmon in the Pacific Northwest (Beechie et al. 1994; Thompson and Lee 2000; Rosenfeld 2003; Kauffmann and Hughes 2006). Although much of Alaska still remains in a near-pristine state, it would be naïve and potentially damaging to ignore challenges facing fishery management agencies in the Pacific Northwest (and likely across the globe) where they look to offset the degradation or loss of fish habitat as fisheries decline. The battle to sustain and protect both salmon and habitat must include land management considerations and protection measures. Indeed, the single most effective habitat oriented action for salmon sustainability may be to protect existing good habitat (Frissel 1993; Lichatowich et al. 2000).

The Alaska State Legislature approved the Southeast Sustainable Salmon Fund program (SSSF hereafter) in its fiscal year 2001 appropriations bill. In later years, the program would be restructured and renamed (Alaska Sustainable Salmon Fund or AKSSF) to reflect statewide strategies. The Sustainable Salmon Fisheries Policy (5 AAC 39.222, SSF Policy hereafter) mandates protection of salmon habitats and requires continued access to these habitats by anadromous fish. Together, the AKSSF and SSSF Policy provided necessary funds and strategic guidance for research and management entities in Alaska to perform inventory, monitoring, and

assessment of salmonid populations and their habitats across Alaska. Ultimately, this would allow the Alaska Department of Fish and Game (ADF&G) to design and implement a program with goals to identify, prioritize, protect and restore habitat that is critical for ensuring sustainable populations and yields of Pacific salmon across Alaska.

In 2001, the SSSF provided funds necessary to initiate efforts jointly overseen by the former Habitat & Restoration Division of ADF&G (ADF&G, hereafter) and ADF&G, Division of Sport Fish (ADF&G-SF), with cooperation from local, state, federal, and tribal government landowners and stakeholders. The goal was to identify and classify the potential threats/risks to salmonids in SEAK and further develop research and inventory projects that could address the individual threats or risks to specific areas of SEAK. This effort was identified as the Annual Habitat Condition Assessment (AHCA) and resulted in a regional identification and prioritization of existing and near-term needs for ensuring sustainable populations of salmonids in SEAK, generally constrained to non-harvest issues (e.g., fish passage, adequate fish habitat, etc.). The combined knowledge and applied work experience of area and regional staff formed the foundation from which 28 elements of "Imminent Needs" (IN) categories were identified; aggregation of these elements led to 4 IN categories: 1) risk from existing roads and trails; 2) risk from near-term development; 3) value based on historic and current salmonid stock assessments; and 4) risk from incomplete documentation or identification of anadromous fish-bearing water bodies.

Multiple projects were identified and funded through the SSSF and AKSSF programs to address these individual categories recognizing the fact that different data collection protocols would need to be employed based on specific needs. All of these projects evolved into multi-year efforts and included: 1) Road Condition-Fish Passage Monitoring; 2) Nearshore Marine Habitat Surveys; 3) Transboundary-Sentinel Watershed Monitoring; and 4) Salmon Habitat Surveys in Lakes and Streams.

The Salmon Habitat Surveys in Lakes and Streams Project used available funds and staff to initiate a program of conducting stream habitat surveys and assessments in conjunction with identifying fish distributions on a prioritized list of water bodies in SEAK, and is the focus of this document.

OBJECTIVES

The overall goal of this project was to identify salmonid distribution patterns and conduct habitat inventories and assessments of prioritized watersheds in SEAK. Identification of salmonid distribution patterns would lead to updates of the Anadromous Waters Catalog (AWC) where appropriate, capture ADF&G-SF index area extents and locations, and provide improved information regarding resident salmonids and other fish species. ADF&G-SF index areas are used to estimate instream abundance of salmon in standardized sections (i.e., reaches) of select stream systems, as well as providing dates of peak abundance. Although the ADF&G-SF monitors Chinook salmon with this approach, the focus of this project for index areas was solely on coho salmon and steelhead trout *O. mykiss*. Habitat inventories and assessments will lead to updates of regional hydrography data layers and provide baseline data on riverine metrics that are important to understanding salmonid habitat use and preference. These metrics assist in the evaluation of land use activities that potentially affect aquatic habitats across the Tongass National Forest.

All data collection activities were guided by established protocols using spatial data collection allowing immediate integration with a geographic information system (GIS).

1. WATERSHED PRIORITIZATION: Identify watersheds or portions of watersheds where surveys will take place using a combination of coarse-screening exercises and ADF&G-SF staff input.
2. STREAM HABITAT SURVEYS: Conduct stream habitat surveys in prioritized watersheds and integrate into a GIS.
3. SALMONID DISTRIBUTION AND MAPPING: Collect salmonid distribution information in prioritized watersheds and integrate into a GIS.

STUDY AREA

Southeast Alaska is a large archipelago and a narrow strip of mainland encompassing over 1,000 islands and 30,000 km of shoreline, rugged mountain peaks, and some of the largest glaciers in the world. The area stretches across nearly 1,600 km from Dixon Entrance in the south, northward along the province of British Columbia and the Yukon Territory in Canada, and west to Cape Suckling (Figure 1). The terrain is diverse and abrupt with elevations quickly reaching upwards of 1,200 m within a short distance from sea level, and is caused by the colliding of continental plates subducting to create accreted terrains (Nowacki et al. 2001). The resulting geologies of this landscape are varied and all play a large role in the formation and productivity of both terrestrial and aquatic habitats. The steep terrains force moist air coming off of the Gulf of Alaska quickly upward through orographic lifting (Nowacki et al. 2001), which contributes to significant precipitation in the form of rain and snow. The amount of precipitation in this ecosystem can range from as little as 12 cm to more than 150 cm annually.

The vegetation is dominated by Sitka spruce *Picea sitchensis* and western hemlock *Tsuga heterophylla* in the overstory; other overstory tree species locally common include Western red cedar *Thuja plicata*, yellow or Alaska cedar *Chamaecyparis nootkatensis*, and lodgepole or shore pine *Pinus contorta*. Dominant woody shrub species include ericaceous shrubs (e.g., blueberry, huckleberry, etc.) and several species of alder *Alnus sp.* A large variety of herbaceous species inhabit the understory in this temperate rain forest.

Geologic events and hydrologic activity during the approximately 14,000 years since glacial retreat have carved the SEAK landscape into over 4,500 watersheds, containing a myriad of freshwater habitats including rivers, streams, wetlands, lakes and ponds. The region's largest rivers originate as headwaters in British Columbia and the Yukon Territories and flow through the coastal mountains of SEAK before terminating in the marine waters of Alaska. Island streams and rivers far outnumber mainland systems, but are shorter in length due to the steep terrain of the island archipelago of SEAK.

A minimum of 70,000 km of fluvial (e.g., rivers and streams) habitat exists in SEAK, including rivers and streams of varying origins and geomorphic controls. Lakes and ponds are also numerous throughout SEAK where nearly 25,000 dot the landscape on mainland and island systems alike. The largest lakes exceed 1,000 ha while the smallest ponds are common and often less than 50 m in width in their widest dimension. All of these conditions contribute to the formation of extensive freshwater salmon habitats.

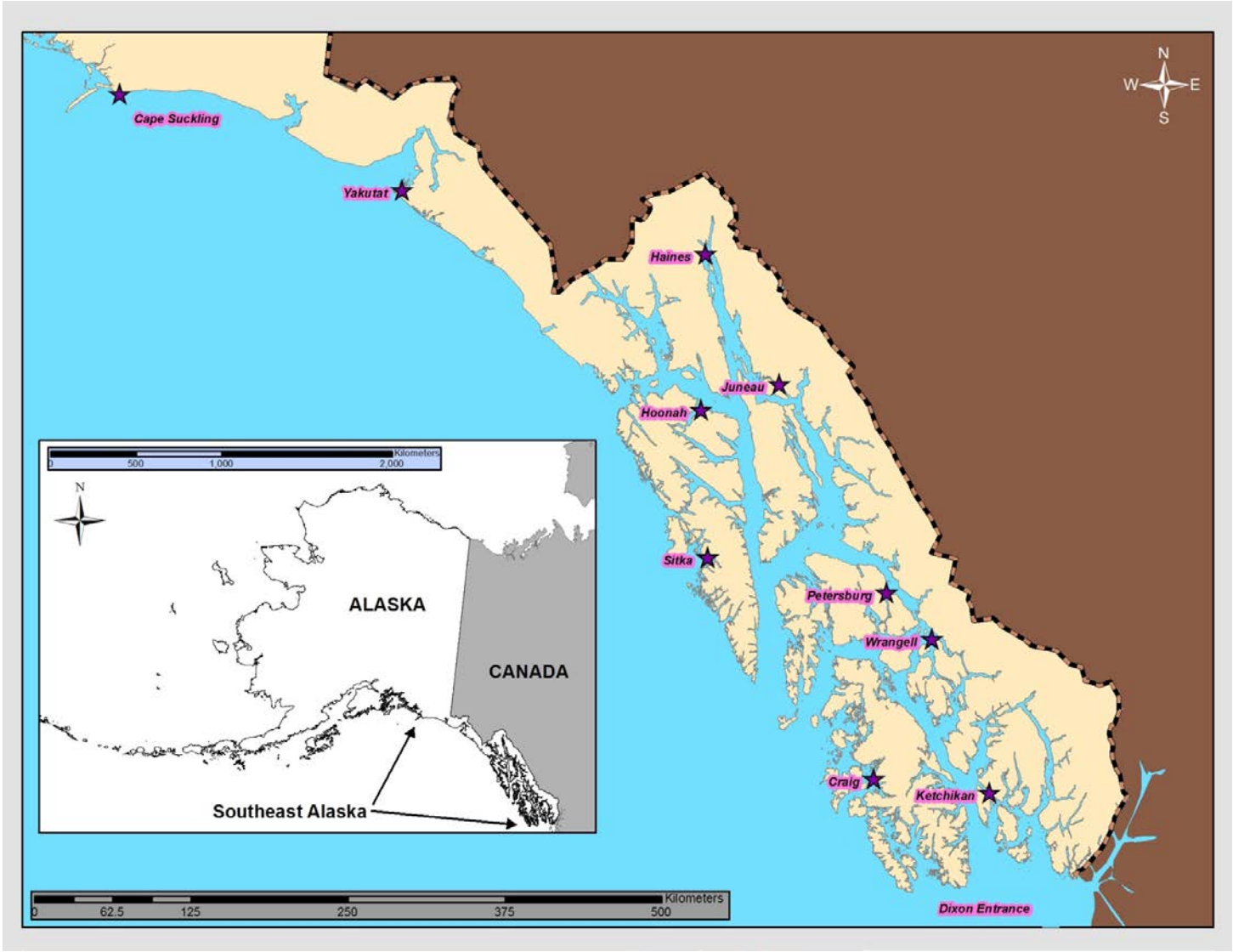

Figure 1.–Geographical extent of project study area in Southeast Alaska.

Landownership across SEAK is primarily administered by the US Forest Service - Tongass National Forest (USFS-TNF), and accounts for over 75% of the terrestrial land area. Other significant land owners in SEAK include the State of Alaska, National Park Service (NPS), regional native corporations, cities and boroughs, and private entities.

Individual Watersheds

The location of all individual watersheds across the entire project study area is depicted in Figure 2; maps of individual watersheds as described below are found in Appendices A1–A12. Watershed summary information and survey types are described in Table 1.

Black Bear Creek – Prince of Wales Island

The Black Bear Creek watershed is located on central Prince of Wales Island, just east and south of Big Salt Lake, and encompasses an area of approximately 4,617 ha (Appendix A1). The Sealaska Regional Corporation is the primary landowner within the watershed, administering over 75% of the land area, which includes the valley floor up to an elevation of approximately 500 m. The USFS-TNF owns the remaining surface lands within the watershed. The Alaska Power and Telephone (AP&T) company operates the Black Bear Lake Hydroelectric system, which draws water from Black Bear Lake. This water then flows into Black Bear Creek. AP&T had identified plans to construct a 2 megawatt "run-of-river" hydroelectric facility on the south fork tributary of Black Bear Creek (Romey and Beamesderfer 2001).

The ADF&G initiated field activities within the watershed, focusing on the area potentially affected by the proposed hydroelectric facility to provide updated and current information regarding resident and anadromous fish use.

Black Bear Creek (AWC Stream Number 103-60-10310) and Black Lake (AWC Number 103-60-10310-0010) provide the most significant anadromous fish habitat within the watershed supporting 4r species of Pacific salmon (coho, sockeye, pink, and chum salmon) and steelhead trout. Five tributaries, all less than 1 km in length, provide additional anadromous fish-bearing habitat, primarily for coho salmon. Resident fish species found within the watershed include Dolly Varden *Salvelinus malma* and cutthroat trout *O. clarkii*. The total mapped stream length within the watershed is approximately 89 km, of which over 11.6 km has been documented with anadromous fishes in the AWC.

Big (108) Creek – Prince of Wales Island

The Big Creek watershed is located on northern Prince of Wales Island, near the community of Whale Pass, and empties into Whale Passage where it drains an area of approximately 3,076 ha (Appendix A2). The USFS-TNF is the primary landowner within the watershed, administering over 70% of the land area; the State of Alaska owns 2 separate parcels of land within the watershed (one at the headwaters upstream and including lands surrounding Twin Island Lake; the other near the estuary and surrounding the community of Whale Pass).

The ADF&G-SF conducts annual index foot surveys for coho salmon on the mainstem of Big Creek (AWC Number 106-30-10800) between the bridge near the estuary and a geomorphic and partial barrier to fish passage downstream of Cavern Lake. ADF&G targeted this portion of the watershed to conduct continuous stream habitat surveys to update the regional hydrography data layers, and also coordinated with ADF&G-SF area staff to identify and demarcate the entire index area using spatial data collection.

Table 1.–Identification of 12 watersheds where various surveys were employed during 2001–2003, Southeast Alaska.

Watershed name	Location	HUC (6th level) identifier)	Existing stock assessment type	Type of survey(s) to be completed in watershed
Black Bear Creek	Prince of Wales Island (POW)	190101030347	None	Fish distribution and mapping;
Big (108) Creek	POW	190101030133	Index – coho foot count	Stream habitat surveys; fish distribution and mapping
Soda Creek	POW	190101030621	None	Stream habitat surveys; fish distribution and mapping
Warm Chuck Creek	Heceta Island	190101030261	Weir-CWT (coho)	Stream habitat surveys; fish distribution and mapping
Ford Arm	Baranof Island	190102030500	Weir (coho, sockeye); index – steelhead snorkel survey	Stream habitat surveys; fish distribution and mapping
Nakwasina River	Baranof Island	190102031105	Index – coho foot count; mark/recapture	Stream habitat surveys; fish distribution and mapping
Cape Yakataga	Mainland – Icy Bay	190104022745 190104022744	None	Fish distribution and mapping
Jordan Creek	Mainland – Juneau	190103010409	None	Stream habitat surveys; fish distribution and mapping
Montana Creek	Mainland – Juneau	190103010403	Index – coho foot count	Stream habitat surveys; fish distribution and mapping
Peterson Creek	Douglas Island – Juneau	190103010900	None	Fish distribution and mapping
Pleasant Bay	Admiralty Island	190102040801	Index – steelhead snorkel survey	Stream habitat surveys; fish distribution and mapping
Petersburg Creek	Kupreanof Island	190102020507	Index – steelhead snorkel survey	Stream habitat surveys; fish distribution and mapping

Figure 2.–Location of individual watersheds within the Southeast Alaska project area where surveys were conducted during 2001–2003.

The Big Creek watershed contains over 64 km of mapped streams, including the mainstem Big Creek (108 Creek as it is known locally), and numerous tributaries of varying length. A total of approximately 6.9 km of anadromous fish stream habitat exists in the watershed. Four lakes in the watershed cover an area of approximately 148 ha, with the largest being Twin Island Lake (approximately 124 ha). Anadromous fish habitat is generally assumed to be confined to the mainstem of Big Creek below Twin Island Lake. Four species of Pacific salmon (coho, sockeye, pink, and chum salmon) and steelhead trout comprise the anadromous fish assemblage in the watershed. Resident salmonids include Dolly Varden.

Soda Bay – Prince of Wales Island

The Soda Bay project area includes 5 individual watersheds that drain into Soda Bay to the north and Natzahini Bay to the south; cumulatively the area encompasses over 8,569 ha (Appendix A3). This area is located on western Prince of Wales Island approximately 3 km from the community of Hydaburg. Sealaska Regional Corporation is the primary landowner in the project area and land use activities include timber harvest, road construction and recreation. The USFS-TNF administers approximately 45% of the project area with similar land use activities.

ADF&G coordinated with the Sealaska Regional Corporation prior to timber harvest activities to assist them in complying with State of Alaska Forest Resources Practices Act (FRPA) and associated Best Management Practices (BMP) as they relate to the protection of salmon and salmon habitats. Efforts by ADF&G and ADF&G-SF focused on conducting stream mapping surveys to update regional hydrography and updating the known distribution of anadromous fish in area waters for incorporation into the AWC.

The Soda Bay project area contains over 98 km of mapped streams, including approximately 23 km of anadromous fish-bearing stream habitat. The most significant anadromous fish streams in the project area include Shelikof Creek (AWC Number 103-40-10090; 3.4 km) and Soda Creek (AWC Number 103-40-10130; 2.5 km). Over 40 lakes are found within the project area, totaling an area of approximately 87 ha. The largest lake is an unnamed water body covering approximately 21.4 ha. Three species of Pacific salmon (coho, pink, and chum salmon) and steelhead trout comprise the anadromous fish assemblage within the project area. Resident salmonids include Dolly Varden and cutthroat trout.

Warm Chuck Creek – Heceta Island

The Chuck Creek project watershed is located on the eastern side of Heceta Island and drains approximately 749 ha before emptying into Warm Chuck Inlet (Appendix A4). The USFS-TNF is the most significant land owner in the watershed, administering nearly 80% of the land area for activities including timber harvest, road construction and recreation. The State of Alaska owns approximately 20% of the watershed, mostly upstream of Chuck Lake.

Chuck Creek (AWC Number 103-80-10310) was part of a coho salmon stock assessment program administered by ADF&G-Commercial Fisheries Division (ADF&G-CF) and ADF&G-SF, where various types of surveys and population assessments have been conducted historically and through 2009. The stock assessment program implemented in 2001 included tagging of juvenile coho salmon with coded wire tags (CWTs), estimating number of adults harvested in commercial and sport fisheries, as well as monitoring of escapement through a weir on Chuck Creek. Detailed description of all coho salmon stock assessment activities associated with the Chuck Creek watershed is provided in Shaul et al. (2003) and McCurdy (2005). ADF&G staff

targeted the Chuck Creek watershed to perform continuous stream habitat surveys to update the regional hydrography data layers and to provide updated and current information regarding anadromous fish habitat for incorporation into the AWC.

The Chuck Creek watershed contains approximately 13.8 km of mapped streams, including over 4.5 km of anadromous fish habitat. The watershed is dominated by karst landform with numerous springs and ground water sources as is typical of these formations (Baichtal and Swanston 1996; Nowacki et al 2001). Two lakes are found in the watershed and total over 64 ha; by far the larger of the two lakes is Chuck Lake, which encompasses nearly 63 ha. Both lakes provide habitat for anadromous and resident fish species. Three species of anadromous Pacific salmon inhabit the watershed (coho, pink, and sockeye salmon), as well as steelhead trout. Resident salmonid species include Dolly Varden and cutthroat trout.

Ford Arm – Chichagof Island

The Ford Arm watershed is located on the western side of Chichagof Island and drains an area of approximately 2,540 ha (Appendix A5). The USFS-TNF owns and administers all lands within the watershed, the most significant portion of which is a part of the West Chichagof-Yakobi Wilderness. The watershed is remote, contains no roads, and access is by boat or plane only.

The Ford Arm watershed is monitored under collaboration between the ADF&G-SF and ADF&G-CF for various stock assessment activities. Clark et al. (1994) and Shaul et al. (*in prep*) provide an overview and description of all Pacific salmon stock assessment activities associated with the Ford Arm watershed; Harding (2005) details index surveys associated with steelhead trout in the Ford Arm watershed. Most notably, the mainstem of Ford Arm Creek downstream of the lake is snorkel surveyed to count steelhead trout as part of an annual index to monitor spawning abundance across SEAK. In addition, a weir has been used on Ford Arm Creek to estimate escapement of coho, sockeye, and pink salmon. ADF&G targeted the Ford Arm watershed to conduct continuous stream habitat surveys to update the regional hydrography data layers and to provide updated and current information regarding anadromous fish habitat for incorporation into the AWC.

The Ford Arm watershed contains approximately 44.4 km of mapped streams, including over 11.3 km of anadromous fish habitat. Ford Arm Creek (AWC Number 113-73-10030) drains Ford Arm Lake and includes approximately 1.4 km of stream length. Eleven lakes encompass over 43 ha, with Ford Arm Lake covering a surface area of 39.4 ha. Only Ford Arm Lake and one other unnamed lake provide habitat for anadromous or resident fish. The anadromous fish species assemblage includes 4 species of Pacific salmon (coho, pink, sockeye, and chum salmon) and steelhead trout. Resident fish species found in the watershed include Dolly Varden and cutthroat trout.

Nakwasina River – Baranof Island

The Nakwasina River watershed is located on the western side of Baranof Island, and empties into Nakwasina Sound approximately 25 km from the community of Sitka (Appendix A6). An adjacent watershed immediately to the south was also considered to be part of the project area. The Nakwasina River watershed drains an area of approximately 8,529 ha, and the Bridge Creek watershed to the south drains an area just over 1,097 ha. The USFS-TNF owns and administers over 95% of the land area across both watersheds; the State of Alaska and several private in-holdings comprise the remaining 5% of land ownership. Land use activities occurring in the

watershed primarily involve recreation, including fishing and hunting. In the past (approximately 1960s), the Nakwasina River watershed was heavily logged with clearcut techniques, primarily on the floodplain including the riparian zone; evidence of tree regeneration and access roads are still readily apparent.

Since 1980, the ADF&G-SF has conducted various stock assessment activities on the Nakwasina River (AWC Number 113-43-10010) to monitor coho salmon production, marine harvest, and spawning escapement (Tydingco 2003). A combination of a juvenile CWT program to estimate the number of adults harvested in marine fisheries, and annual foot index counts and mark-recapture experiments to estimate escapement, allowed ADF&G-SF to address stock assessment questions for the river. The ADF&G targeted the Nakwasina River and the neighboring watershed to conduct continuous stream habitat surveys, in conjunction with identifying potential anadromous fish habitat, in an effort to update regional hydrography data layers and the AWC. In addition, the locations where adult coho salmon were marked and recaptured inriver were spatially identified.

The Nakwasina River watershed contains over 115 km of mapped stream length, including approximately 15.8 km of anadromous fish habitat as identified in the AWC. Six lakes are located within the watershed encompassing an area of over 106 ha, the largest of which is an unnamed lake with a surface area of 54.8 ha. The neighboring Bridge Creek watershed contains 12.41 km of mapped stream length including 3.6 km of anadromous fish habitat. The single lake found in that watershed is approximately 4.1 ha in size. Across both watersheds, 4 species of Pacific salmon (coho, chum, pink, and sockeye salmon) and steelhead trout have been observed, as well as resident Dolly Varden.

Cape Yakataga – Mainland, Icy Bay

The Icy Bay-Cape Yakataga (Cape Yakataga hereafter) project area is located on the mainland of SEAK approximately 163 km north of the community of Yakutat (Appendix A7). The project area includes 2 large glacial-origin mainland watersheds, and one small lowland watershed. The watersheds drain a cumulative area of 101,900 ha, the largest of which is 56,483 ha. Land ownership within the watershed is dominated by various State of Alaska entities (Department of Natural Resources, University of Alaska, and Mental Health Trust) and the Bureau of Land Management (BLM), who collectively administer over 90% of the area within the watersheds. The area is remote and accessed only by plane or boat, although some residents do maintain year-round residence. Primary land use activities include resource extraction (primarily timber), road building, and minor recreational and subsistence fishing and hunting.

Work in the Cape Yakataga project area included collaboration between the ADF&G and forest engineers with the University of Alaska to provide adequate protection of anadromous fish habitat for current and future timber planning efforts. Hydrography, including delineated stream and lake data, was incomplete or lacking across the project area. Identifying the upper extent of anadromous fish habitat by noting significant barriers to fish passage was the primary objective for work conducted in the watersheds. All information captured during the surveys would be used to update the AWC.

The three watersheds are dominated by the Duktoth River (AWC Number 192-30-10100), and North (192-30-10100-2020) and South Channels (192-30-11500) of the Yakataga River and numerous associated tributaries. The three watersheds contain well over 300 km of mapped streams, including over 215 km of anadromous fish stream habitat. Lakes, ponds, and beaver-

flooded riparian habitat dot the landscape within the watersheds, but GIS data layers are inadequate to accurately define and describe lacustrine habitats. The anadromous fish species occurring in the watershed include coho, pink, and Chinook salmon and steelhead trout. Resident species include, but may not be limited to, Dolly Varden.

Jordan Creek – Mainland, Juneau

The Jordan Creek watershed is an urban watershed located on the mainland of SEAK within the City and Borough of Juneau (CBJ) and encompasses an area of approximately 1,089 ha (Appendix A8). The USFS-TNF and CBJ each administer approximately 50% of the land area within the watershed; CBJ lands primarily include the floodplain of Jordan Creek, while USFS-TNF lands are constrained to the hillside below Thunder Mountain. Land use activities in the watershed include residential housing, transportation, and recreation.

Various stock assessment activities conducted by the ADF&G-SF have occurred in the Jordan Creek watershed since the 1980s, focusing primarily on coho salmon. Annual foot counts were used to provide an index for adult coho salmon in the watershed. In addition, a weir was used to estimate the outmigration of juvenile coho salmon in the spring/summer, as well as estimating adult coho salmon escapement in the fall. The ADF&G targeted the Jordan Creek watershed to conduct continuous stream habitat surveys to update regional hydrography layers, as well as providing information to update the AWC for additional anadromous fish-bearing waters found in Jordan Creek and associated tributaries.

The Jordan Creek watershed contains approximately 18.2 km of mapped streams, including 8.9 km of anadromous fish habitat found primarily on the mainstem of Jordan Creek (AWC Number 111-50-10620). Several ponds and lakes are found within the watershed and cover a surface area of approximately 7.4 ha. Anadromous fish species in the watershed include chum, coho, and pink salmon. The resident fish species assemblage includes Dolly Varden and cutthroat trout.

Montana Creek – Mainland, Juneau

The Montana Creek watershed is a moderately large watershed located on the mainland near Juneau (Appendix A9) and drains an area of 27,376 ha. The watershed has urban components in the lower portion downstream of Mendenhall Lake, including the Mendenhall River floodplain; north and east of Mendenhall Lake the land is dominated by Mendenhall Glacier and the Juneau Icefield. Land ownership in the upper watershed is dominated by the USFS-TNF; the downstream portion of the watershed near salt water that encompasses all of the Mendenhall River floodplain and a portion of the Montana Creek floodplain, is administered by the CBJ. The State of Alaska owns a portion of the headwaters of Montana Creek and the area surrounding Mendenhall Lake. Land use activities within the watershed are varied and include residential housing, transportation, urban development and recreation.

Montana Creek (AWC Number 111-50-10500-2003) is one of the ADF&G-SF index areas surveyed annually via foot counts for coho salmon. Montana Creek is a popular sport fishing location with easy access for multiple species of anadromous and resident fish. The ADF&G targeted Montana Creek and prioritized tributaries to conduct continuous stream habitat surveys for updating regional hydrography layers. ADF&G-SF also captured the spatial extent of the coho salmon foot survey index area, which begins at the confluence with the Mendenhall River (AWC Number 111-50-10500) and includes Montana Creek proper to the confluence with McGinnis Creek (AWC Number 111-50-10500-2003-3060), as well as the majority of McGinnis

Creek. The ADF&G also captured GPS waypoints and counts of adult coho while conducting annual foot counts throughout the Index area.

The Montana Creek watershed contains approximately 138.7 km of mapped streams, including 42.8 km of anadromous fish-bearing stream habitat. Over 50 lakes and ponds of varying size cover a cumulative area of 437.7 ha; most of anadromous and resident fish habitat provided by these lakes and ponds are found within the Mendenhall Lake and Dredge Ponds complex. The anadromous fish species assemblage of the entire watershed includes 5 species of Pacific salmon (Chinook, coho, chum, pink, and sockeye salmon) and steelhead trout. Resident fish species include Dolly Varden and cutthroat trout. All of these species are found in Montana Creek, with the exception of sockeye salmon.

Peterson Creek – Douglas Island

The Peterson Creek project area is located on northwest Douglas Island approximately 14 km west of downtown Juneau in SEAK (Appendix A10). The watershed drains an area of approximately 1,053 ha. Land ownership in the watershed is administered by the Goldbelt Urban Corporation, State of Alaska, and the USFS-TNF. Goldbelt Urban Corporation owns a narrow strip of land adjacent to salt water including the floodplain of Peterson Creek; the State of Alaska administers the middle elevations above Goldbelt Urban Corporation property, and the USFS-TNF lands in the watershed include the upper elevations extending beyond the watershed boundary. Documented land use activities include recreational hiking, fishing and hunting.

The Peterson Creek watershed was targeted for surveys based on proposed development plans, which required an updated assessment of salmonid distribution and hydrography. To this end, the ADF&G and ADF&G-SF initiated stream mapping to update regional hydrography and intensive fish capture efforts to identify salmonid distribution patterns that would be used to update the AWC.

The watershed contains approximately 19.8 km of mapped streams, including over 16 km of anadromous fish habitat found in the mainstem of Peterson Creek (AWC Number 111-50-10750) and the numerous tributaries. No lakes or ponds are located within the watershed. The anadromous fish species assemblage of the entire watershed includes 4 species of Pacific salmon (coho, chum, pink, and sockeye salmon) and steelhead trout. Resident fish species include Dolly Varden and cutthroat trout.

Pleasant Bay – Admiralty Island

The Pleasant Bay watershed is located on the east side of Admiralty Island approximately half way between the communities of Juneau and Petersburg (Appendix A11). The watershed drains an area of approximately 3,767 ha. The USFS-TNF is the sole administrator of lands within the watershed, which is part of the Admiralty National Monument and Kootznoowoo Wilderness Area. The watershed is in a remote location and access is by boat or plane only. The national monument and wilderness area designations generally limit land use activities to recreational and research endeavors.

Pleasant Bay Creek (AWC Number 111-12-10050) is 1 of the 10 index systems annually snorkel surveyed to count steelhead trout in SEAK to monitor their relative abundance (Harding 2005). ADF&G targeted the mainstem of Pleasant Bay Creek below a significant fish passage barrier and prioritized tributaries to conduct continuous stream habitat surveys for updating regional hydrography. ADF&G and ADF&G-SF also captured the spatial extent of the steelhead trout

snorkel survey index area, as well as collecting GPS points associated with individual adult steelhead trout observations encountered during peak counts.

The watershed contains approximately 42.7 km of mapped stream length, including nearly 2.6 km of anadromous fish habitat, which is confined to the mainstem of Pleasant Bay Creek below the barrier noted above. The cumulative lake surface area within the watershed is approximately 48.7 ha and is dominated by Pleasant Bay Lake, which is 48.1 ha in size. Anadromous fish species found in the watershed include coho, sockeye, chum, pink salmon, and steelhead trout. Resident fish species include Dolly Varden and cutthroat trout.

Petersburg Creek – Kupreanof Island

The Petersburg Creek watershed is a moderately large watershed located on Kupreanof Island, emptying into the Wrangell Narrows due east of Petersburg (Appendix A12). The watershed drains an area of approximately 10,566 ha. The USFS-TNF is the sole land owner within the watershed. The area is a popular recreational fishing and hunting area for residents of Petersburg and greater SEAK.

Petersburg Creek (AWC Number 106-44-10600) is 1 of the 10 index systems annually snorkel surveyed to count steelhead trout in SEAK to monitor their relative abundance (Harding 2005). ADF&G targeted the mainstem of Petersburg Creek and prioritized tributaries to conduct continuous stream habitat surveys for updating regional hydrography. ADF&G and ADF&G-SF also captured the spatial extent of the steelhead trout snorkel survey index area, as well as collecting GPS points associated with individual adult steelhead trout observations encountered during peak counts.

The watershed contains approximately 171.1 km of mapped stream length, including over 25.3 km of anadromous fish habitat. The cumulative lake surface area within the watershed is approximately 73.2 ha and is dominated by Petersburg Lake, which is 72.7 ha in size. The anadromous fish species assemblage includes 4 species of Pacific salmon (coho, chum, sockeye, and pink salmon) and steelhead trout. Resident fish species inhabiting the watershed include Dolly Varden and cutthroat trout.

METHODS

WATERSHED PRIORITIZATION

The prioritization of watersheds in SEAK where various salmonid distribution and salmonid habitat surveys would take place was driven by the AHCA program and stakeholder input. This assessment included an integrated GIS that housed available hydrological, biological, land status/ownership, land resource development, and expert opinion information. This data-rich map provided a means to classify individual watersheds by a regional ranking, as well as identifying the IN category(s) most relevant.

Relevant local and current issues warranting ADF&G attention and input was often considered along with the strategy described above. The needs for updating the AWC and collecting stream habitat information were considered of highest importance. A balance, however, between watersheds with little or no salmonid stock information and watersheds moderately to intensively monitored for stock assessment was imparted on the selection strategy. This provided a prioritization strategy giving consideration to watersheds with stock assessment-rich data and those without, all of which would benefit from additional cataloguing efforts for updating the

AWC and stream habitat surveys to update SEAK regional hydrography. Spatial data protocols would guide all efforts allowing integration with GIS and facilitating accurate mapping and delineation.

STREAM HABITAT SURVEYS

The mainstem reaches and prioritized tributaries associated with the 12 project areas (Figure 2) were surveyed following the stream habitat survey protocol[1]. Surveys were completed across all watersheds from 2001 to 2003; individual survey dates are provided in Appendix A13. The core components of the stream habitat survey protocol used in the current study were derived from the USFS Region 10 Tier II Aquatic Habitat Survey (USFS 2001), and the USFS Channel-type Users Guide (USFS 1992). The stream habitat survey provided key data necessary for conducting fine-coarse assessments of the habitat that may be important to fish at both the watershed and geomorphic reach scales. The stream habitat survey methodology included the collection of both physical and biological features and events encountered while transiting along the stream network. The locations of these features/events were recorded on GPS receivers, adding the necessary spatial data for full integration with a GIS. Regardless of the density of physical and biological features encountered during surveys, GPS waypoints were captured every 30 m to ensure water bodies were accurately and precisely delineated.

The underlying unit of scale at which physical habitat parameter statistics were aggregated and reported for the stream habitat survey method was the geomorphic stream reach (stream reach hereafter) level. Identification of distinct reaches was synonymous with the stream classification system used to describe geomorphically distinct stream segments in the context of the watershed, or better known as the "Tongass Channel-type Classification" system. This classification scheme was based on the geomorphic process groups, which "describe the interrelationship between watershed runoff, landform relief, geology, and glacial or tidal influences on fluvial erosion and deposition processes". Individual stream reaches have a minimum mapping unit or length of 100 m; further, they are generally homogeneous throughout their length with regard to macro-habitat characteristics. Therefore, individual stream reaches were classified by the physical attributes found within their geomorphic boundaries[1].

Data collected to achieve this objective included: (1) mapping the stream course; (2) mapping physical habitat features and fish observations; (3) characterizing physical habitat of stream reaches and side channels; and (4) documenting features/events with photos. Physical habitat measures recorded within each reach included: stream gradient; channel bed width; incision depth; bankfull width; predominant bank composition; channel pattern; dominant substrates (primary, secondary and tertiary); length of stream reach; length of side channel(s); length of riparian disturbance (by type); number of barriers (by type); number of large-wood accumulations; number of key-wood pieces; and counts of macro-pools. All data collected during this project were entered into the division's *Odyssey* database following established

[1] Frenette, B., J. V. Nichols, K. L. Schroeder, A. P. Crupi, and D. P. Gregovich, Unpublished a. Stream survey user guide. Alaska Department of Fish and Game, Division of Sport Fish, Juneau.

protocols[2], and handled identically with respect to data processing and quality assurance/quality control (QA/QC) measures.

Four of the 12 project areas had objectives that did not warrant the continuous stream habitat survey methods outlined above, or staff and funding were insufficient to conduct these extensive surveys. These watersheds included the Black Bear Creek watershed (Appendix A1), those associated with the Soda Bay project area (Appendix A3), the Cape Yakataga watershed (Appendix A7), and the Peterson Creek watershed (Appendix A10). Specific objectives and methods as they relate to stream mapping and stream habitat surveys in these watersheds are provided below.

Black Bear Creek – Prince of Wales Island

Two objectives were identified for the Black Bear project area related to mapping of hydrography: 1) delineate the perimeter of a beaver pond complex located between the mainline access road and upper portion of Black Bear Creek upstream of Black Lake; and 2) delineate hydrography of the south fork tributary, near the proposed location of the new pump house. The first objective was addressed using similar spatial data collection methods as employed in the continuous stream habitat mapping, where GPS waypoints are captured at fine-scale intervals ($\leq$30 m). This allowed the margin of the beaver pond complex to be mapped and integrated into the project GIS. The second objective was similarly addressed using GPS waypoint capture to map and delineate the south fork tributary for integration into GIS. The field crew began the survey at the confluence with Black Bear Creek and noted this location accordingly as the lowest point of the south fork tributary. From this confluence, the crew worked upstream capturing GPS waypoints at least every 30 m until they reached a point where the stream no longer provided anadromous fish habitat.

Soda Bay – Prince of Wales Island

ADF&G staff worked closely with a forester employed by the Sealaska Regional Corporation to identify project objectives and the area to be surveyed. Improving the delineation of their corporate streams layer and identifying anadromous habitat were the primary goals. To address these data gaps, ADF&G visited the prioritized waters across the five watersheds employing fine-scale mapping in association with fish capture effort. Fine-scale mapping included capturing GPS waypoints at $\leq$30 m intervals, beginning at salt water and continuing upstream to a point where anadromous fish habitat was considered to be absent. Because sufficient information existed for the lower portion of Soda Creek downstream of Soda Lake, surveys were initiated upstream of Soda Lake.

Peterson Creek – Douglas Island

ADF&G staff worked closely with ADF&G-SF biologists, primary landowners (Goldbelt Urban Corporation, CBJ), and local contractors to provide updated information that would be used to guide proposed development plans for the Peterson Creek watershed. Improved delineation of stream channels and identifying anadromous fish habitat were the primary goals. To address

[2] Frenette, B., J. V. Nichols, K. L. Schroeder, A. P. Crupi, and D. P. Gregovich, *Unpublished* b. Odyssey database user guide. Alaska Department of Fish and Game, Division of Sport Fish, Juneau.

these data gaps, ADF&G employed fine-scale mapping of all stream channels and connections in association with fish capture efforts. GPS waypoints were captured at ≤30 m intervals to map all stream corridors from saltwater or their confluence with the mainstem of Peterson Creek up to a point where anadromous fish habitat was considered to be absent.

Cape Yakataga – Mainland, Icy Bay

A unique collaboration with the ADF&G-SF and landowners in the lower Cape Yakataga project area (University of Alaska and the Mental Health Trust) provided a means for ADF&G-SF field crews to provide discontinuous stream habitat feature information that could be used to map the extent and location of streams with respect to anadromous fish habitat. This information would lead to updates of the AWC (see Fish Distribution and Mapping section below for further explanation) that would facilitate timber planning unit layout and design as required by State of Alaska FRPA and adherence to the AWC. In essence, field crews captured GPS waypoints on specific tributaries associated with their confluence of previously mapped mainstem reaches (i.e, a tributary's lowest downstream point), as well as hydrologic and geomorphic features (e.g., stream gradient >16%, barriers to fish passage) that demarcated a tributary's upper extent with respect to anadromous fish habitat.

SALMONID DISTRIBUTION AND MAPPING

All fish distribution and mapping efforts were guided by similar spatial data collection protocols described above for stream habitat surveys, which allowed stream mapping points (for delineating hydrography) and all fish observations or capture/effort locations to be delineated and integrated into a GIS. Generally, fish distribution and mapping efforts were conducted concurrently with stream habitat surveys. The *Stream Habitat Survey User Guide* [3] provides methods and techniques which guide fish distribution and mapping efforts.

The 12 watersheds where fish distribution and mapping efforts were applied had varying objectives relating to the type of fish distribution information required. While all activities included capturing precise spatial locations of effort and catch or observation, different methods were employed and warrant description here. All efforts associated with this objective can be categorized, by watershed, into 2 categories: 1) salmonid index area extents; and 2) salmonid distribution updates. Each of the 12 watersheds is thus identified in Table 2.

Salmonid Index Area Counts and Extents

The ADF&G-SF conducted multiple surveys annually to attain a peak count in select systems as part of a regional index to monitor the relative abundance of coho salmon and steelhead trout. All index counts occurred annually within the same extent of individual watersheds, thereby providing consistency in the length of stream monitored. Longer stretches of stream and river were broken into multiple reaches. Data collected during index surveys could be identified at the individual reach scale or cumulatively across the entire index area. This number represented one of several index area counts, which were repeated generally 3 times per year, per system to attain a peak annual count.

[3] Frenette, B., J. V. Nichols, K. L. Schroeder, A. P. Crupi, and D. P. Gregovich, Unpublished a. Stream survey user guide. Alaska Department of Fish and Game, Division of Sport Fish, Juneau.

Coho salmon index surveys were conducted by foot as observers walked on the stream bank wearing polarized glasses; at each location where coho salmon were observed, the total number of coho salmon were recorded by life stage (e.g., adult, juvenile) and activity (e.g., spawning, holding), if known. A GPS waypoint was captured at every fish observation, and this information was recorded along with the number of fish and their activity. GPS waypoints were also captured during each survey to identify the bottom and top of index area extents; if the larger index area contained multiple reaches, a GPS waypoint was captured at the downstream and upstream end of each reach. Digital photographs were generally captured at these locations and at individual fish observations.

Steelhead trout index surveys were conducted via snorkeling, generally in a downstream orientation. A snorkel survey typically included 3 crew members, two of which performed the snorkeling, while the other recorded data and provided safety support for bears or significant water obstacles. Snorkel observers worked in tandem covering the water from bank to bank throughout the index area. At each location where steelhead trout were observed, the total number was recorded by life stage and activity, similar to that described for coho salmon. A GPS waypoint was captured at every observation of steelhead trout, and this information was recorded along with the number of fish and their activity. GPS waypoints for each reach interval were also captured during each survey to identify the extent of the index area. Digital photographs were generally captured at these locations and at individual fish observations.

Six of the 12 watershed project areas included salmonid index area counts and extents; two of these six watersheds also addressed AWC updates. Table 2 identifies all 12 watersheds by fish distribution and mapping class.

Table 2.–Identification of fish distribution and mapping activities and categories employed in the 12 watersheds visited for this project during 2001–2003, Southeast Alaska.

Watershed name	Location	Fish distribution/mapping category
Black Bear Creek	Prince of Wales Island (POW)	Salmonid distribution updates
Big (108) Creek	POW	Salmonid index area counts (coho-foot)
Soda Creek	POW	Salmonid distribution updates
Warm Chuck Creek	Heceta Island	Salmonid distribution updates
Ford Arm	Baranof Island	Salmonid distribution updates; salmonid index area extent (steelhead-snorkel)
Nakwasina River	Baranof Island	Salmonid index area counts (coho-foot)
Cape Yakataga	Mainland – Icy Bay	Salmonid distribution updates
Jordan Creek	Mainland – Juneau	Salmonid distribution updates
Montana Creek	Mainland – Juneau	Salmonid index area extent and counts (coho-foot)
Peterson Creek	Douglas Island – Juneau	Salmonid distribution updates
Pleasant Bay	Admiralty Island	Salmonid index area extent and counts (steelhead-snorkel)
Petersburg Creek	Kupreanof Island	Salmonid index area extent and counts (steelhead-snorkel)

Salmonid Distribution Updates

Trip planning for salmonid distribution update (salmonid update hereafter) work often required coordination with landowners and ADF&G area biologists to gain access and identify individual project area extent and schedules. Once this communication was established and agreed upon by collaborators, ADF&G staff developed a project GIS with all relevant data layers (watershed boundaries, AWC streams and other hydrography, land ownership, roads, etc.). The GIS was used to prioritize and identify where field crews would conduct surveys within identified watersheds, which in turn would provide information necessary to update known distribution patterns of salmonid species. Project area maps were used in the field to guide all activities. GPS waypoints were uploaded to GPS units, when it was necessary to direct field staff to precise locations or features in the watershed that warranted individual attention.

Essential elements of an objective that would provide updated information on salmonid distribution patterns includes capturing fish across prioritized waters and having an accurate delineation of the water bodies where fish are observed. This satisfies requirements associated with updating nonanadromous species distribution patterns and legal mandates per Alaska statute that are required for updating the AWC. Salmonid update work in this project followed procedures that would allow general salmonid updates and official updates to the AWC. This required ADF&G staff to capture and identify presence of anadromous fish with respect to lower and upstream distribution, as well as mapping the watered habitats where these fish were observed. GPS waypoint capture facilitated all mapping efforts associated with salmonid presence and the habitats they occupied.

Fish species were captured using 2 primary techniques: 1) baited and sterilized minnow traps; and 2) dip nets. Occasionally, adult salmon were visually observed and identified, rather than captured. Minnow traps included 1/4 inch and 1/8 inch mesh, metal and fabric collapsible traps. Every trap was baited with salmon roe that had been previously treated with a sterilization formula (e.g., Betadine®[4]). Traps were set and fished for varying amounts of time depending on logistical considerations and stream temperatures. Because establishing the presence of salmonids, rather than measures of abundance or density, was the goal of all salmonid update related activities, there were no concerns for standardizing trapping periods or catch per unit effort. Dip nets were used in conjunction with minnow traps or opportunistically as field crews transited streams. Dip nets included fine-mesh nets (1/32 inch) with handles of varying lengths. All salmonids captured were identified to the species level; additional information collected included life stage (e.g., fry, juvenile, adult) and life history strategy (e.g., anadromous, resident), if known. All efforts associated with salmonid updates used 1 of these 2 capture methods, or visual observation of adult Pacific salmon, to identify presence and distribution patterns of anadromous and resident salmonids in prioritized waters.

Information recorded in conjunction with all capture, effort, or observation locations included: 1) GPS waypoint; 2) fish capture/observation method; 3) date/time of capture; 4) species; 5) life stage; 6) life history strategy (if known); and 7) number of fish captured. Additionally, GPS waypoints were captured at least every 30 m to ensure an accurate depiction and mapping of the watered habitats where salmonids were observed, and how these connected with previously

[4] Product names are included for a complete description of the process and do not constitute product endorsement.

delineated mainstem or tributary waters within the watershed. Hydrologic (e.g., confluence, divergence, change in stream gradient), geomorphic (primarily barriers), and anthropomorphic features (e.g., stream crossing structures) that influence fish distribution patterns were also identified and captured while conducting salmonid distribution surveys.

Activities associated with salmonid updates were conducted in 7 of the 12 watershed project areas (Table 2). Methods used to identify and map the distribution of resident or nonanadromous salmonid species were identical to those used for updating the AWC, as identified above. Generally, focus on resident fish species distribution patterns occurred concurrently with AWC surveys when their habitats converged; however, the fact that nonanadromous or resident salmonids often inhabit waters upstream of anadromous extent, required field crews to continue mapping hydrography and distribution of fish upstream of habitats occupied by anadromous fish.

RESULTS

WATERSHED PRIORITIZATION

Twelve watersheds were identified for survey during the years 2001–2003 using the strategy and criteria described previously (Table 1; Figure 2). Individual watersheds required varying types of surveys depending upon the information that was identified as necessary to address development or other land management considerations. ADF&G staff evaluated existing information and the 'needs' identified for individual watersheds to implement a program that would address known data gaps and provide essential habitat and salmonid distribution information.

STREAM HABITAT SURVEYS

ADF&G staff surveyed approximately 171.5 km of stream habitat across the 12 watershed project areas in SEAK. This included capturing over 3,500 GPS waypoints that were used to map and delineate water bodies and associated features, including riparian disturbance locations, stream crossing structures, barriers, etc. The 171.5 km of stream habitat included nearly 200 unique reaches. This information is summarized for each watershed project area in Table 3. The dates of survey in each watershed are provided in Appendix A13.

Table 3.–Summary statistics associated with stream habitat surveys in the 12 watersheds visited during 2001–2003, Southeast Alaska.

Watershed name	Number of GPS waypoints collected	Number of unique stream reaches or water bodies surveyed	Total length (km) of surveyed streams in watershed
Black Bear Creek	133	4	1.9
Big (108) Creek	105	7	5.6
Soda Creek	254	13	22.3
Warm Chuck Creek	182	11	7.0
Ford Arm	256	22	8.6
Nakwasina River	602	24	18.9
Cape Yakataga	654	39	30.4
Jordan Creek	172	4	5.9
Montana Creek	461	11	17.9
Peterson Creek	415	32	22.4
Pleasant Bay	148	8	8.4
Petersburg Creek	298	19	22.1
Total	3,680	194	171.5

Individual Watersheds

Black Bear Creek – Prince of Wales Island

Approximately 1.6 km of aquatic habitat was surveyed and mapped in the Black Bear Creek watershed; this included 1.1 km of stream/tributary habitat and approximately 0.5 km of pond habitat created by beaver activity. In addition, 17 distinct stream crossing structures were spatially identified and categorized by design type (e.g., Corrugated Metal Pipe (CMP), log-stringer bridge (LSB), or permanent modular bridge (PMB)). Each structure was evaluated in preliminary or coarse terms relating to their ability to provide adequate fish passage. ADF&G captured 133 GPS waypoints within the watershed while spatially identifying these features and mapping stream or pond habitat (Figure 3).

ADF&G focused stream habitat surveys primarily along the main access road paralleling the mainstem of Black Bear Creek (downstream of Black Lake) on river-right (looking downstream) and upstream of Black Lake in the vicinity of the proposed hydroelectric facility pump house. Surveys downstream of Black Lake focused on locating and identifying design type and fish passage ability of stream crossing structures that drained upslope tributaries to Black Bear Creek. This area included 9 CMPs, one PMB and one LSB. Both bridges were deemed to be in good condition and providing adequate fish passage; 3 of the 9 CMPs were perched >10 cm, including one that was damaged with associated outlet erosion; the remaining six CMP's appeared to functioning properly.

Surveys upstream of Black Lake focused on mapping the area/perimeter of a beaver pond complex, locating and identifying design type and fish passage ability of stream crossing structures and mapping the south fork tributary from its confluence with Black Bear Creek upstream to the proposed location for a pump house. The beaver pond complex was mapped and observed to encompass an area of 2.2 ha. Four CMP's and 2 LSB's located in this area all appeared to functioning adequately for drainage and fish passage.

Big (108) Creek – Prince of Wales Island

Approximately 5.6 km of mainstem river habitat was surveyed and mapped in the Big (108) Creek drainage. The mainstem of Big Creek from the estuary upstream to Cavern Lake (AWC Number 106-30-10800-0010) was classified into 5 distinct geomorphic reaches or individual channel types (Figure 4). The channel type classification, average stream gradient, density (number/km) of macro pools and large woody debris (LWD) and channel length of individual reaches is summarized in Table 4.

Table 4.–Stream channel metrics calculated for the mainstem of Big (108) Creek on Prince of Wales Island, Southeast Alaska.

Reach number	Channel type classification	Average stream gradient (%)	Density – macro pools (#/km)	Density – LWD[b] (#/km)	Measured length (km)
1	ES4	0.78	NA[a]	NA[a]	1.15
2	FP5	1.30	12.0	96.0	0.25
3	LC2	2.25	30.4	117.4	0.23
4	LC1	2.50	20.4	134.2	1.52
5	LC2	2.10	28.6	157.1	0.49
6	LC1	0.63	15.3	96.0	1.76
7	HC3	8.00	0.0	0.0	0.20
Total					5.61

[a] Macro pools and LWD are not counted in estuarine or palustrine channels due to varying tide levels or water clarity and depth.

[b] LWD = large woody debris.

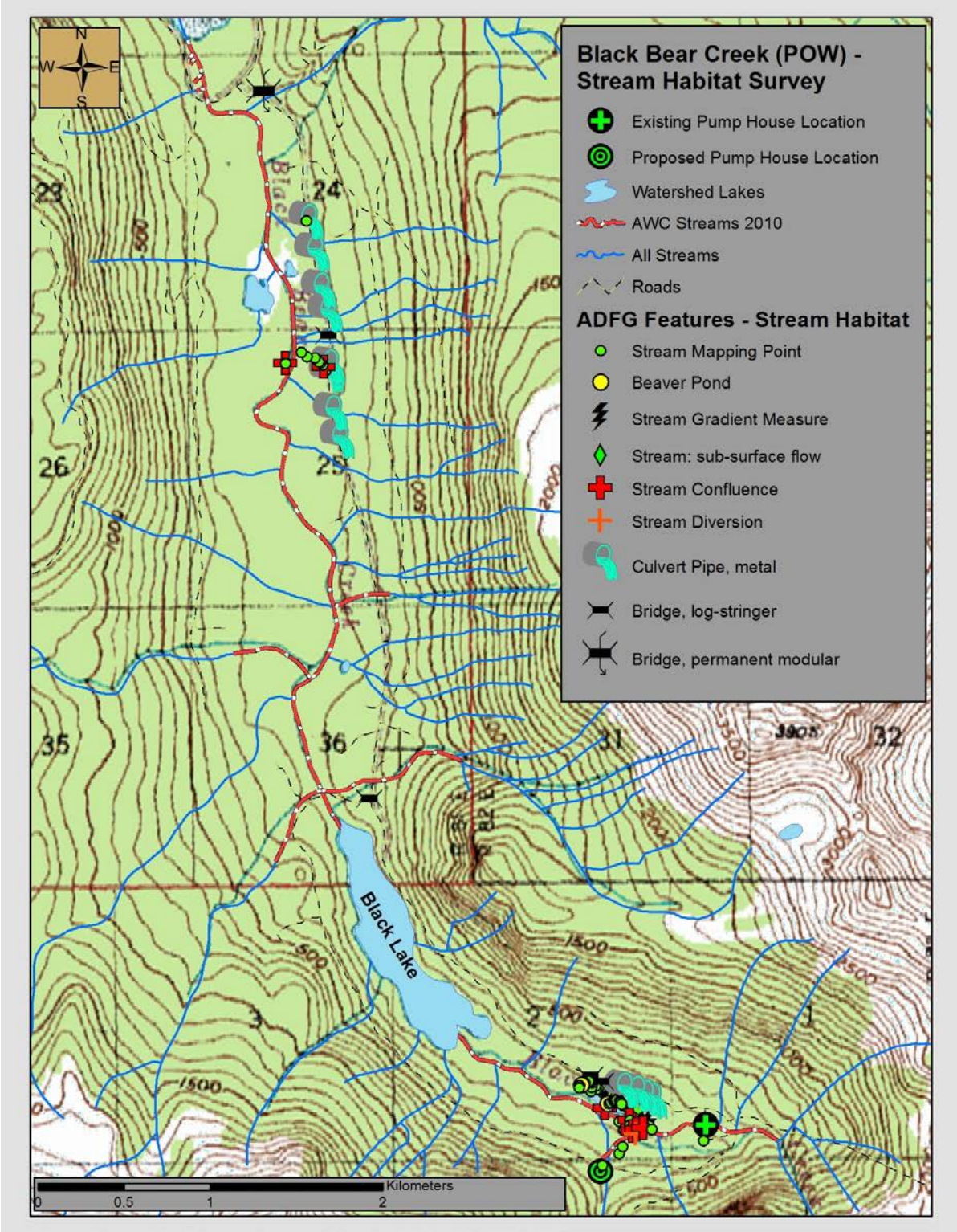

Figure 3.–Hydrography related features encountered during stream habitat surveys in the Black Bear Creek watershed on Prince of Wales Island, Southeast Alaska.

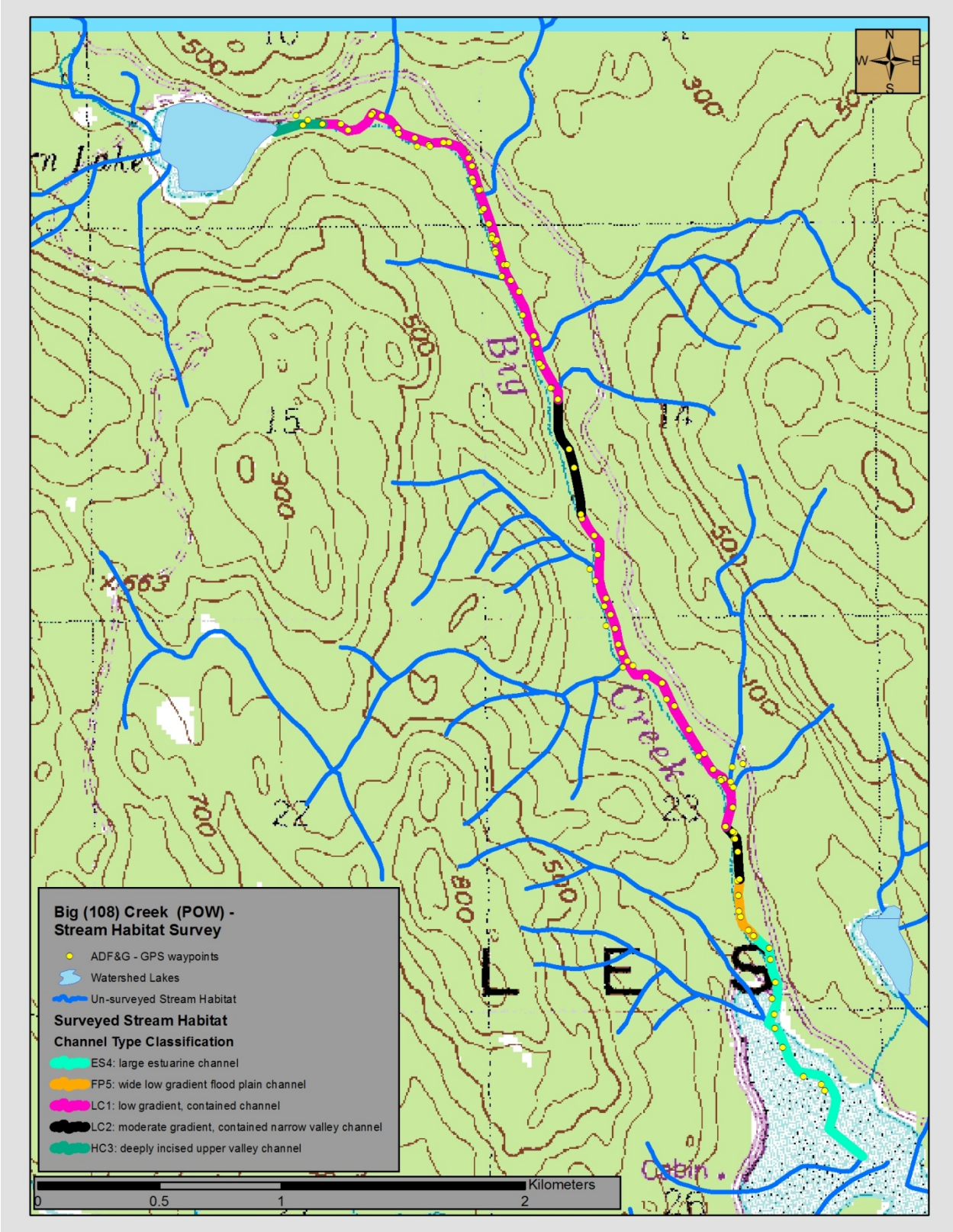

Figure 4.–Surveyed and unsurveyed hydrography encountered during stream habitat surveys in the Big (108) Creek watershed on Prince of Wales Island, Southeast Alaska.

Two stream crossing structures were identified and were associated with the mainstem of Big Creek downstream of Cavern Lake, and included one CMP and one permanent, modular bridge. Both structures provided adequate fish passage. Other notable features encountered on the mainstem or riparian zone of Big Creek included 2 riparian disturbances; one of these was associated with a bank stabilization measure, which affected approximately 20 m of river bank; the other was associated with a clearcut timber harvest adjacent to both banks of the river and encompassing a length of approximately 1.6 km downstream of Cavern Lake. A total of 105 GPS waypoints were captured while conducting stream habitat surveys in the watershed.

Soda Bay – Prince of Wales Island

The Soda Bay project area encompassed 5 watersheds and numerous stream and lake/pond habitats. ADF&G surveyed approximately 22.3 km of mainstem and tributary stream habitat across the five watersheds, including 13 distinct streams or portions of streams. A total of 254 GPS waypoints were captured while conducting stream habitat surveys to delineate aquatic habitats (Figure 5). Although roads were mostly absent in the project area, one stream crossing structure was purposefully visited and evaluated as this structure (CMP) had recently been installed by forest and road engineers. A total of 5 ephemeral or geomorphic stream barriers were mapped and classified. Forty stream confluence locations were mapped.

Warm Chuck Creek – Heceta Island

ADF&G staff surveyed and mapped 7.0 km of stream habitat, including mainstem and prioritized tributaries of the Warm Chuck Creek watershed. Eleven distinct reaches were mapped and classified into 6 geomorphic channel types (Figure 6). The channel type classification, average stream gradient, density (number/km) of macro pools and LWD, and measured channel length (km) of individual reaches is summarized in Table 5.

Table 5.–Stream channel metrics calculated for prioritized waters of the Warm Chuck Creek watershed on Heceta Island, Southeast Alaska.

Reach number	Channel type classification	Average stream gradient (%)	Density – macro pools (#/km)	Density – LWD[b] (#/km)	Measured length (km)
1	ES4	0.75	NA[a]	NA[a]	0.30
2	LC1	1.00	17.9	264.2	1.06
3	PA5	0.50	NA[a]	NA[a]	0.73
4	PA3	0.50	NA[a]	NA[a]	0.14
5	MC1	2.00	65.6	287.5	0.32
6	PA5	1.00	NA[a]	NA[a]	0.07
7	PA5	0.00	NA[a]	NA[a]	0.28
8	MC1	2.00	57.1	357.1	0.14
9	PA5	0.50	NA[a]	NA[a]	0.30
10	FP3	1.00	27.3	395.5	0.22
11	PA5	0.50	NA[a]	NA[a]	1.39
Total					7.01

[a] Macro pools and LWD are not counted in estuarine or palustrine channels due to varying tide levels or water clarity and depth.

[b] LWD = large woody debris

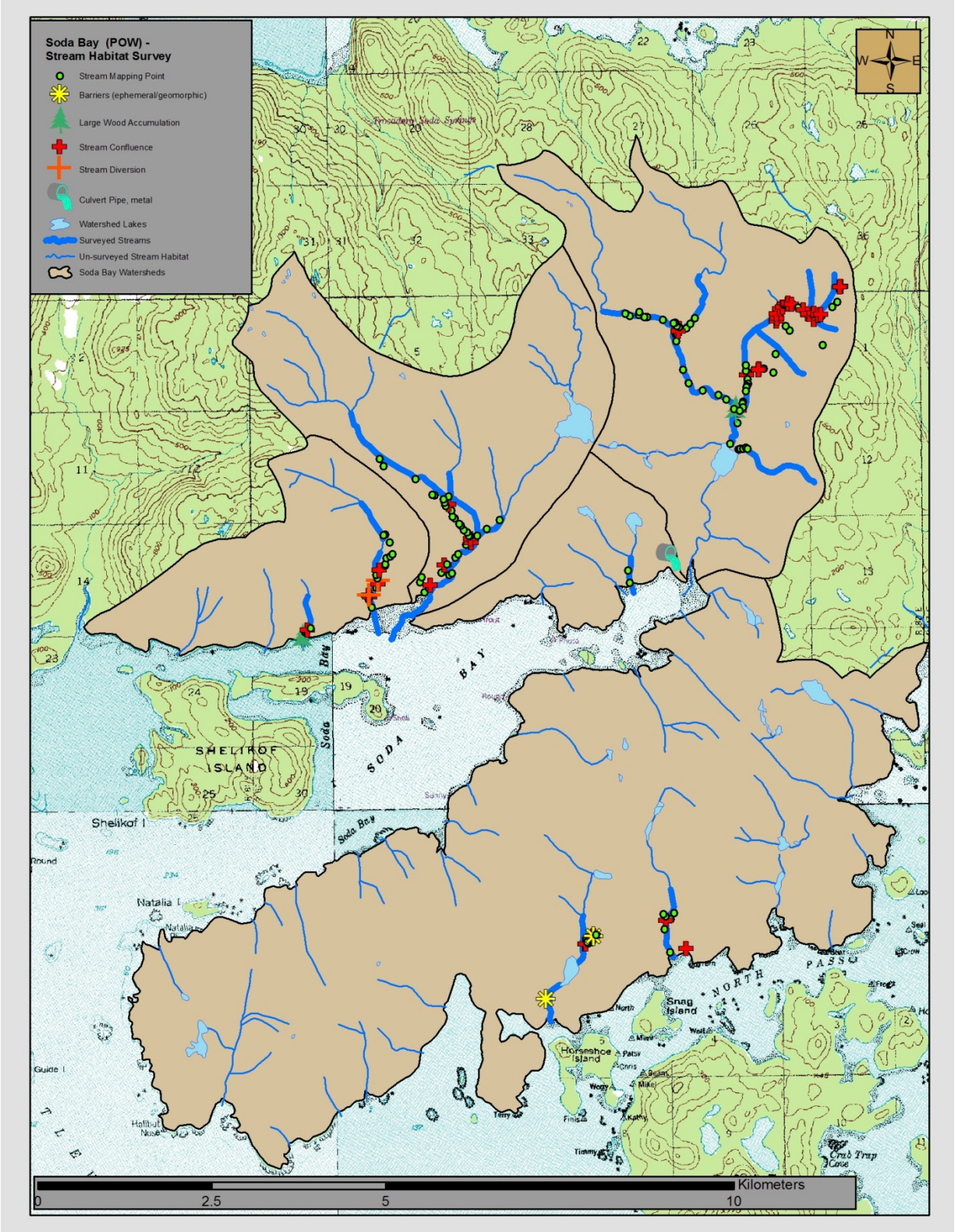

Figure 5.–Hydrologic and riparian features encountered during stream habitat surveys in Soda Bay watersheds on Prince of Wales Island, Southeast Alaska.

Six stream crossing structures were surveyed and mapped in the watershed. This included 4 CMPs, 1 PMB, and 1 log culvert (LGC). Three of the four CMPs were functioning properly; one was perched approximately 45 cm, although no fish habitat was considered to be associated with the stream. The PMB and LGC were both providing efficient fish passage and functioning properly. One location was identified in the watershed where a stream crossing structure had been removed.

Although geomorphic barriers were not observed in the watershed, ephemeral barriers associated with beaver activity were abundant, and 40 of these features were mapped. Twelve individual beaver ponds or complexes were identified and mapped and were a significant habitat within the watershed. Seven instances of riparian disturbance were noted in the watershed, including four that were associated with past timber harvest adjacent to the riparian zone. One location was associated with a 20 m stretch where slope failure and undercutting of the bank was occurring and another was unclassified. A total of 182 GPS waypoints were captured while conducting surveys in the watershed.

Ford Arm – Chichagof Island

ADF&G staff surveyed and mapped 8.64 km of stream habitat, including mainstem, side channel, and prioritized tributaries of the Ford Arm watershed. The 22 distinct reaches which were surveyed included 11 different geomorphic channel types (Figure 7). The channel type classification, average stream gradient, density (number/km) of macro pools and LWD and measured channel length (km) of individual reaches is summarized in Table 6.

Table 6.–Stream channel metrics calculated for prioritized waters of the Ford Arm watershed on Chichagof Island, Southeast Alaska.

Reach number	Channel type classification	Average stream gradient (%)	Density – macro pools (#/km)	Density – LWD[c] (#/km)	Measured length (km)
1	ES2	1.00	NA[a]	NA[a]	0.14
2	FP3	1.50	36.8	194.7	0.19
3	MM1	2.50	25.0	216.7	0.24
4	ES4	0.63	NA[a]	NA[a]	0.50
5	LC2	1.50	19.4	38.7	0.31
6	FP4	1.00	16.1	118.2	1.43
7	LC2	0.50	13.9	183.3	0.36
8	AF1	2.50	4.0	128.0	0.25
9	FP3	0.50	25.9	155.6	0.27
10	FP3	0.50	37.5	175.0	0.08
11	FP4	0.50	42.7	255.2	0.96
12	MM2	2.00	26.1	156.5	1.15
13	LC2	2.50	25.0	85.0	0.20
14	FP3	1.50	33.3	186.1	0.36
15	MC2	4.25	54.5	481.8	0.11
16	MM1	3.00	0.0	231.3	0.16
17	PA1	1.00	NA[a]	NA[a]	0.07
18	FP3	1.50	47.1	223.5	0.17
19	MC2	4.00	112.5	387.5	0.08
20	FP3	1.00	29.9	219.4	0.67
21	MC2	3.00	10.1	22.8	0.79
22	HC1	6.00	NA[b]	NA[b]	0.05
Total					8.64

[a] Macro pools and LWD are not counted in estuarine or palustrine channels due to varying tide levels or water clarity and depth.

[b] Macro pools and LWD density estimates were not available for this HC1 reach because it was not surveyed over its entire length.

[c] LWD = large woody debris

No stream crossing structures exist in this remote watershed due to the fact no road building has occurred. Both geomorphic (n = 9) and ephemeral barriers (n = 5) were mapped and identified in the watershed; geomorphic barriers included high gradient chutes and waterfalls, and ephemeral barriers were associated with beaver activity or the presence of LWD creating significant step pools. Nine large wood accumulations (LWAs) were observed across the watershed. No observations of riparian disturbance were recorded during surveys. A total of 256 GPS waypoints were captured during watershed surveys.

Nakwasina River – Baranof Island

This project area included 2 contiguous watersheds, including the primary and much larger Nakwasina River watershed and the Bridge Creek watershed. Both watersheds share the same estuary, located at the head of Nakwasina Sound. Approximately 18.9 km of stream habitat consisting of prioritized mainstem, side channel, and tributary habitat was surveyed and mapped in the Nakwasina River watershed. These habitats included 24 distinct reaches and associated side channels representing 16 different geomorphic channel types (Figures 8–9). An additional 8.5 km of side channel and tributary habitat was mapped via GPS waypoint collection, but was not classified into channel type. The channel type classification, average stream gradient, density (number/km) of macro pools and LWD, and measured channel length (km) of individual reaches is summarized in Table 7.

Table 7.–Stream channel metrics calculated for prioritized waters of the Nakwasina and Bridge Creek watersheds on Baranof Island, Southeast Alaska.

Reach number	Channel type classification	Average stream gradient (%)	Density – macro pools (#/km)	Density – LWD[b] (#/km)	Measured length (km)
1	ES4	1.00	NA[a]	NA[a]	0.70
2	FP5	1.50	18.3	205.6	4.47
3	FP4	2.00	13.2	287.9	0.91
4	FP5	2.50	12.1	253.0	1.49
5	MM2	4.00	11.4	34.1	0.44
6	FP4	1.50	29.6	420.4	1.08
7	PA1	1.00	NA[a]	NA[a]	0.33
8	ES2	1.00	NA[a]	NA[a]	1.11
9	FP3	1.00	34.5	227.6	0.29
10	PA1	1.00	NA[a]	NA[a]	0.97
11	FP3	1.00	25.0	105.8	0.52
12	FP3	1.00	80.0	500.0	0.30
13	FP0	1.00	150.0	400.0	0.04
14	FP0	1.00	100.0	156.3	0.16
15	FP3	1.00	33.3	176.2	0.42
16	PA1	0.00	NA[a]	NA[a]	0.53
17	PA0	0.00	NA[a]	NA[a]	0.20
18	FP4	1.00	19.7	175.0	0.76
19	PA5	0.00	NA[a]	NA[a]	0.16
20	FP3	1.00	50.0	212.5	0.40
21	FP3	1.00	32.5	162.6	1.23
22	MM1	3.00	31.6	84.2	0.19
23	FP3	1.00	60.6	193.9	1.32
24	FP3	1.00	93.0	302.3	0.86
Total					18.88

[a] Macro pools and LWD are not counted in estuarine or palustrine channels due to varying tide levels or water clarity and depth.
[b] LWD = large woody debris.

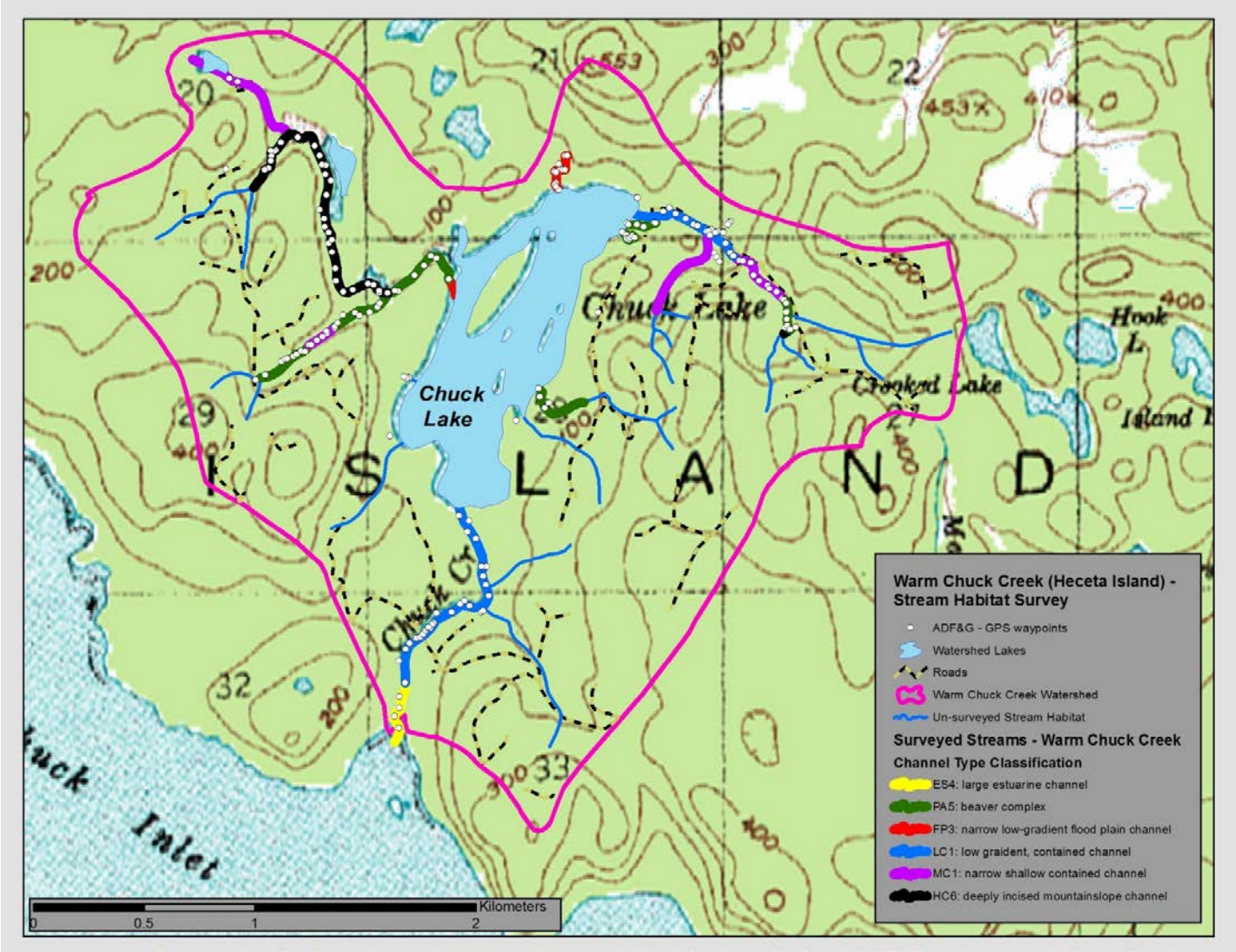

Figure 6.–Surveyed and unsurveyed hydrography encountered during stream habitat surveys in the Warm Chuck Creek watershed on Heceta Island, Southeast Alaska.

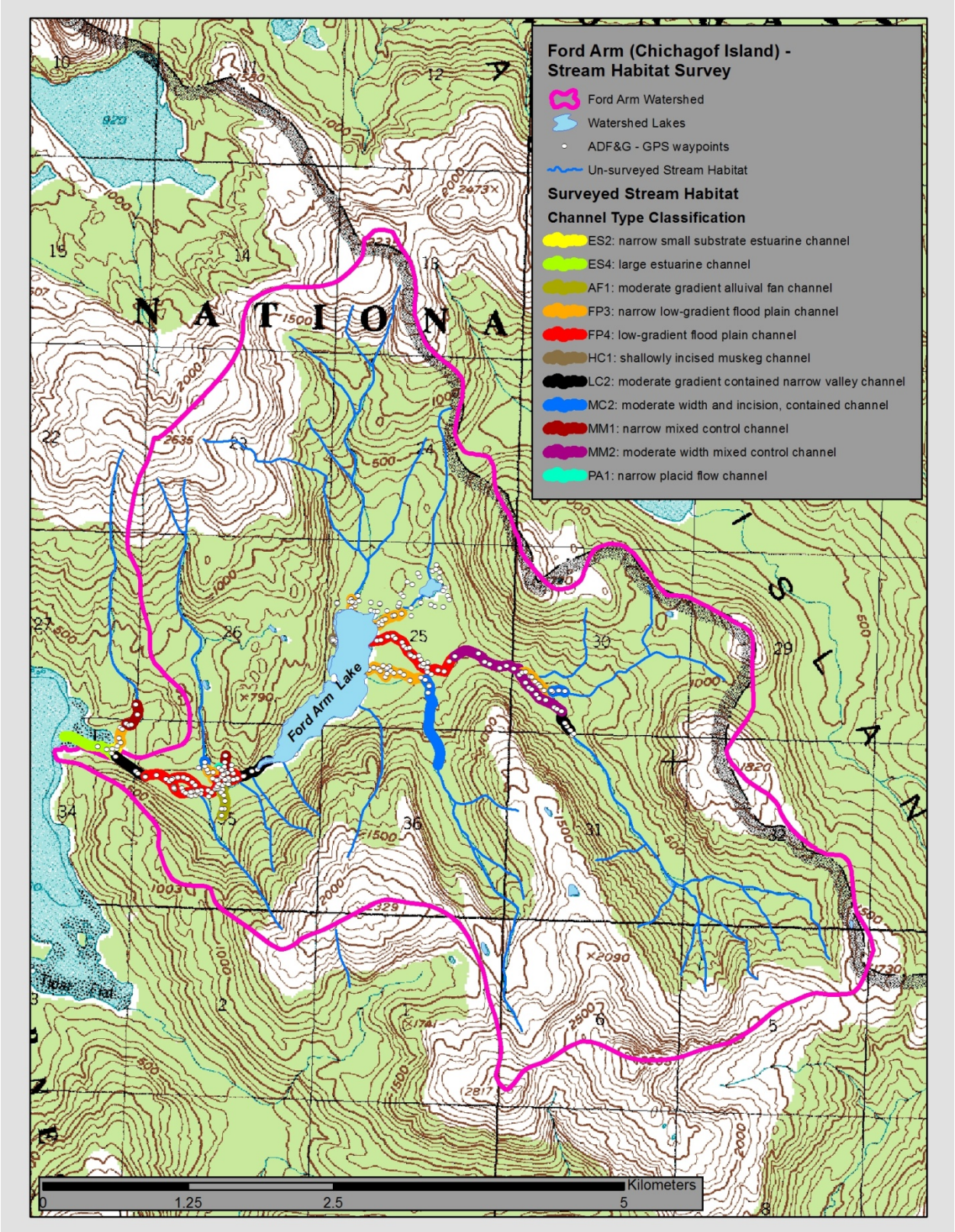

Figure 7.–Surveyed and unsurveyed hydrography encountered during stream habitat surveys in the Ford Arm watershed on Chichagof Island, Southeast Alaska.

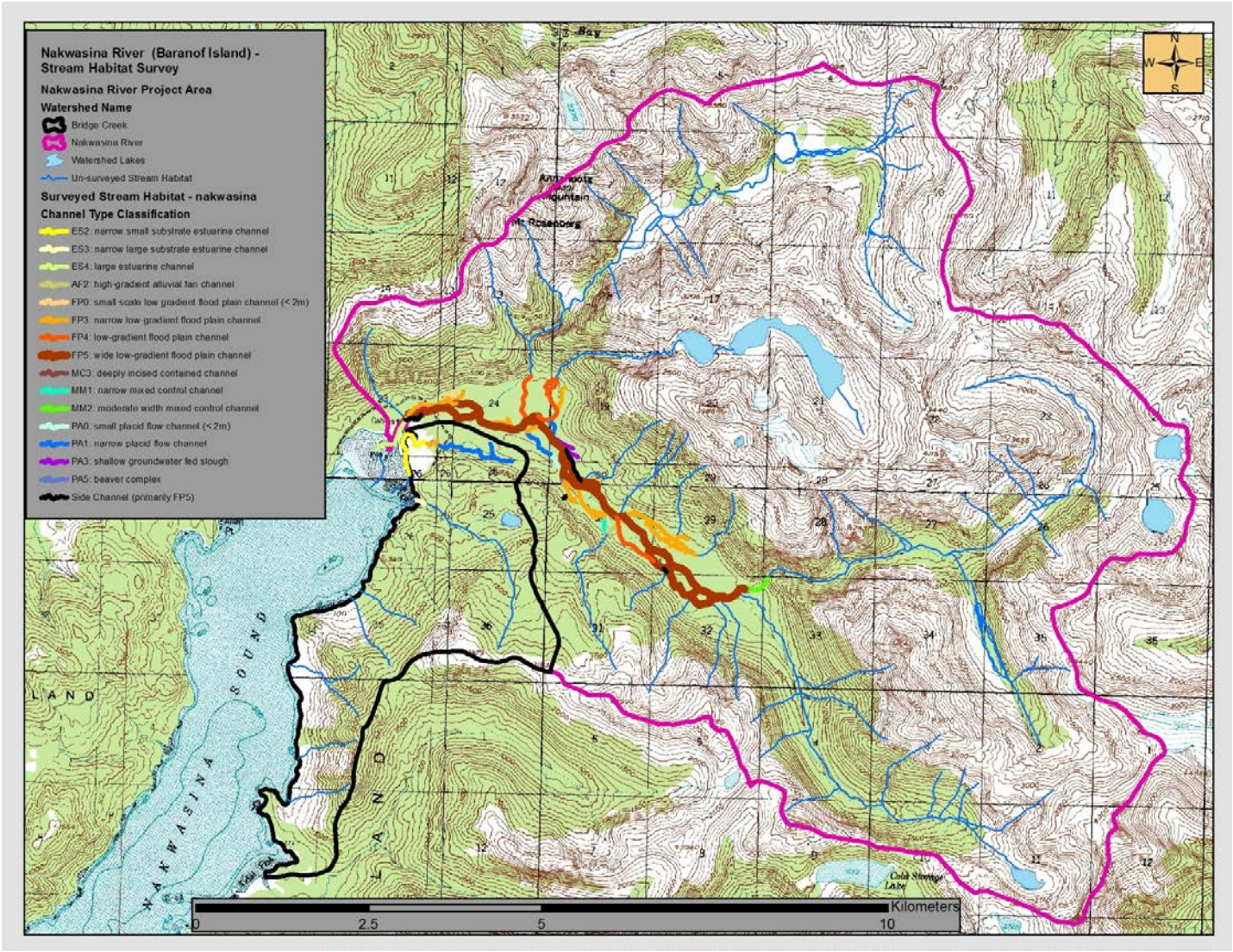

Figure 8.–Surveyed and unsurveyed hydrography encountered during stream habitat surveys in the Nakwasina River and Bridge Creek watersheds on Baranof Island, Southeast Alaska.

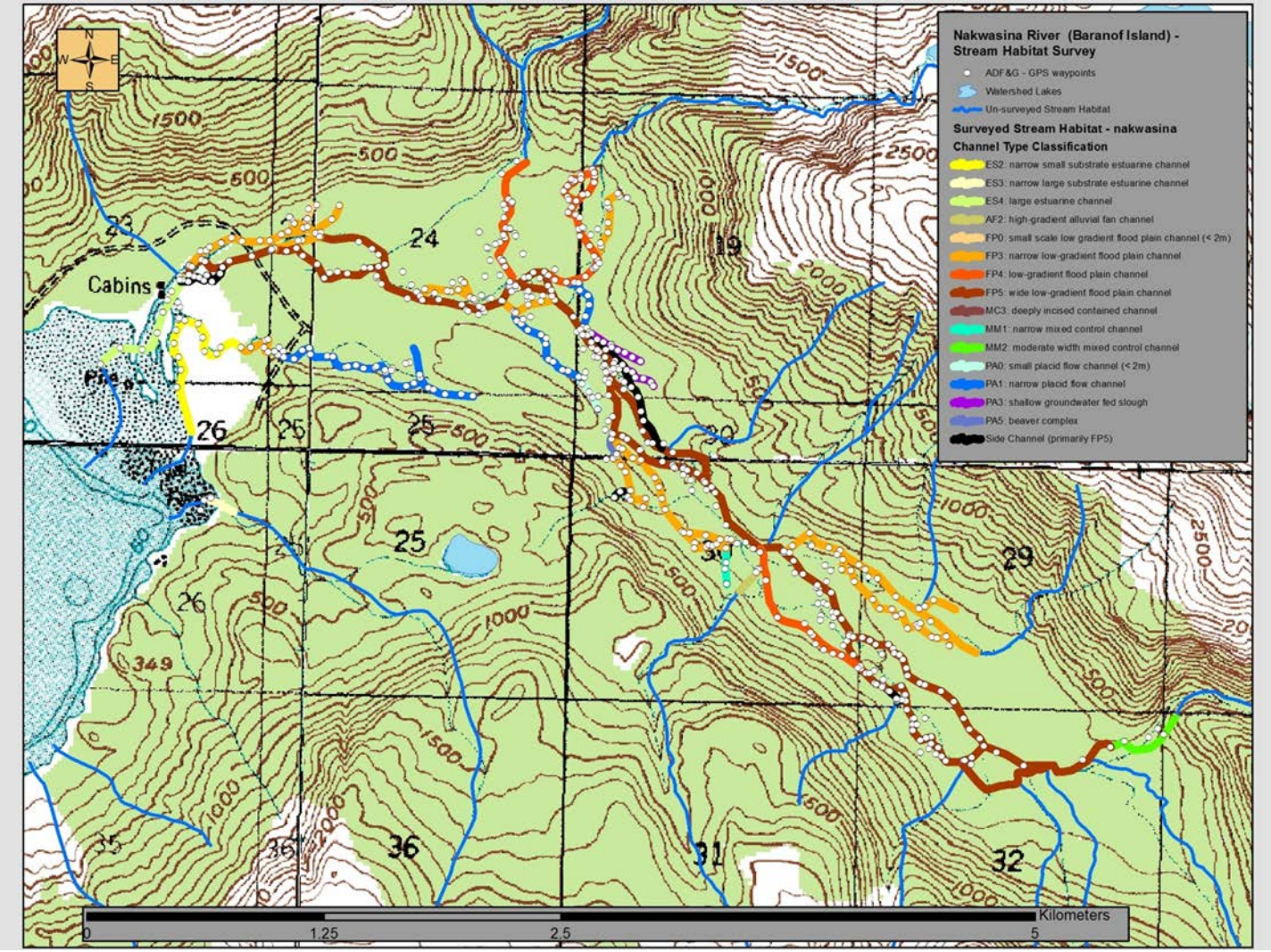

Figure 9.–Location of GPS waypoints and surveyed and unsurveyed hydrography encountered during stream habitat surveys in the Nakwasina and Bridge Creek watersheds on Baranof Island, Southeast Alaska.

Although timber harvest activities, including the presence of roads, is still visible on the floodplain and riparian area of the Nakwasina River watershed, no stream crossing structures remain. Two road crossings where structures were removed in the past were observed. Four barriers were identified and surveyed in the watershed, including 3 large geomorphic induced waterfalls and one unclassified barrier.

Other stream or riparian features encountered during surveys included: a) 3 beaver ponds of varying dimensions; b) 267 stream confluences and diversions; c) 11 LWAs; and d) 6 locations where riparian disturbance occurred. Modifications of the riparian forest due to timber harvest, and associated bank erosion/slumping, were the principal riparian disturbance (RDB) effects. ADF&G staff captured a total of 602 waypoints while conducting stream habitat surveys.

Cape Yakataga – Mainland, Icy Bay

The Cape Yakataga project area included 3 adjacent watersheds: the North Cape Yakataga and South Cape Yakataga watersheds, and the much smaller Mink Creek drainage. Most of the stream habitat surveys conducted by ADF&G occurred in the South Cape Yakataga watershed. A total of 654 GPS waypoints were captured while mapping the location of streams, rivers, and tributaries in prioritized areas across the project area. A minimum of 39 different water bodies was mapped, which included approximately 30.4 km of stream habitat (Figure 10). Stream features identified and mapped during surveys included: a) 116 stream confluences and divergences; b) 55 locations demarcating the upper extent of fish habitat; c) 15 beaver ponds of varying dimensions; d) 2 ephemeral debris jams; e) 4 unidentified barriers; f) 2 LSBs; and g) 1 PMB.

Jordan Creek – Mainland, Juneau

ADF&G staff surveyed 5.87 km of mainstem habitat in the Jordan Creek watershed, which included four distinct reaches associated with 3 geomorphic channel types (Figure 11). The channel type classification, average stream gradient, density (number/km) of macro pools and LWD, and measured stream reach length (km) for the Jordan Creek watershed are provided in Table 8.

Table 8.–Stream channel metrics calculated for prioritized waters of the Jordan Creek watershed on the mainland of Southeast Alaska.

Reach number	Channel type classification	Average stream gradient (%)	Density – macro pools (#/km)	Density – LWD[b] (#/km)	Measured length (km)
1	PA3	0.50	NA[a]	NA[a]	1.82
2	FP3	0.50	32.7	160.6	2.26
3	PA5	0.20	NA[a]	NA[a]	0.37
4	FP3	0.50	32.4	131.0	1.42
Total					5.87

[a] Macro pools and LWD are not counted in estuarine or palustrine channels due to varying tide levels or water clarity and depth.
[b] LWD = large woody debris.

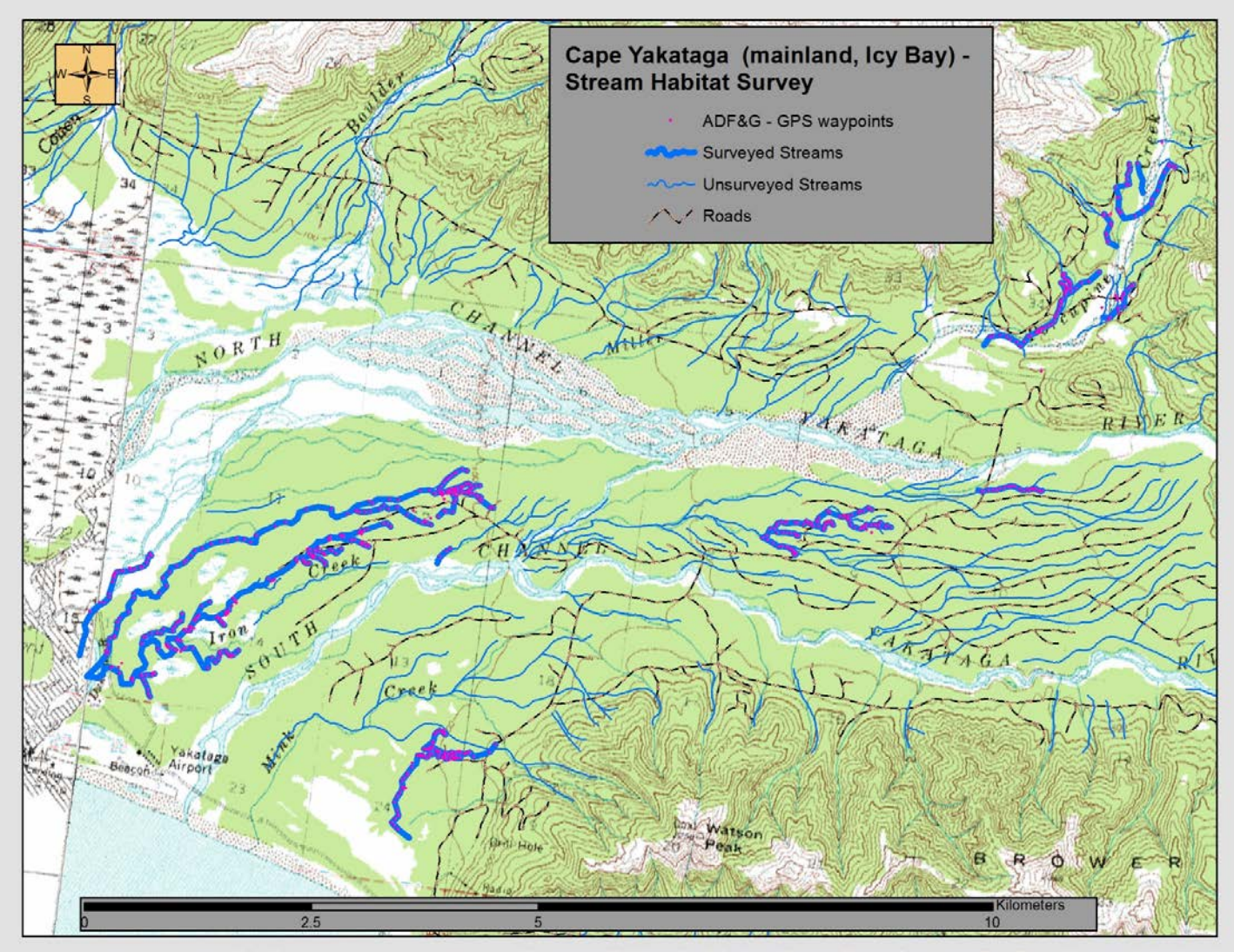

Figure 10.–Location of GPS waypoints and surveyed and unsurveyed hydrography encountered during stream habitat surveys in the Cape Yakataga watersheds on the mainland of Southeast Alaska, near Icy Bay.

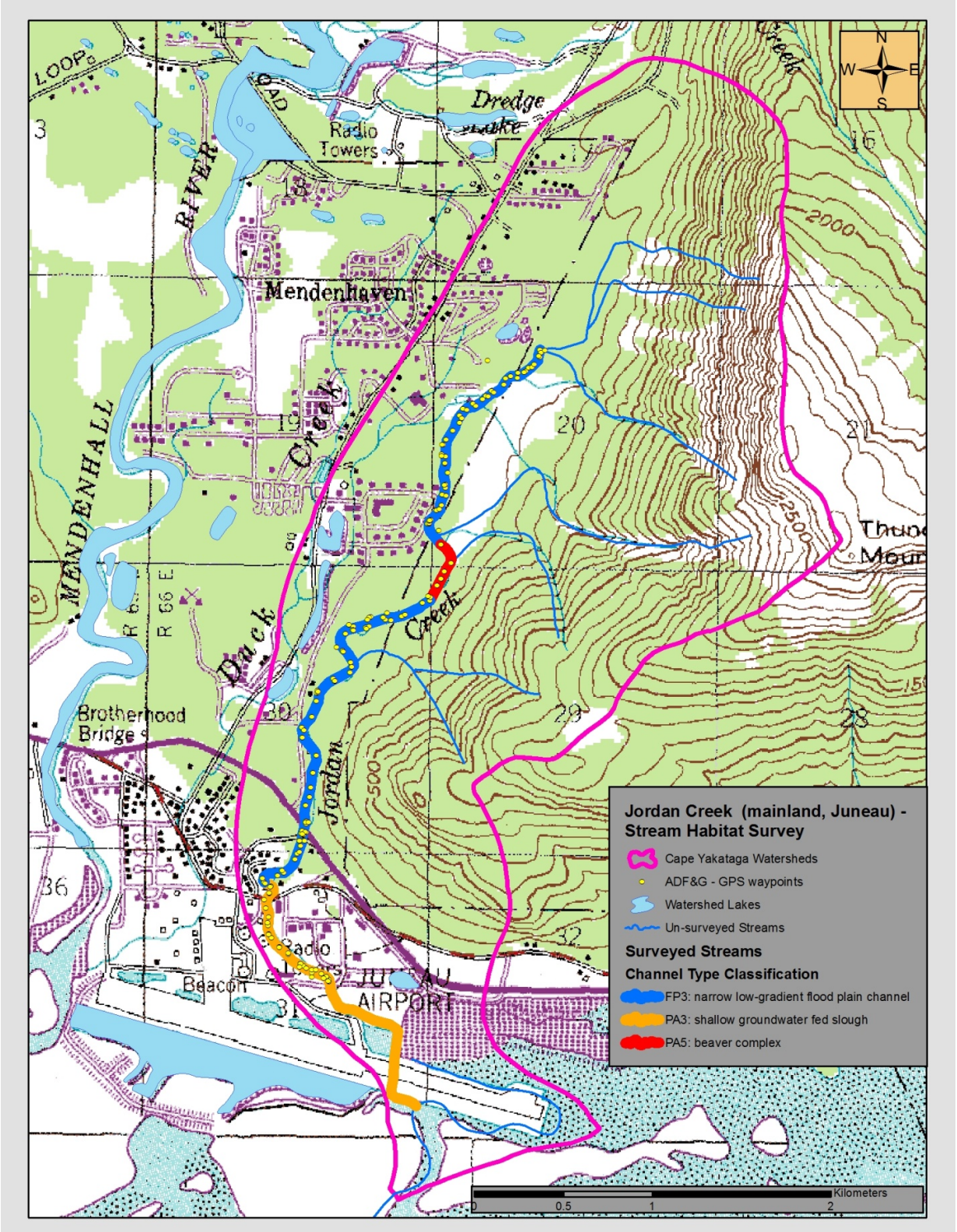

Figure 11.–Location of GPS waypoints and surveyed and unsurveyed hydrography encountered during stream habitat surveys in the Jordan Creek watershed on the mainland of Southeast Alaska, near Juneau.

The Jordan Creek watershed is an urban watershed located in close proximity to residential housing and commercial development, including a dense network of roads, and as such a significant number of stream features and riparian disturbance patterns were observed. Stream crossing structures (n = 18) on the mainstem of Jordan Creek included 11 undefined bridges (including four that provided pedestrian access only), 4 permanent bridges providing vehicular access, and 3 CMPs. All stream crossing structures appeared to be functioning properly. Riparian disturbance was observed at 17 different locations within the watershed, and affected nearly half (2.81 km) of the entire Jordan Creek surveyed area (5.87 km). Urban/commercial landscaping was the category of RDB most commonly observed (n = 9); all of these occurred between the airport and Egan Highway. Impervious surfaces from parking areas (n =3) and roads (n = 2) were also significant RDB factors in the same area.

ADF&G located 21 stream confluences on the mainstem of Jordan Creek. One beaver pond located within the PA5 stream reach was observed. A total of 172 GPS waypoints were collected while conducting stream habitat surveys within the watershed.

Montana Creek – Mainland, Juneau

ADF&G staff surveyed 17.93 km of mainstem and tributary habitat within the Montana Creek watershed. All surveys focused on Montana Creek and prioritized tributaries upstream of the confluence with the Mendenhall River. These waters included 11 distinct reaches representing 7 different geomorphic channel types (Figure 12). The channel type classification, average stream gradient, density (number/km) of macro pools and LWD, and measured stream reach length (km) for the Jordan Creek watershed are provided in Table 9.

Table 9.–Stream channel metrics calculated for prioritized waters of the Montana Creek watershed on the mainland of Southeast Alaska.

Reach number	Channel type classification	Average stream gradient (%)	Density – macro pools (#/km)	Density – LWD[a] (#/km)	Measured length (km)
1	FP4	1.00	28.4	255.7	4.97
2	FP4	0.50	65.0	526.7	0.60
3	LC2	1.00	15.1	73.7	3.50
4	MM1	2.50	42.9	141.0	1.61
5	MC2	3.00	19.3	122.4	2.23
6	FP3	1.00	18.8	143.8	0.32
7	MM2	1.50	31.5	128.8	0.73
8	FP4	0.50	27.5	51.0	0.51
9	FP5	0.83	37.4	175.4	2.11
10	MC2	3.33	45.8	58.3	0.24
11	FP3	1.50	46.9	113.3	1.43
Total					17.93

[a] LWD = large woody debris.

A total of 14 stream crossing structures were surveyed and mapped in the project area, including: a) 5 unidentified bridges; b) 2 permanent bridges; and c) 7 CMPs. The only bridge providing nonrecreational vehicle passage was a permanent bridge located on Back Loop road. All structures were functioning properly. Riparian disturbance factors were observed at 40 locations across the project area and associated with approximately 3.4 km of stream bank; riparian foot traffic accounted for over 60% (approximately 2.0 km). All other RDB was associated with sediment input from eroding banks, bank stabilization measures, or impervious surfaces.

Only 2 barriers were identified within the project area, including 1 geomorphic induced waterfall and 1 ephemeral debris jam. Other stream features that were mapped included 150 stream confluence or diversion locations and 6 LWAs. ADF&G crews captured 461 GPS waypoints while conducting stream habitat surveys.

Peterson Creek – Douglas Island

ADF&G crews captured 415 GPS waypoints while mapping the watered habitats of Peterson Creek. No information on geomorphic reach characteristics was captured during these surveys, although the mainstem of Peterson Creek and all associated tributaries were delineated up to a point considered the end of salmonid habitat. A minimum of 32 different streams, including the mainstem of Peterson Creek were delineated within the watershed, totaling over 22.4 km of habitat (Figure 13). General stream mapping points used to demarcate stream channel locations accounted for the majority of the waypoints captured; 69 stream confluence or diversion locations assisted in updating hydrography and associated connections of the watered habitats within the watershed.

Pleasant Bay – Admiralty Island

ADF&G staff surveyed and mapped 8.43 km of prioritized mainstem and tributary habitat within the Pleasant Bay watershed. All surveys occurred below an impassable fish barrier located approximately 0.58 km downstream of Pleasant Bay Lake. The mapped mainstem and tributaries consisted of 8 distinct reaches associated with 7 different geomorphic channel types (Figure 14). The channel type classification, average stream gradient, density (number/km) of macro pools and LWD, and measured stream length (km) for surveyed streams in the watershed is provided in Table 10. A total of 148 GPS waypoints were captured while conducting stream habitat surveys.

Table 10.–Stream channel metrics calculated for prioritized waters of the Pleasant Bay watershed on Admiralty Island, Southeast Alaska.

Reach number	Channel type classification	Average stream gradient (%)	Density – macro pools (#/km)	Density – LWD[c] (#/km)	Measured length (km)
1	ES4	1.00	NA[a]	NA[a]	0.41
2	LC2	2.00	5.6	55.2	1.25
3	FP4	1.00	13.3	171.7	1.73
4	MM1	3.00	NA[b]	NA[b]	0.96
5	FP3	1.00	29.0	222.6	0.62
6	PA5	1.00	NA[a]	NA[a]	0.77
7	FP3	1.00	25.5	200.0	2.39
8	MM1	3.50	20.0	200.0	0.30
Total					8.43

[a] Macro pools and LWD are not counted in estuarine or palustrine channels due to varying tide levels or water clarity and depth.

[b] Macro pools and LWD were not collected in this channel due to staff time constraints.

[c] LWD = large woody debris.

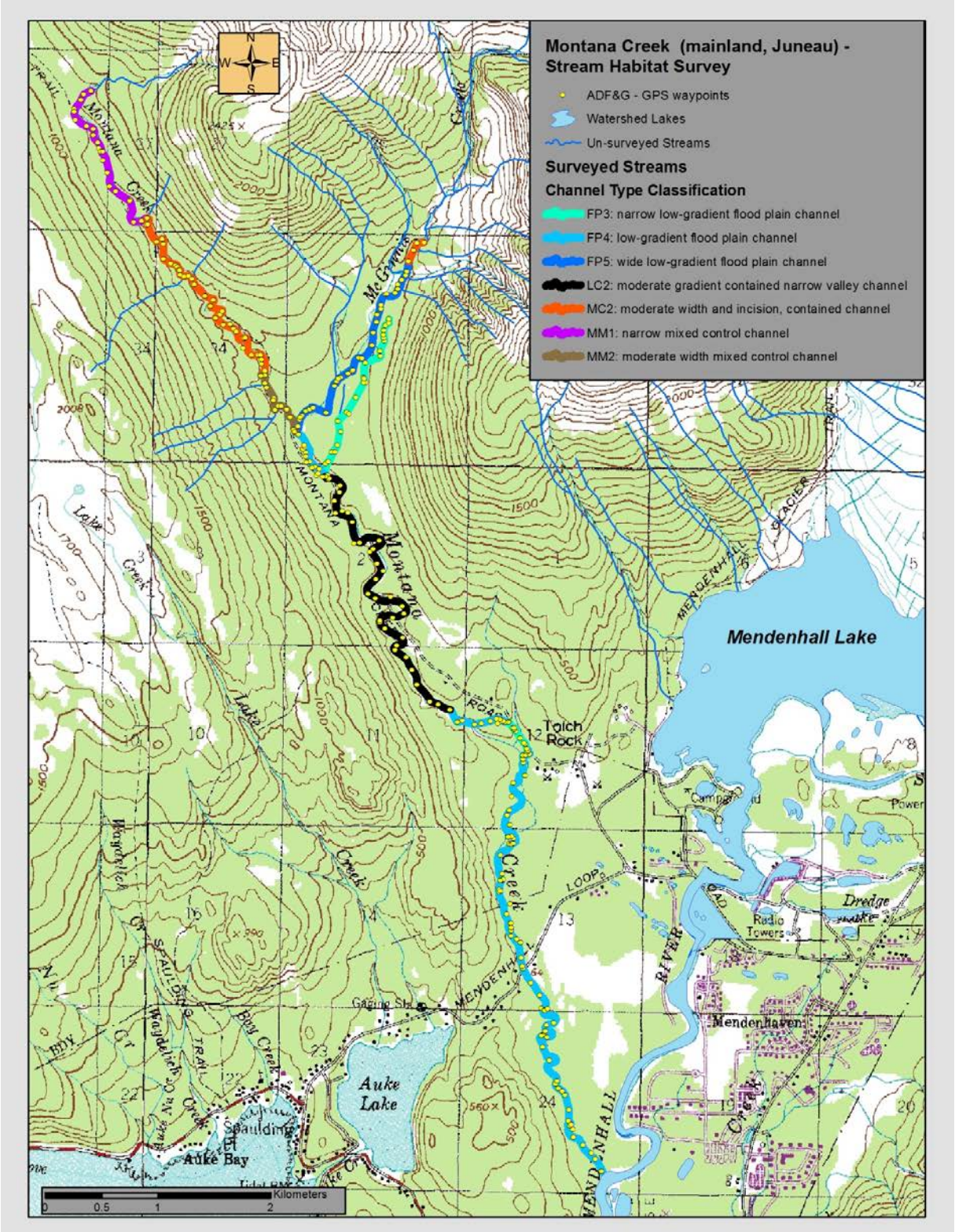

Figure 12.–Location of GPS waypoints and surveyed and unsurveyed hydrography encountered during stream habitat surveys in the Montana Creek watershed on the mainland of Southeast Alaska, near Juneau.

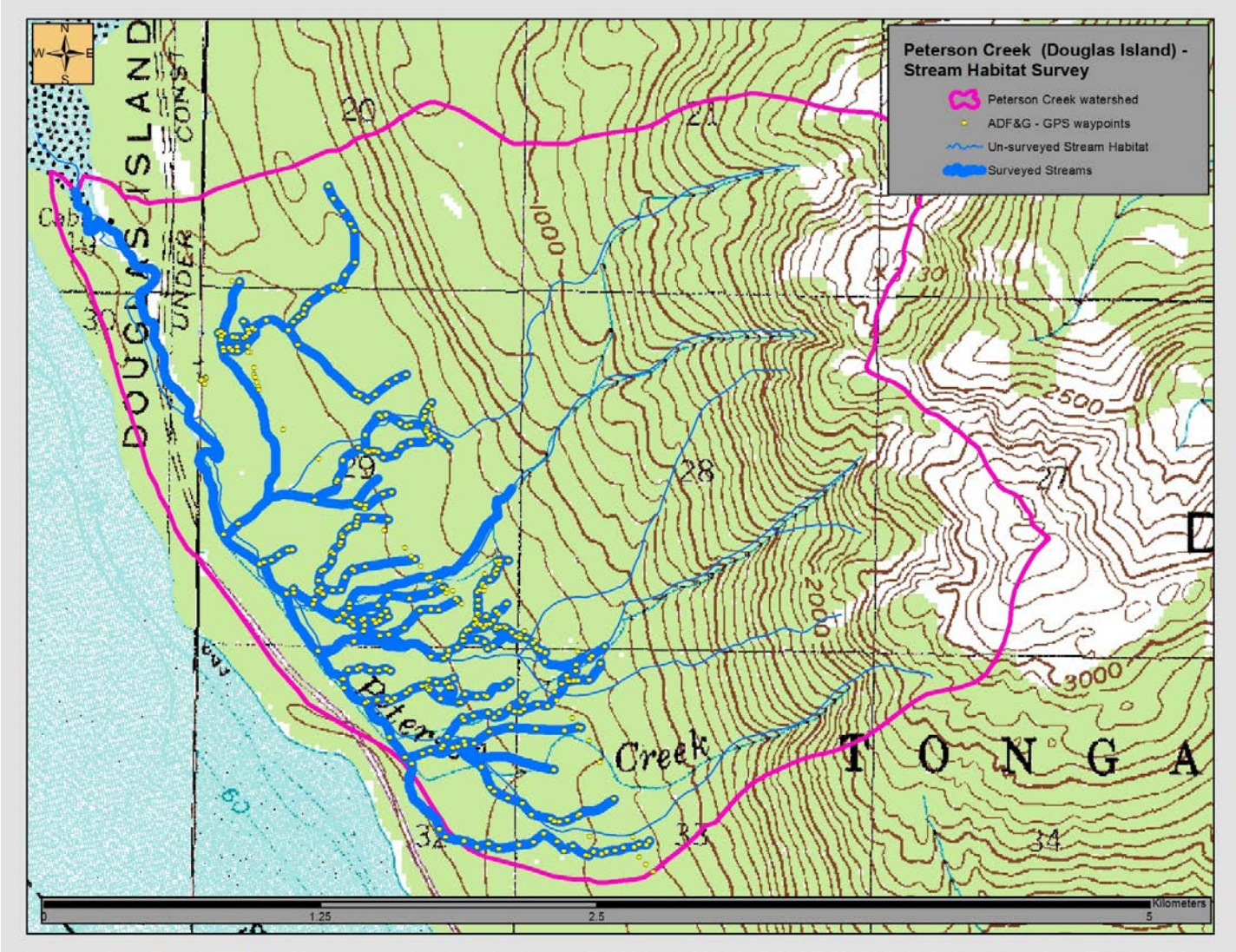

Figure 13.–Location of GPS waypoints and surveyed and unsurveyed hydrography encountered during stream habitat surveys in the Peterson Creek watershed on Douglas Island, Southeast Alaska.

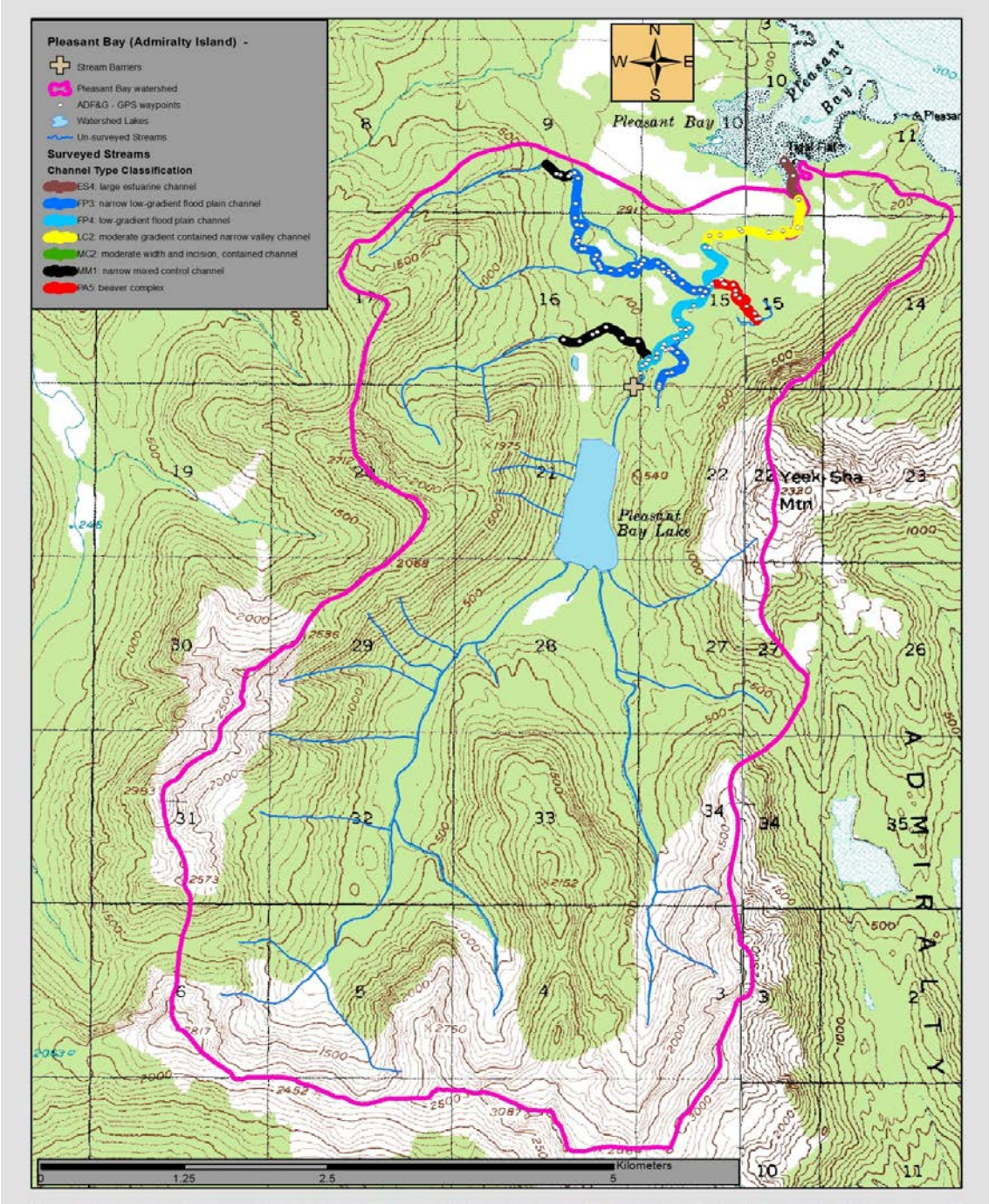

Figure 14.–Location of GPS waypoints and surveyed and unsurveyed hydrography encountered during stream habitat surveys in the Pleasant Bay watershed on Admiralty Island, Southeast Alaska. No roads or stream crossing structures exist in this watershed located within the Admiralty National Monument-Kootznoowoo Wilderness Area. Three instances of RDB were noted during surveys, all of which were associated with sediment input as the result of naturally eroding banks. Other stream related features identified and mapped by ADF&G crews included: a) LWAs (n = 6); b) beaver pond (n = 1); c) ephemeral debris jam (n = 5); d) geomorphic imposed high gradient cascade barrier (n = 1); and e) stream confluence and diversion points (n = 42).

Petersburg Creek – Kupreanof Island

ADF&G staff surveyed and mapped 22.1 km of prioritized mainstem and tributary habitat within the Petersburg Creek watershed. Surveys targeted the mainstem below and above Petersburg Lake and several significant tributaries. These waters included 19 distinct stream reaches and 12 different geomorphic channel type combinations (Figure 15). The channel type classification, average stream gradient, density (number/km) of macro pools and LWD, and measured stream length (km) for surveyed streams in the watershed is provided in Table 11.

Table 11.–Stream channel metrics calculated for prioritized waters of the Petersburg Creek watershed on Kupreanof Island, Southeast Alaska.

Reach number	Channel type classification	Average stream gradient (%)	Density – macro pools (#/km)	Density – LWD[b] (#/km)	Measured length (km)
1	ES4	0.40	NA[a]	NA[a]	2.49
2	FP5	0.25	21.1	41.2	3.79
3	LC2	0.80	11.6	23.1	2.68
4	MM2	1.53	43.6	159.8	1.17
5	FP4	0.70	58.3	173.3	0.60
6	ES3	1.00	NA[a]	NA[a]	0.23
7	AF1	2.30	54.5	359.1	0.22
8	FP5	0.83	60.7	219.0	0.84
9	FP4	0.53	48.3	291.7	1.20
10	LC1	0.77	29.7	168.0	1.28
11	FP4	1.40	68.4	448.0	0.98
12	PA1	1.00	NA[a]	NA[a]	0.07
13	PA2	0.00	NA[a]	NA[a]	0.93
14	FP3	0.93	62.5	487.5	0.72
15	MM1	1.70	33.3	277.8	0.45
16	PA2	0.00	NA[a]	NA[a]	1.27
17	FP4	0.13	33.0	122.7	0.97
18	PA5	0.07	NA[a]	NA[a]	1.76
19	FP3	0.63	70.7	448.8	0.41
Total					22.06

[a] Macro pools and LWD are not counted in estuarine or palustrine channels due to varying tide levels or water clarity and depth.

[b] LWD = large woody debris.

No roads exist in this watershed, although 2 stream crossing structures (footbridge) were documented. Two beaver ponds were identified during surveys. No geomorphic barriers were encountered during surveys, although 12 ephemeral debris jams were encountered. Three instances of RDB were observed and associated with foot traffic or sediment input. Five LWAs were mapped within the project area. The complex stream network included 124 confluence or diversion points. ADF&G staff captured 298 GPS waypoints conducting surveys in the Petersburg Creek watershed.

SALMONID DISTRIBUTION AND MAPPING

Salmonid Index Area Counts and Extents

ADF&G staff worked with ADF&G-SF to identify and delineate the extent of salmonid index areas and individual reaches as well as assisting with the multiple counts of coho salmon or

steelhead trout conducted annually over the duration of this project. Index area extents were delineated for the six watershed project areas identified in Table 3. Some of the individual index areas contained multiple reaches. Delineation of individual salmonid index areas is provided in Figure 16 for the six watersheds where their spatial extent was captured; type of survey, focal species, and reach metrics are provided in Table 12 for each of the six watersheds.

Table 12.–Index area type, focal species, and reach metrics for the six watersheds monitored with annual surveys in Southeast Alaska.

Watershed name	Index area: type	Index area: species	Index area: number of reaches	Index area: total length (km)
Big (108) Creek	Foot	Coho	1	1.79
Ford Arm	Snorkel	Steelhead	1	1.57
Nakwasina River	Foot	Coho	1	4.28
Montana Creek	Foot	Coho	4	13.03
Pleasant Bay	Snorkel	Steelhead	2	1.84
Petersburg Creek	Snorkel	Steelhead	3	7.19
Total			12	29.70

ADF&G conducted coho salmon foot count index surveys in 3 watershed project areas (Big-108 Creek, Nakwasina River, and Montana Creek) along with ADF&G-SF area biologists. One count was conducted within the Big (108) Creek project area on October 30, 2003. During this survey, a total of 98 adult coho salmon were observed across the index area extent, which includes a single reach (Figure 16). Coho salmon were generally observed to be holding in 'schools' in glide and riffle meso-habitats. No fish were observed to be spawning in this area during the survey.

Coho salmon index survey work conducted in the Nakwasina River watershed occurred November 17–19, 2003. A single foot count was conducted in addition to a recapture event of adults originally marked with CWTs. The Nakwasina River coho salmon index area extent includes a single reach (Figure 16). A total of 154 adult coho salmon were observed during the foot count on November 18, 2003. The majority were observed in large scour pool meso-habitats. The largest single count of fish included 43 adult coho salmon. Adult coho salmon were also captured and inspected for marks at 3 different locations using a modified beach seine. A total of 19 adult coho salmon were thus captured.

The third watershed project area where coho salmon index surveys were conducted was Montana Creek. The Montana Creek project area includes 4 distinct reaches within the larger index area (Figure 16), including three on the mainstem of Montana Creek and one on McGinnis Creek, which is a tributary to Montana Creek. Three index surveys conducted by foot were completed during the fall of 2003. The first survey occurred on October 3 and a total of 588 adult coho salmon were observed throughout all mainstem reaches; no coho salmon were observed in the McGinnis Creek reach. The lowest downstream reach had a total count of 321 coho salmon, the middle reach had a count of 172, and 95 coho salmon were observed in the upstream reach. The second of the three surveys was conducted on October 16, when a total count of 808 coho salmon were observed in the four reaches as follows: 1) lowest downstream reach: 422; 2) middle reach: 214; 3) upstream reach: 172; and 4) McGinnis reach: 0. The final survey in 2003 was completed on October 29, when a total count of 293 was observed. The number of coho salmon observed within individual reaches is not available for this survey.

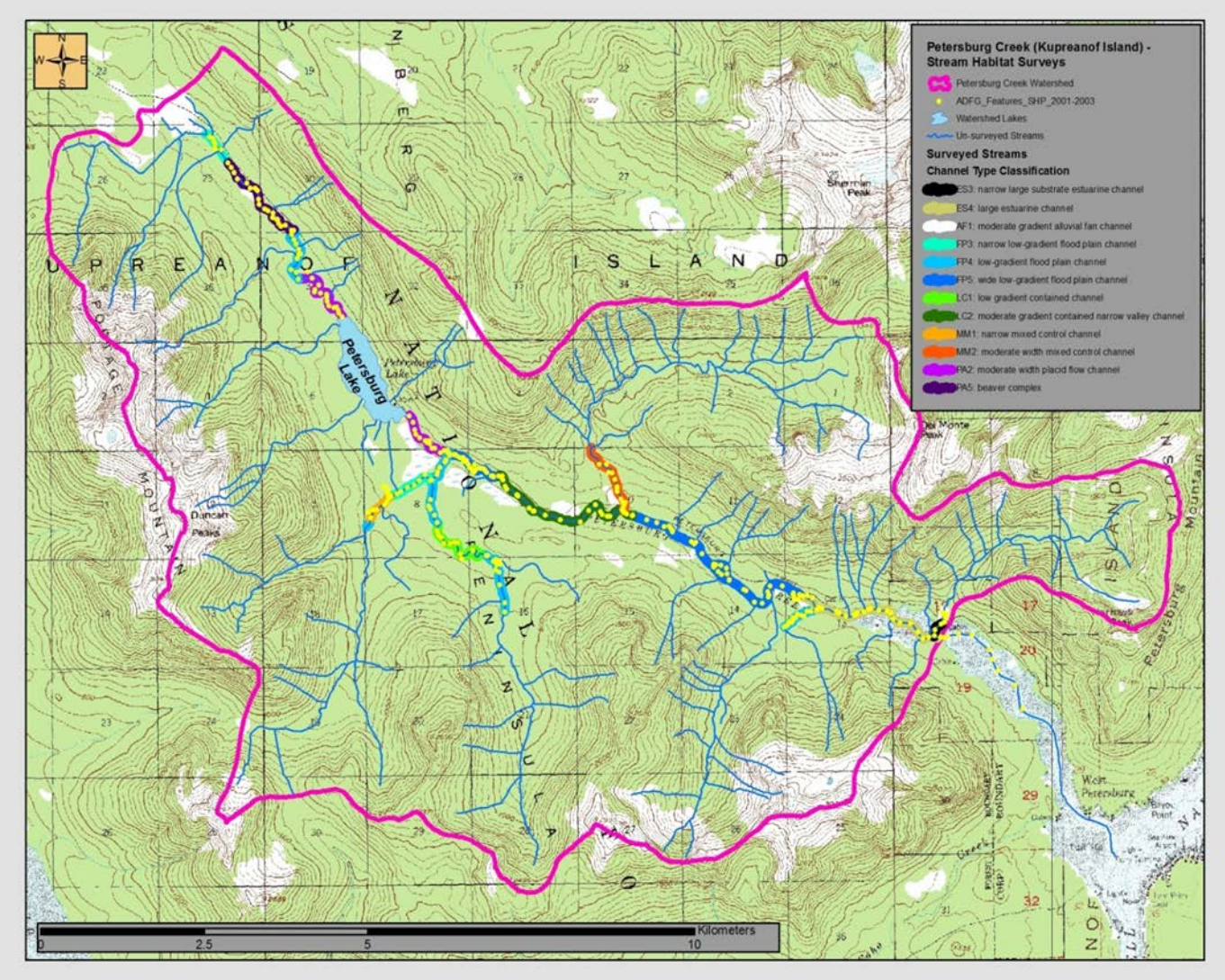

Figure 15.–Location of GPS waypoints and surveyed and unsurveyed hydrography encountered during stream habitat surveys in the Petersburg Creek watershed on Kupreanof Island, Southeast Alaska.

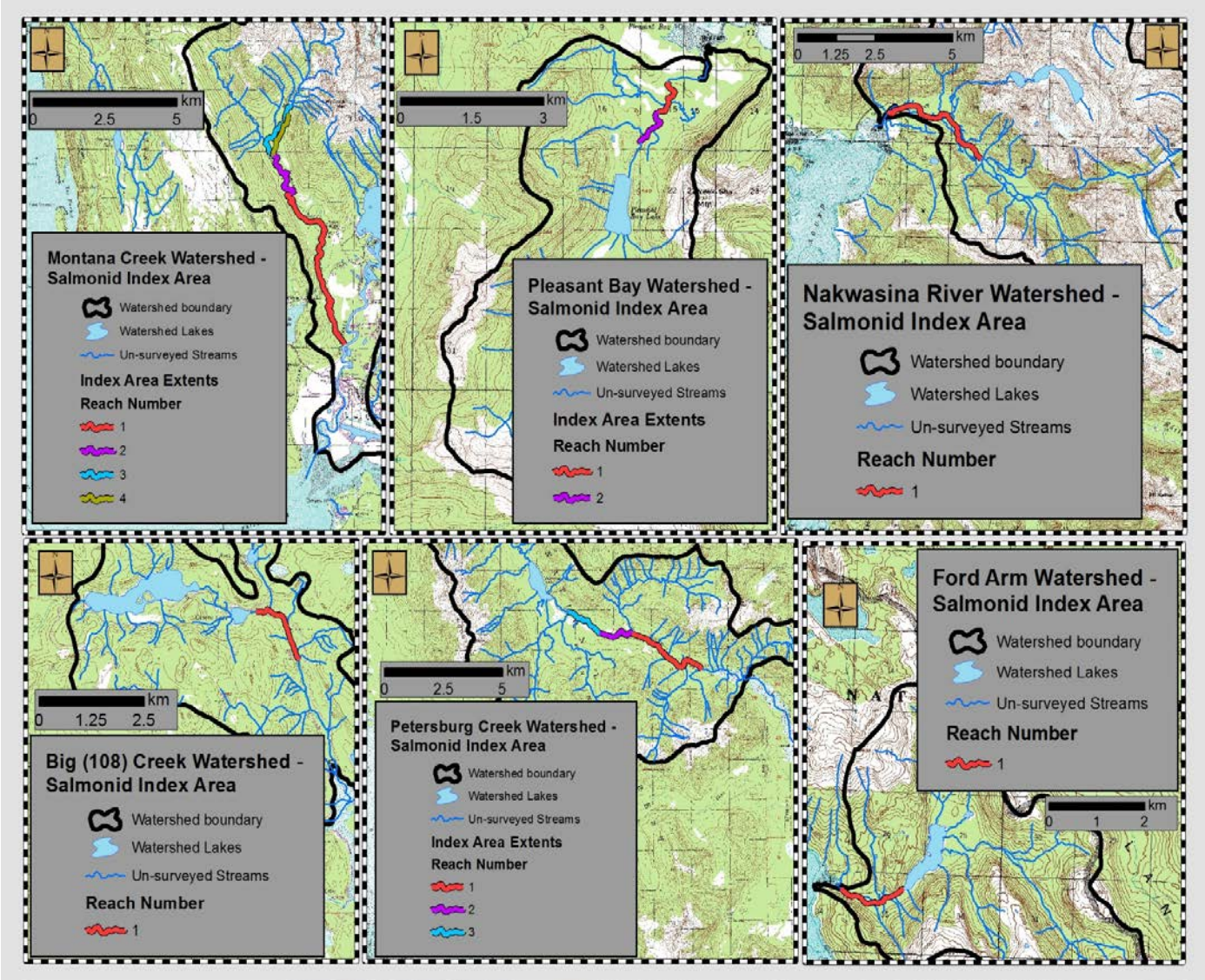

Figure 16.–Delineation of salmonid index area extents in 6 watersheds within the Southeast Alaska project study area.

ADF&G conducted snorkel surveys for adult steelhead trout in 2 watershed project areas (Pleasant Bay and Petersburg Creek). The Pleasant Bay watershed includes 2 reaches (lower, upper) where steelhead trout snorkel surveys occur (Figure 16). Four surveys were conducted during 2003; dates of surveys were April 25, May 1, May 8, and May 19. The total count of steelhead trout observed in the lower reach during these survey dates was 8, 23, 24, and 13, respectively. The total count of steelhead trout observed in the upper reach during these surveys was 11, 24, 21, and 11, respectively. The total counts across the entire index area for these four survey dates ranged from a low of 19 (April 25) to a high of 47 (May 1). The Petersburg Creek watershed project area includes 3 reaches, all downstream of Petersburg Lake. One steelhead trout snorkel survey was conducted by ADF&G and ADF&G-SF staff during 2003 (April 29). A total of 116 adult steelhead trout were observed during this survey. The number of adult steelhead trout observed within the three individual reaches was not recorded due to a GPS malfunction.

Surveys in the Ford Arm watershed only included delineating the spatial extent of the steelhead trout snorkel index area so no counts are reported for that system.

Salmonid Distribution Updates

ADF&G staff surveyed approximately 117.5 km of habitat while conducting fish distribution and mapping activities leading to updates of the AWC, or while updating the known distribution of resident salmonid species (salmonid updates, collectively). This work occurred within the seven watershed project areas identified in Table 2. ADF&G captured 385 GPS waypoints while conducting surveys across the eight watersheds, which included documenting over 450 instances of fish capture or effort. A total of 1,790 salmonids were captured or observed during surveys, representing 6 species (coho, chum, sockeye, and pink salmon, and Dolly Varden and cutthroat trout). ADF&G identified approximately 38.13 km of previously unmapped anadromous fish habitat during surveys in the eight watersheds, including 49 new stream reaches (Table 13). Salmonid distribution updates and effort are described below for each of the eight watersheds where these activities occurred.

Black Bear Creek – Prince of Wales Island

Salmonid updates in the Black Bear Creek watershed (Figure 17) included documenting the distribution of salmonids at prioritized stream road crossings, near the south fork tributary, and the mapped beaver pond upstream of Black Lake. ADF&G placed baited minnow traps (n = 76) immediately upstream and downstream of crossing structures (i.e., culvert pipes, log culverts, log-stringer bridges) and in the south fork tributary and beaver pond to determine presence of salmonids. A total of 427 salmonids were captured during these efforts. Species and life stage of captured fish included coho salmon, Dolly Varden, and cutthroat trout, all of which were classified as juveniles. No salmonids were captured at 18 of the 76 trapping locations. Four tributary streams to the mainstem of Black Bear Creek were identified as containing anadromous fish habitat and fish (coho salmon) that were not listed in the 1999 version of the AWC and associated atlas. These stream reaches and mapped fish distribution along with watershed hydrography are delineated in Figure 17.

Table 13.–Total anadromous stream length and individual streams identified in the presurvey (year 2000) and postsurvey (year 2003) Anadromous Waters Catalog in the 12 watersheds visited for this project during 2001–2003, Southeast Alaska.

Watershed name	Total length (km) of anadromous stream length in watershed (presurvey): year 2000	Total length (km) of anadromous stream length in watershed (post-survey): year 2003	Total number of anadromous streams in watershed (presurvey): year 2000	Total number of anadromous streams in watershed (postsurvey): year 2003
Black Bear Creek	11.35	12.26	9	13
Big (108) Creek	7.00	7.00	2	2
Soda Creek	11.43	18.44	12	18
Warm Chuck Creek	2.45	4.51	4	10
Ford Arm	11.13	11.13	7	7
Nakwasina River	18.86	18.86	13	13
Cape Yakataga	88.86	110.02	68	84
Jordan Creek	11.56	11.56	10	10
Montana Creek	36.06	36.06	22	22
Peterson Creek	9.84	16.83	6	23
Pleasant Bay	2.26	2.26	1	1
Petersburg Creek	14.17	14.17	10	10
Totals	224.97	263.10	164	213

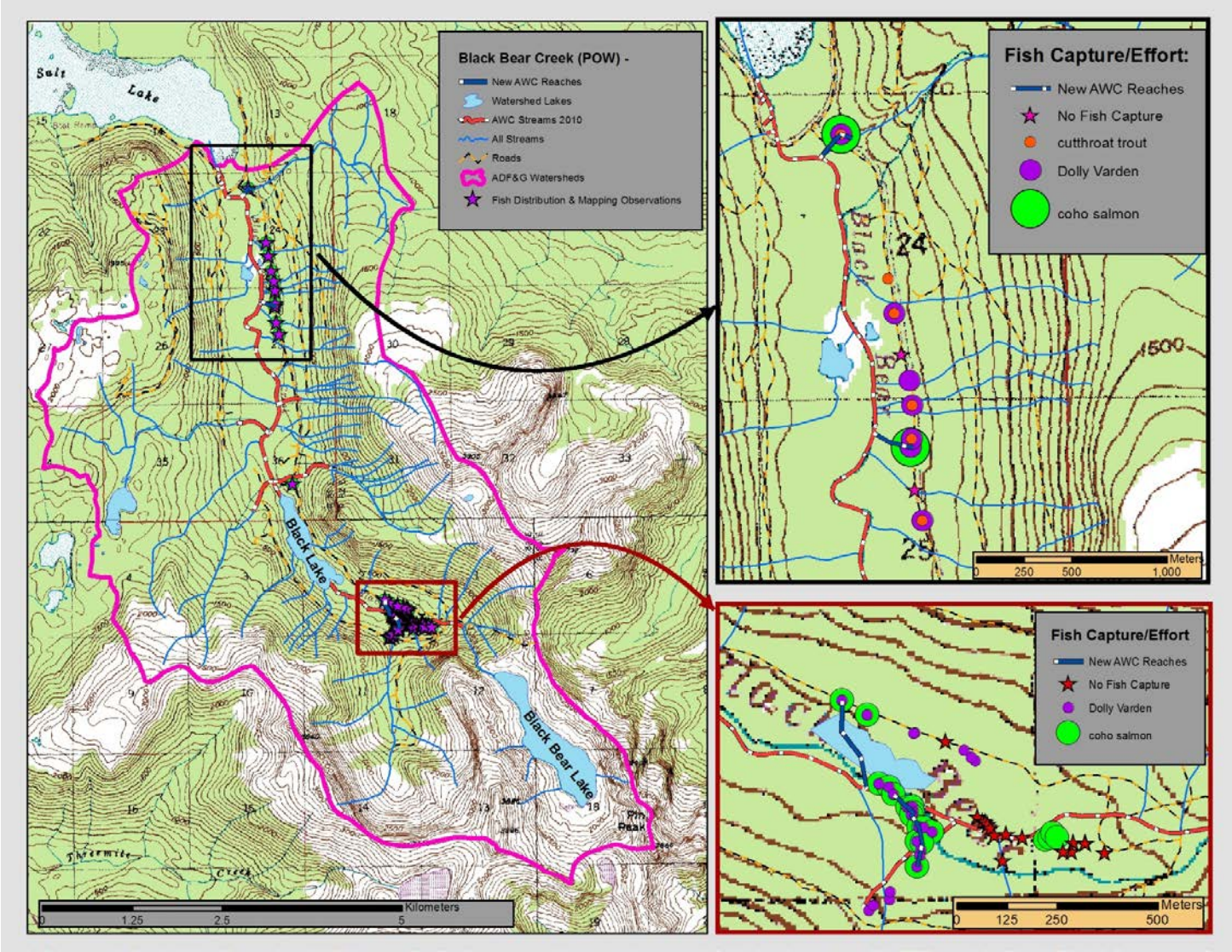

Figure 17.–Delineation of fish capture and effort in the Black Bear Creek project area, Prince of Wales Island, Southeast Alaska.

Soda Bay – Prince of Wales Island

Salmonid updates in the Soda Bay project area (Figure 18) included documenting the distribution of salmonids within prioritized streams that were contained in timber planning units. ADF&G initiated salmonid update surveys beginning near salt water by placing baited minnow traps to identify and confirm anadromous fish presence in the lowest reaches of prioritized streams; if anadromous fish were captured, minnow trapping efforts continued upstream to a point where no anadromous fish were captured, or where significant barriers prohibited passage. Information on resident and other nonanadromous salmonids was also collected.

ADF&G placed a total of 111 minnow traps in the project area. Seven visual observations of adult Pacific salmon were also recorded. A total of 531 salmonids were thus observed. Species and life stage of observed fish included coho salmon (juvenile and adult), chum and pink salmon (adult only), and juvenile Dolly Varden and cutthroat trout. No salmonids were captured at 19 of the 111 trapping locations. Two significant headwater tributaries to Soda Creek and 1 small mainstem reach were identified as hosting anadromous fish habitat and fish; these streams were not previously catalogued in the AWC and included 5.92 km of newly recognized anadromous fish habitat. These stream reaches and mapped salmon distribution along with watershed hydrography are delineated in Figure 18.

Warm Chuck Creek – Heceta Island

ADF&G conducted salmonid update surveys in the Chuck Lake outlet (Chuck Creek) and all tributaries draining into the lake. Salmonids were captured via minnow traps (n = 17) or dip net (n = 3). A total of 60 salmonids were captured, including 38 juvenile coho salmon, 19 juvenile cutthroat trout, and 3 Dolly Varden. Salmonids were not captured at 5 of the 17 minnow trapping locations. A total of 2.06 km of new anadromous fish habitat was identified across 6 tributary streams within the watershed compared to the year 1999 AWC. These stream reaches and mapped salmon distribution along with watershed hydrography are delineated in Figure 19.

Ford Arm – Chichagof Island

ADF&G conducted minimal salmonid update work in the Ford Arm watershed, as the documentation of anadromous fish-bearing waters in the watershed was deemed accurate by ADF&G and ADF&G-SF biologists. Salmonid observations were limited to 5 locations, including four where minnow traps were placed for juvenile fish and 1 visual observation of an adult chum salmon. A total of 5 juvenile salmonids were captured in minnow traps including 4 coho salmon and 1 sockeye salmon. No new anadromous fish-bearing waters were identified. Salmonid observation locations and hydrography are delineated for the Ford Arm watershed in Figure 20.

Cape Yakataga – Mainland, Icy Bay

ADF&G conducted a unique type of salmonid update work with cooperation and agreement from primary landowners in the Cape Yakataga project area. These activities are described in the Methods section of this document. Although generally no fish capture or observation techniques were used, ADF&G was able to map streams, identify connectivity with previously catalogued water bodies, and document the upper extent of anadromous fish-bearing habitat to provide information necessary to update the AWC for this area.

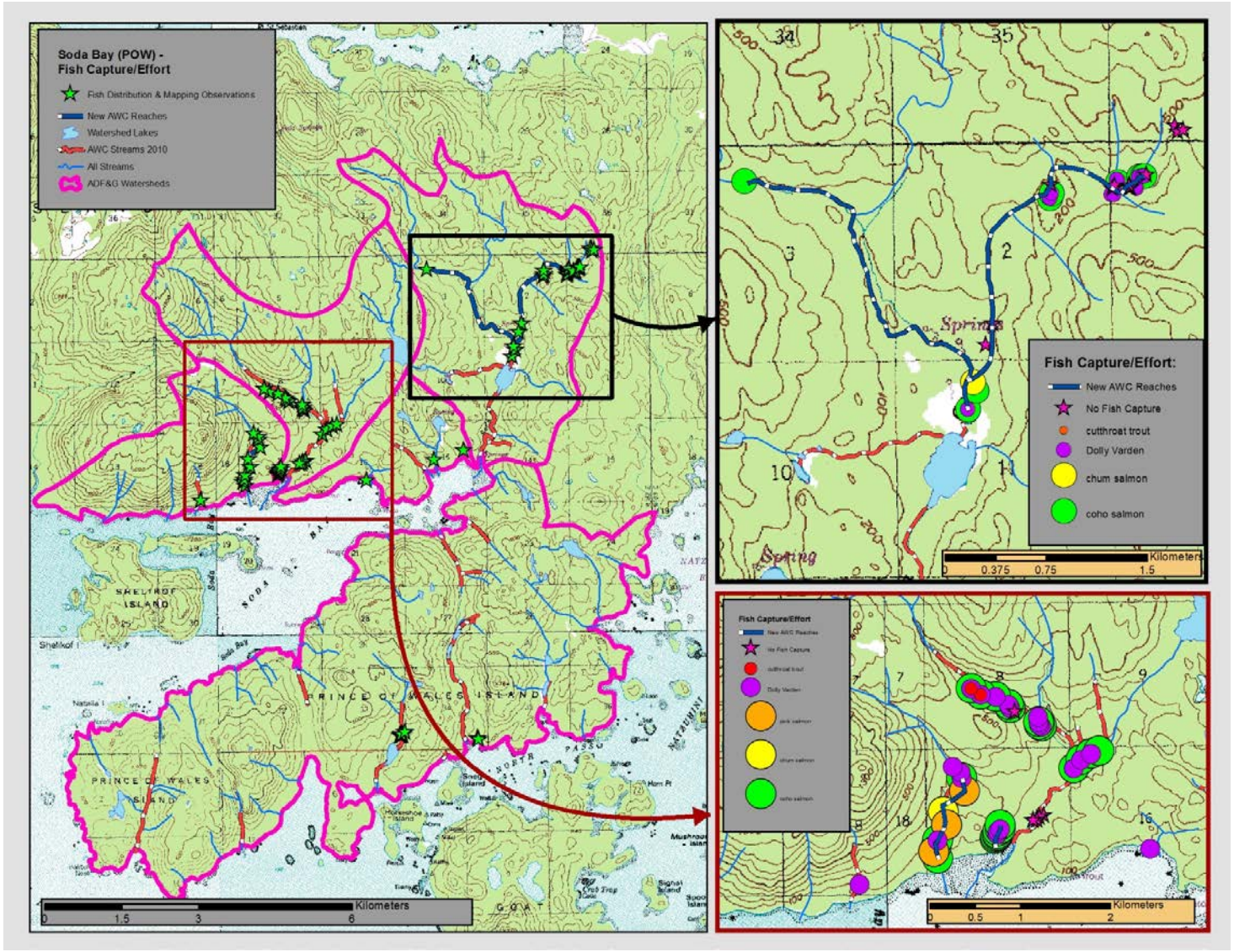

Figure 18.–Delineation of fish capture and effort in the Soda Bay project area, Prince of Wales Island, Southeast Alaska.

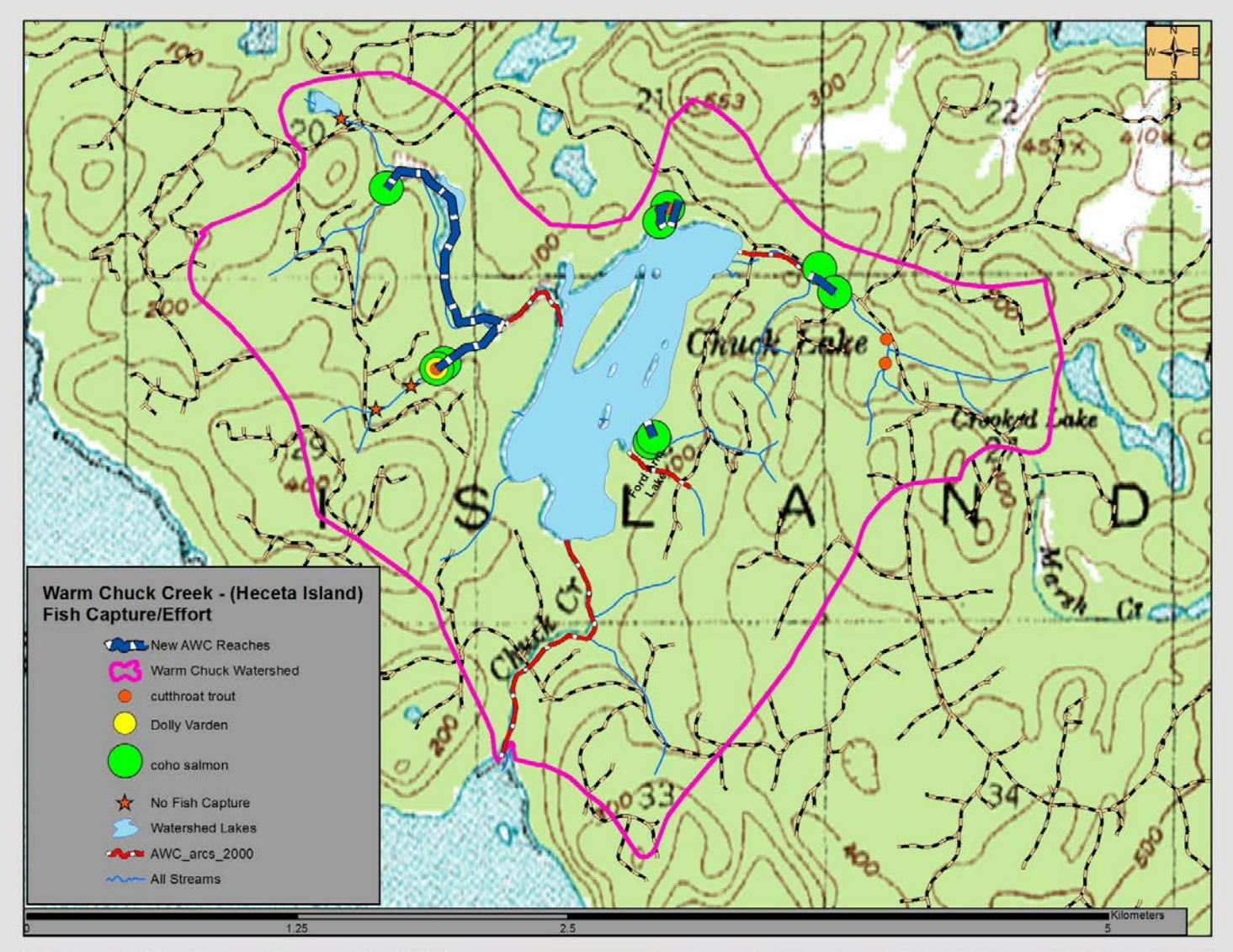

Figure 19.–Delineation of fish capture and effort in the Warm Chuck Creek project area, Heceta Island, Southeast Alaska.

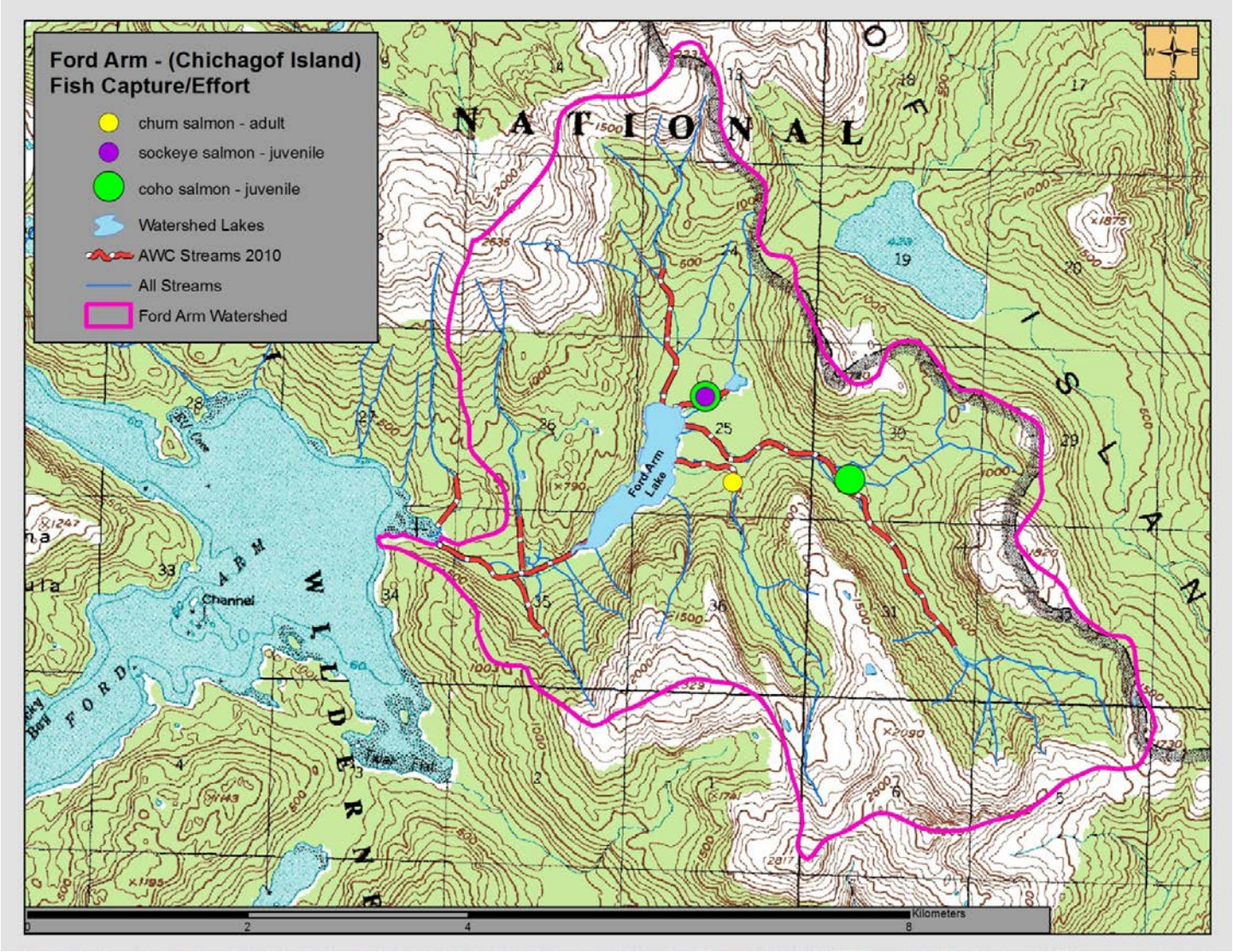

Figure 20.–Delineation of fish capture and effort in the Ford Arm project area, Chichagof Island, Southeast Alaska.

Salmonid update activities performed by ADF&G led to the identification and delineation of 16 water bodies containing anadromous fish habitat and fish that were not in the previous (year 1999) AWC (Figure 21). These 16 water bodies included tributaries to the North and South Channels of the Yakataga River, Iron Creek, and Mink Creek. This included a total of 21.16 km of anadromous fish habitat, primarily believed to be associated with coho salmon rearing needs.

Jordan Creek – Mainland, Juneau

ADF&G conducted minimal salmonid update activities in the Jordan Creek watershed, as the documentation of anadromous fish-bearing waters and extent was deemed accurate in the AWC. Salmonid observations were limited to 7 different locations, including 1 location where 6 juvenile coho salmon were dipnetted; the remaining 6 observations included counts of adult coho salmon ranging from 1 to 12 fish. These salmonid observations and hydrography are delineated for the Jordan Creek watershed in Figure 22.

Peterson Creek – Douglas Island

ADF&G conducted extensive salmonid update surveys in the Jordan Creek watershed between April 1 and December 19, 2001. A total of 151 locations distributed across individual tributaries and the mainstem of Peterson Creek were surveyed for fish using baited minnow traps (n = 148), dip net (n = 2), or by visual observation (n = 1). Only 1 trapping location yielded no fish. A total of 576 salmonids were thus observed (Figure 23). Species and life stage of captured or observed fish included juvenile coho salmon (n = 169), adult pink salmon (n = 1), Dolly Varden (n = 227), and cutthroat trout (n = 179).

Prior to salmonid update surveys conducted during 2001, the total length of anadromous fish habitat for the Peterson Creek watershed was approximately 9.18 km. After surveys were completed, the total length of identified anadromous fish habitat in the watershed was approximately 16.83 km. Figure 24 depicts the extent of anadromous fish habitat identified in the AWC based on presurvey and postsurvey information.

DISCUSSION

WATERSHED PRIORITIZATION

The watershed prioritization strategy employed for this project was based on a foundation of relevant spatial data layers, identification of significant data gaps, proposed development activities, and expert opinion. All components of the strategy were considered in light of salmon and salmon habitat issues. The strategy involved a dynamic or evolving process, borne out of practical matters related to funding levels and staff availability, as well as the need to address current and recently emerging land management activities. If the strategy were repeated in future years, it was recognized that individual watersheds may be prioritized differently, depending on availability of new information regarding land management decisions, fishery management scenarios, or other factors. The selection of the 12 watersheds where activities occurred under this project was guided by a strategy that required input from landowners and managers, fishery and habitat biologists, and other stakeholders. Collectively, the group was tasked with identifying priority watersheds and the type of surveys that would be used to address key issues related to salmon and salmon habitat.

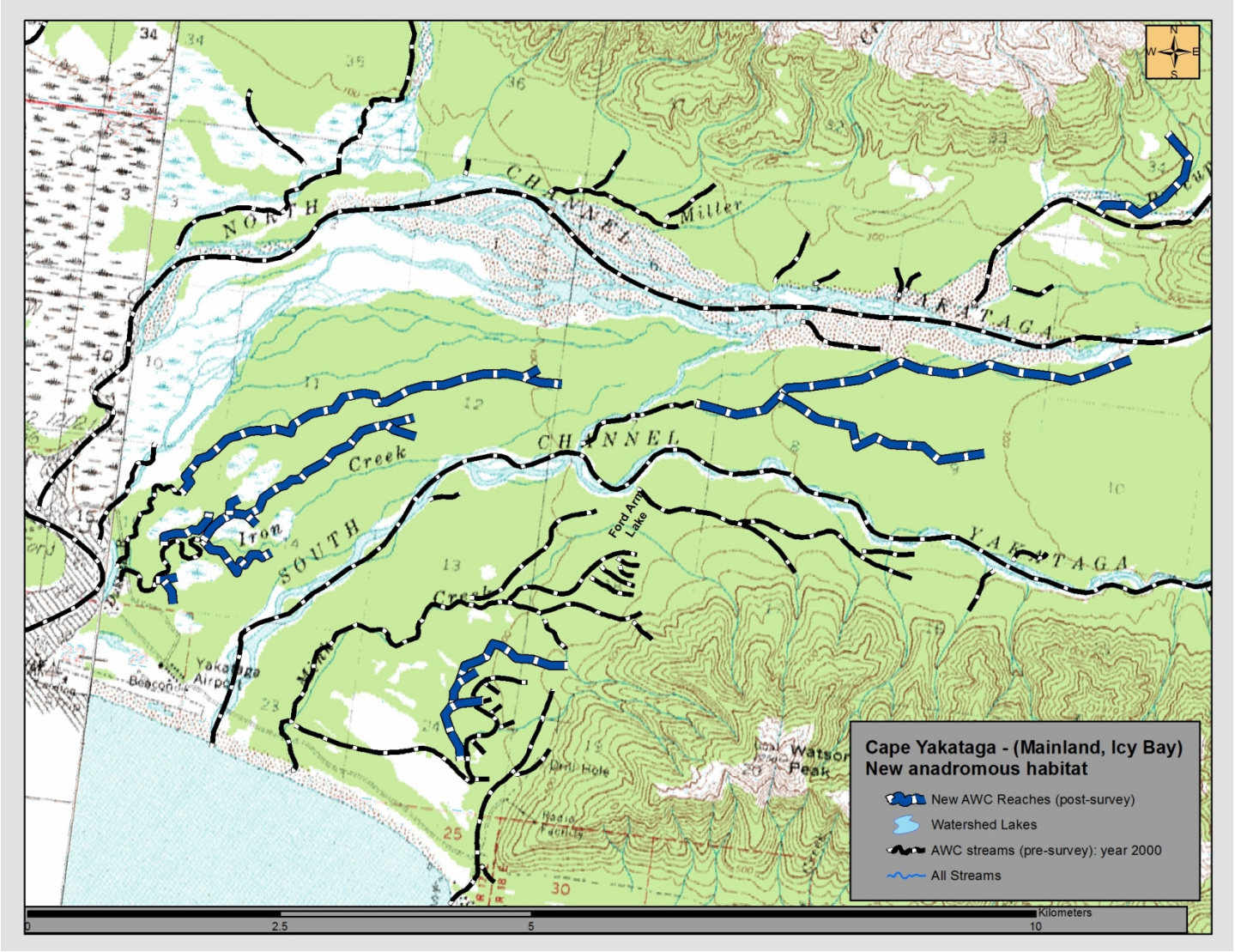

Figure 21.–Delineation of pre-survey (Year 1999 Anadromous Waters Catalog) and post-survey (Year 2004 Anadromous Waters Catalog) anadromous fish habitat in the Cape Yakataga project area, mainland Southeast Alaska.

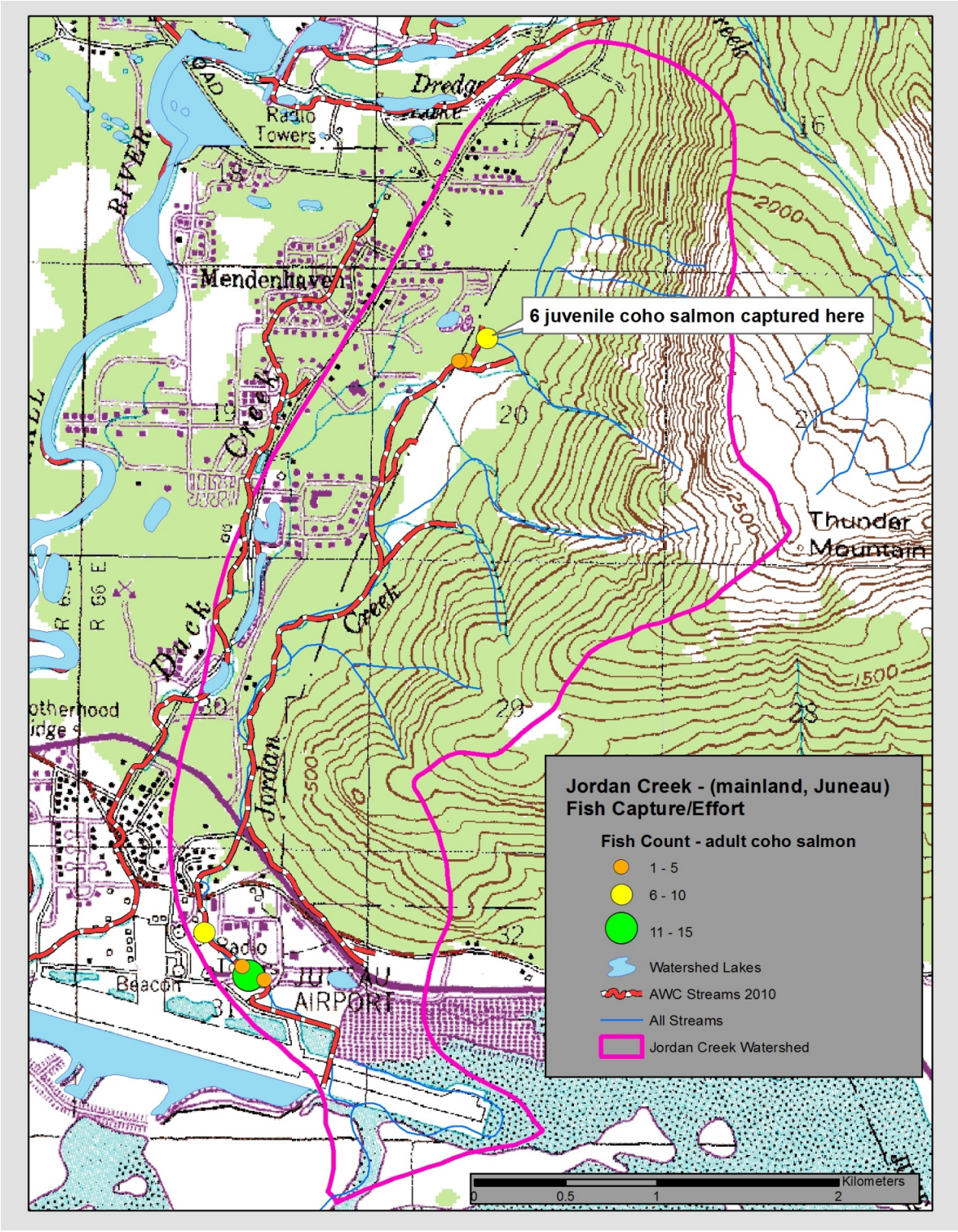

Figure 22.–Delineation of fish capture and effort in the Jordan Creek project area, mainland Southeast Alaska.

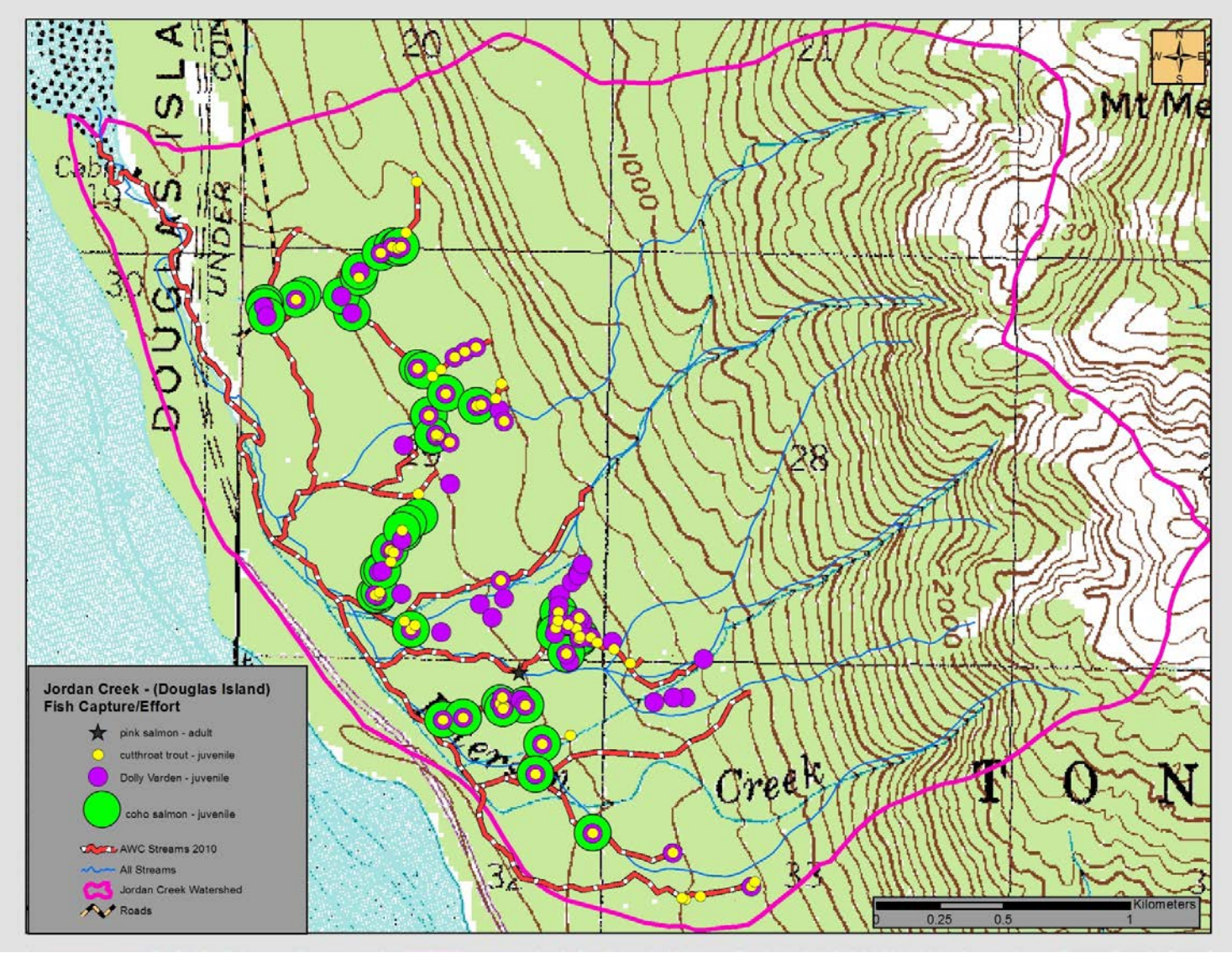

Figure 23.–Delineation of fish capture and effort in the Peterson Creek project area, Douglas Island, Southeast Alaska.

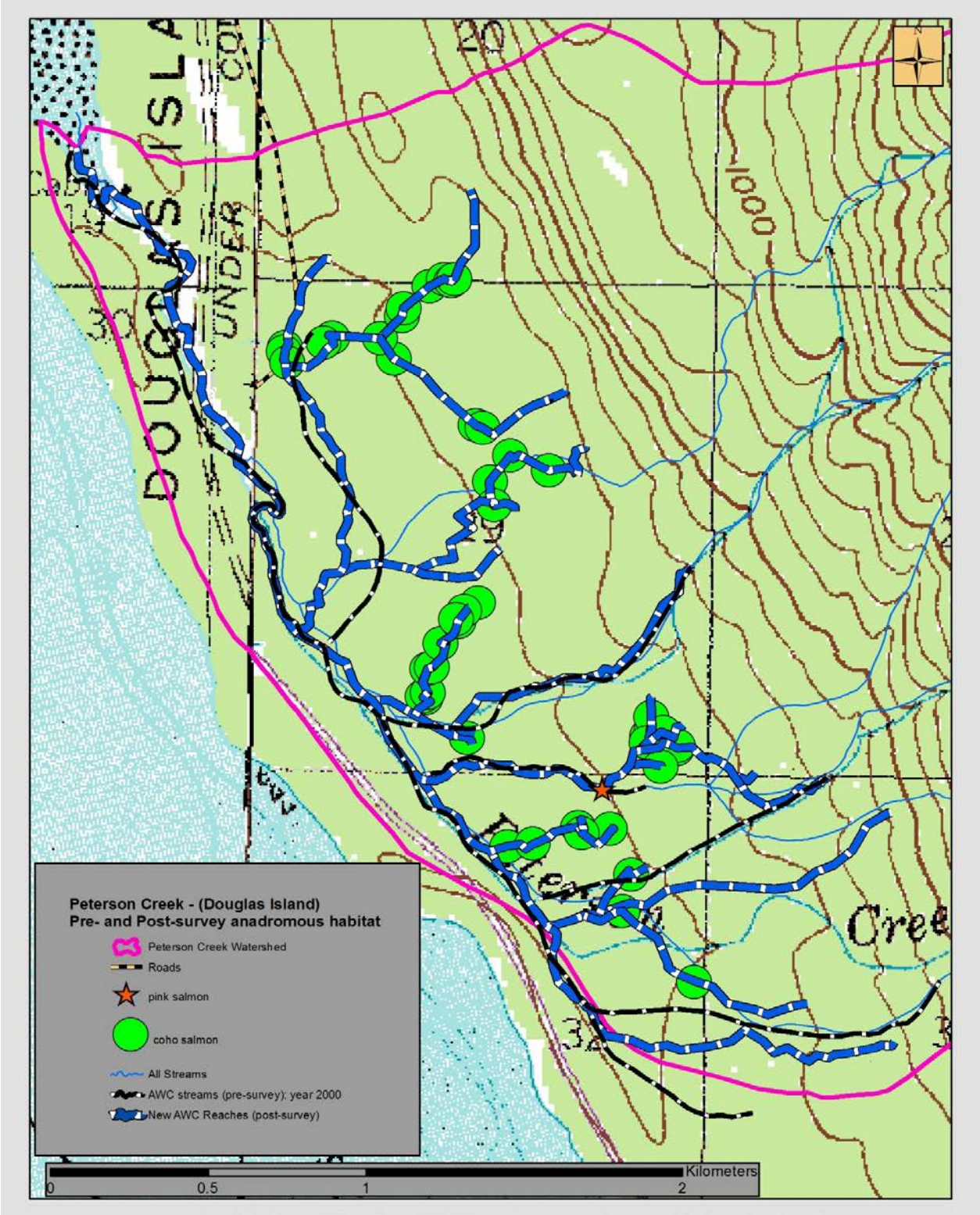

Figure 24.–Delineation of presurvey (year 1999 Anadromous Waters Catalog) and postsurvey (year 2004 Anadromous Waters Catalog) anadromous fish waters in the Peterson Creek project area, Douglas Island, Southeast Alaska.

STREAM HABITAT SURVEYS

Stream habitat surveys provide a means to identify, classify, and enumerate metrics that are important to salmonids and further our understanding of salmonid habitat use and preference in SEAK. The classification of waters into unique geomorphic process groups and channel types and accurate delineation of water bodies are essential tools used across SEAK for managing aquatic and riparian resources.

Information derived from stream habitat surveys is useful at different geographic scales for a variety of purposes. At fine scales (i.e., individual stream reaches), habitat surveys demarcate the precise location of a channel, its connectivity with other aquatic habitats and riparian and terrestrial features, the density of important fishery habitat parameters (e.g., LWD and macro-pools), and a host of related physical characteristics, all of which contribute to an evaluation of hydrologic function, aquatic habitat capability, and riparian management functions (USFS 1992).

At a broader watershed scale, stream habitat survey information is useful in understanding the full suite of available habitats that are important to the diversity of salmonid species and individual life stages that are found in the watershed. Comparing watershed metrics, such as total stream length, the number of lakes, or the amount of floodplain habitat, etc., are all useful tools in explaining the presence, distribution, and abundance of salmonids in individual watersheds. This information can also be used in a variety of watershed prioritization strategies, including that used for this project.

Stream habitat surveys conducted during this project provided fine-scale mapping of hydrography including streams, rivers, tributaries, side channel habitats, and lakes and ponds that were immediately available for GIS integration and updating corporate data layers. A wide diversity of entities cooperated with ADF&G to acquire this data, and incorporate into shared and individually administered spatial datasets. These entities include the USFS-TNF, State of Alaska (Department of Natural Resources, University of Alaska, Mental Health Trust), regional native corporations, and various city and boroughs.

This project provided new and updated information and delineation of a diversity of aquatic habitats across the 12 watershed project areas totaling a length of over 171 km. Survey data included identification, delineation, and measurement of a significant number of associated fluvial, riparian, and geomorphic features, as well as stream crossing structures. This comprehensive dataset provides the foundation from which to better understand salmonid distribution patterns, and when incorporated into conservation and management scenarios, ensures sustainable populations of the same.

SALMONID DISTRIBUTION AND MAPPING

Fish distribution data collected during this project included documenting the precise locations where salmon were observed or effort was applied in the 12 priority watershed project areas. The number of fish by species and life stage was recorded during all efforts, along with the requisite spatial information allowing integration with GIS. The GIS provided an efficient and accurate means to delineate and update relevant data layers, including most notably the AWC. The two types of fish distribution and mapping surveys are discussed individually below.

Salmonid Index Area Counts and Extents

The capture of data associated with salmonid index areas included identifying their spatial extent within an individual watershed and collecting GPS waypoints associated with each fish or group of fish observed during a survey. Although the delineation of individual counts of fish observed during index surveys may prove to be useful in the future, the main intent of this work was simply to permanent mark and delineate the location and extent of survey areas in a particular watershed. Index survey results are often used as a relative abundance index, making comparisons across years and between streams. This information is a useful management tool in absence of full stock assessment activities. However, the utility of comparisons across years for a single stream is only apparent if there is assurance that the same stretch of stream is surveyed each time. ADF&G's efforts to map salmonid index areas, provided an opportunity to capture regionally significant long-term datasets on salmon abundance in a geographical perspective.

Salmonid Distribution Updates

Data associated with salmonid distribution updates included the capture of spatial information necessary to identify exactly where fish were observed. New information on the presence of resident and anadromous salmon at the watershed and individual stream reach was captured throughout the 12 watersheds in the study area. When considered with other available data, this improves our knowledge of salmonid species distribution patterns and habitat relationships.

Additional anadromous fish use for several Pacific salmon species and life stage combinations were identified in the watersheds surveyed during this project. The proactive identification of anadromous fish habitat provides land managers with the information necessary to protect salmonid habitat and access to the same under Alaska statute. This satisfies important criteria established under the SSF Policy, and is a top priority of the ADF&G-SF.

ACKNOWLEDGEMENTS

Funding for this project was provided by the AKSSF and Dingell-Johnson/Wallop-Breaux (DJ) through the Federal Aid in Sport Fish Restoration Program.

The native corporations of Sealaska and Goldbelt coordinated with ADF&G providing access to portions of the Soda Bay and Black Bear Project Areas (Sealaska) and Peterson Creek Project Area (Goldbelt). Jeff Hermanns, University of Alaska Forester provided endless support with our field efforts in the Cape Yakataga Project Area. Our field activities in this project area were coordinated by ADF&G biologists Phil Mooney and Linda Speerstra of Sitka.

Kevin Brownlee, fish biologist with the ADF&G-SF assisted our ADF&G staff in coordinating field efforts within the Black Bear Creek Project Area, as well as providing information regarding the proposed hydro facility. Joe Bovee, forester for Sealaska Corporation, provided logistical support and housing during our field work in the Soda Bay Project Area. Mark Minillo provided staff with resources and field assistance within the Black Bear Creek and Soda Bay project areas.

Work on the Peterson Creek project area was a cumulative effort by many biologists within the ADF&G, including Kevin Brownlee, Brian Glynn, Mark Schwan, Catherine Pohl, Carl Schrader, Bill Hanson, Jason Shull and Kevin White. In addition, members of the Tlingit & Haida Central Council, including Cal Richert and Cathy Needham, provided fish trapping data on tributaries of Peterson Creek, which helped in overall data mining for the project. Art Dunn and Gary

Murdoch, both assisting Totem Creek, Inc., also provided spatial data and comments for field inspections. ADF&G biologists responsible for all data collection, quality control, analyses, and interpretation included Dave Gregovich, Christine Schmale, Kim Obermeyer, Sanjay Pyare, and Brian Frenette.

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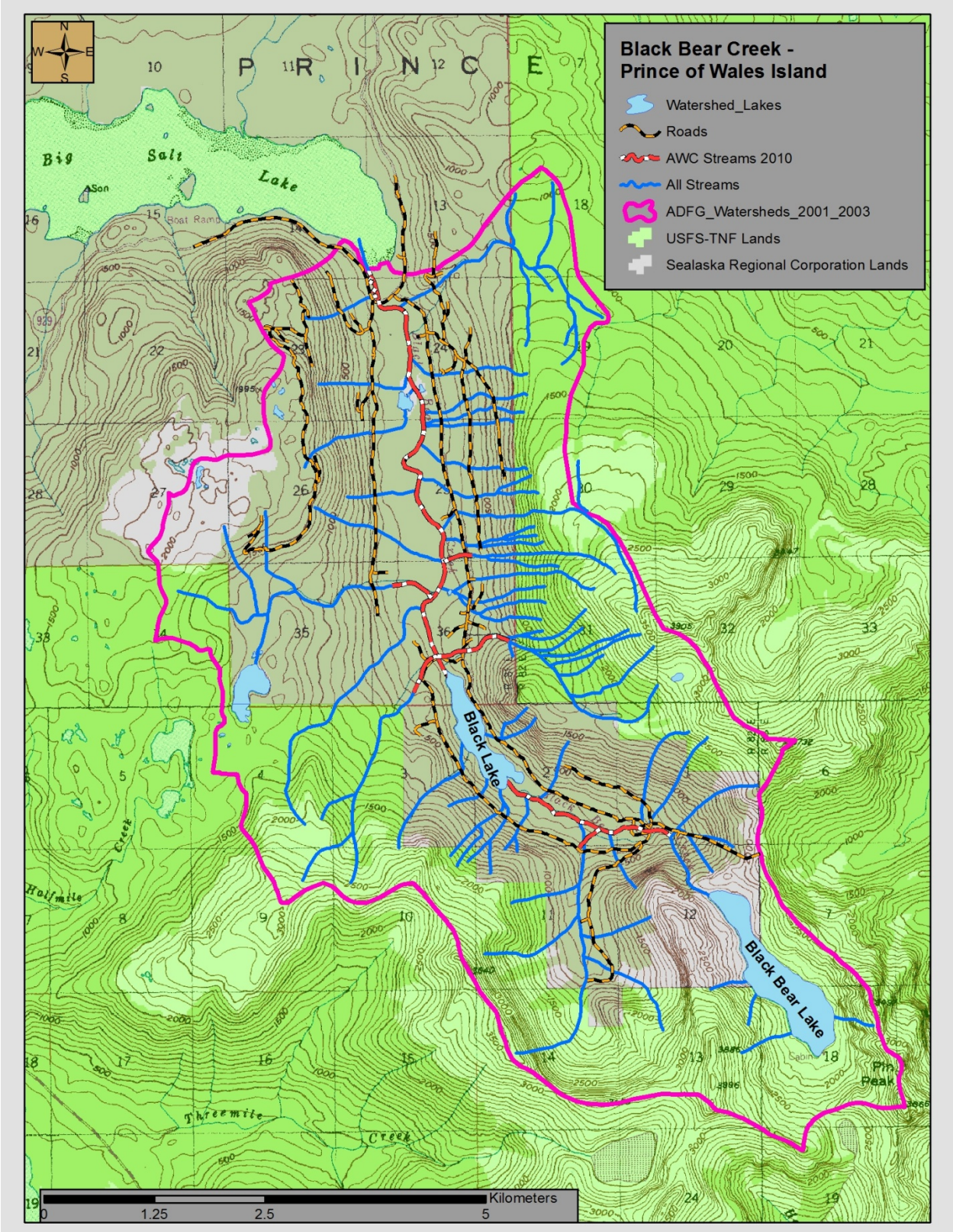
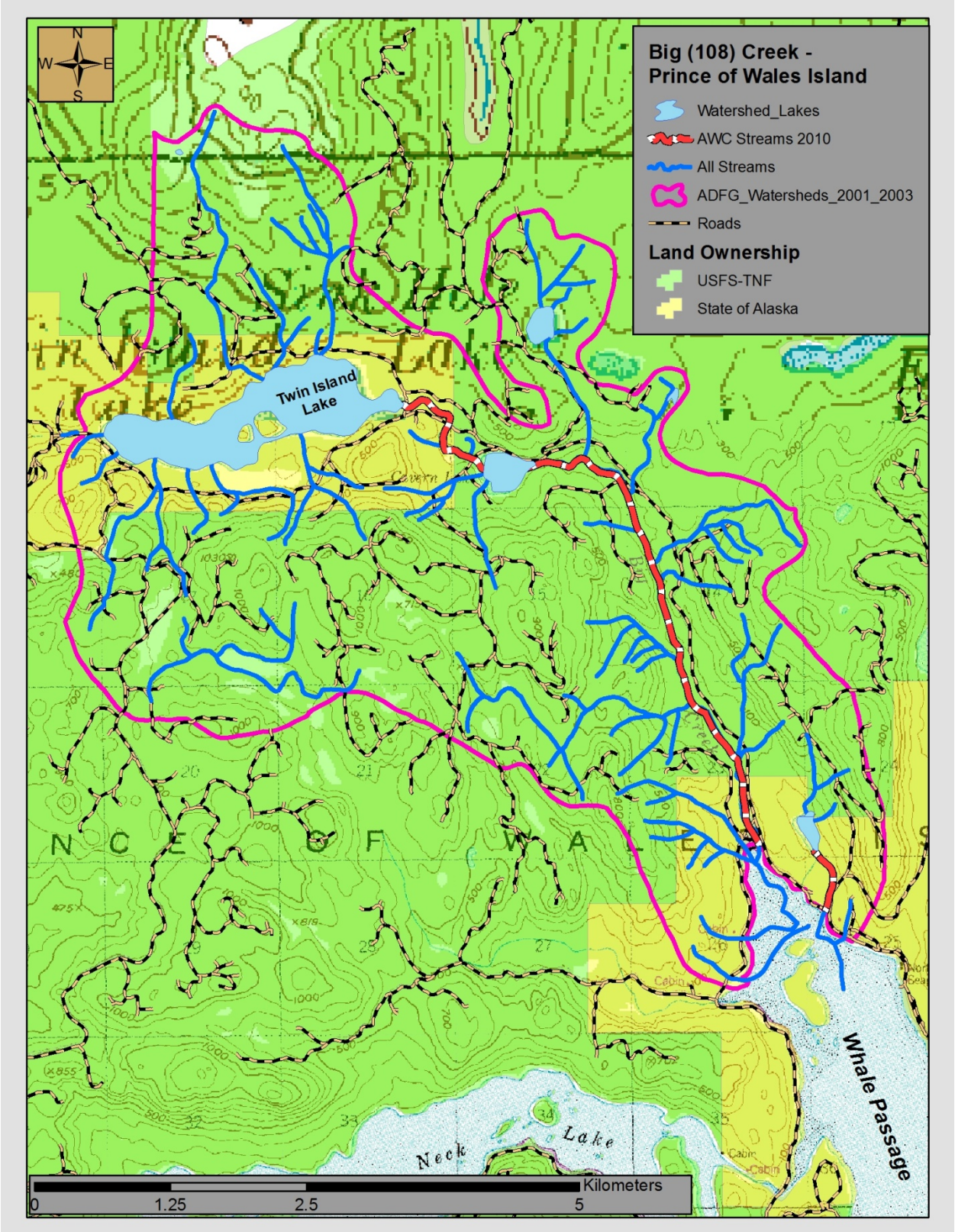
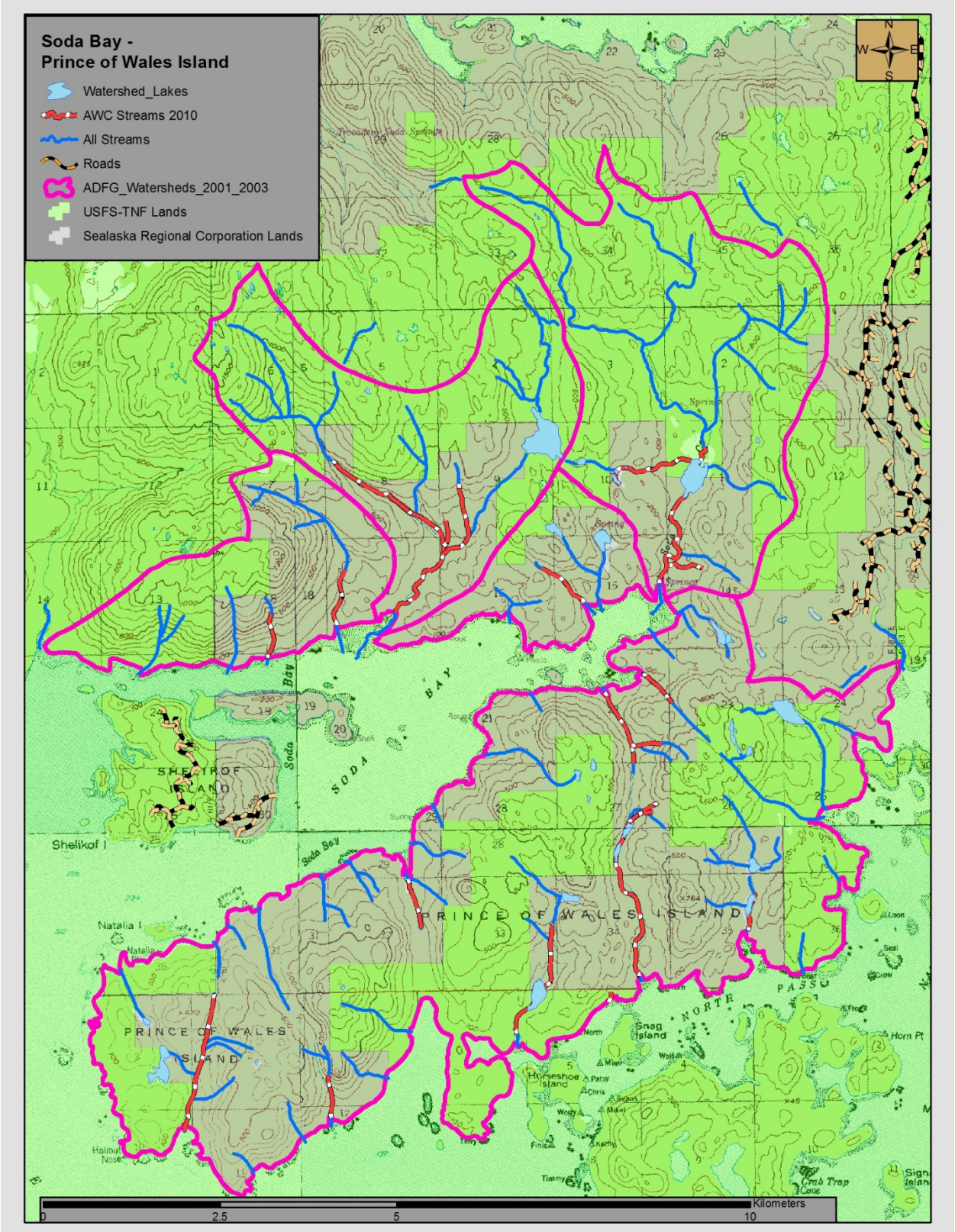
APPENDIX A –
INDIVIDUAL WATERSHED MAPS



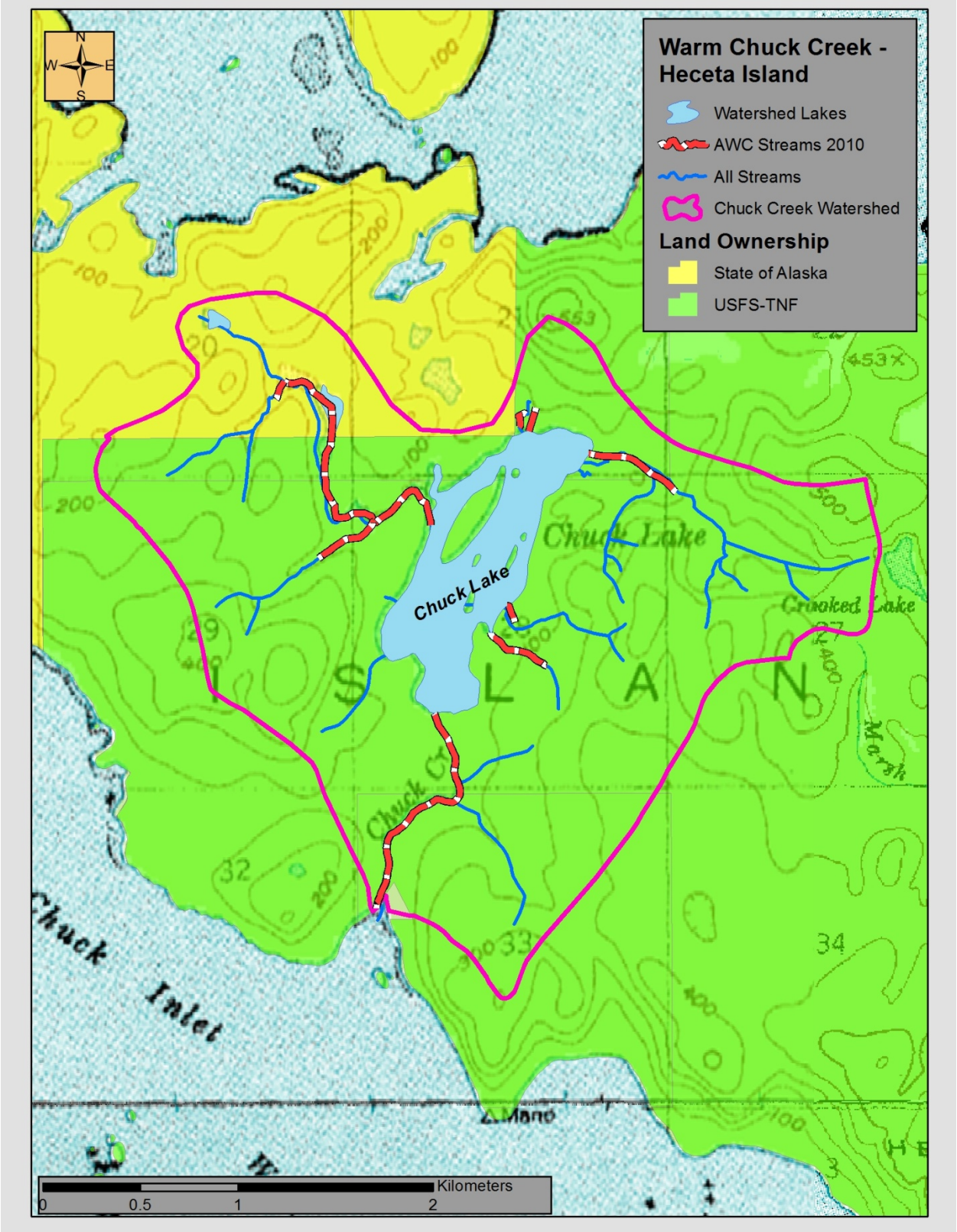
Appendix A1.–Watershed hydrography, roads, and land ownership in the Black Bear Creek watershed on Prince of Wales Island, Southeast Alaska.



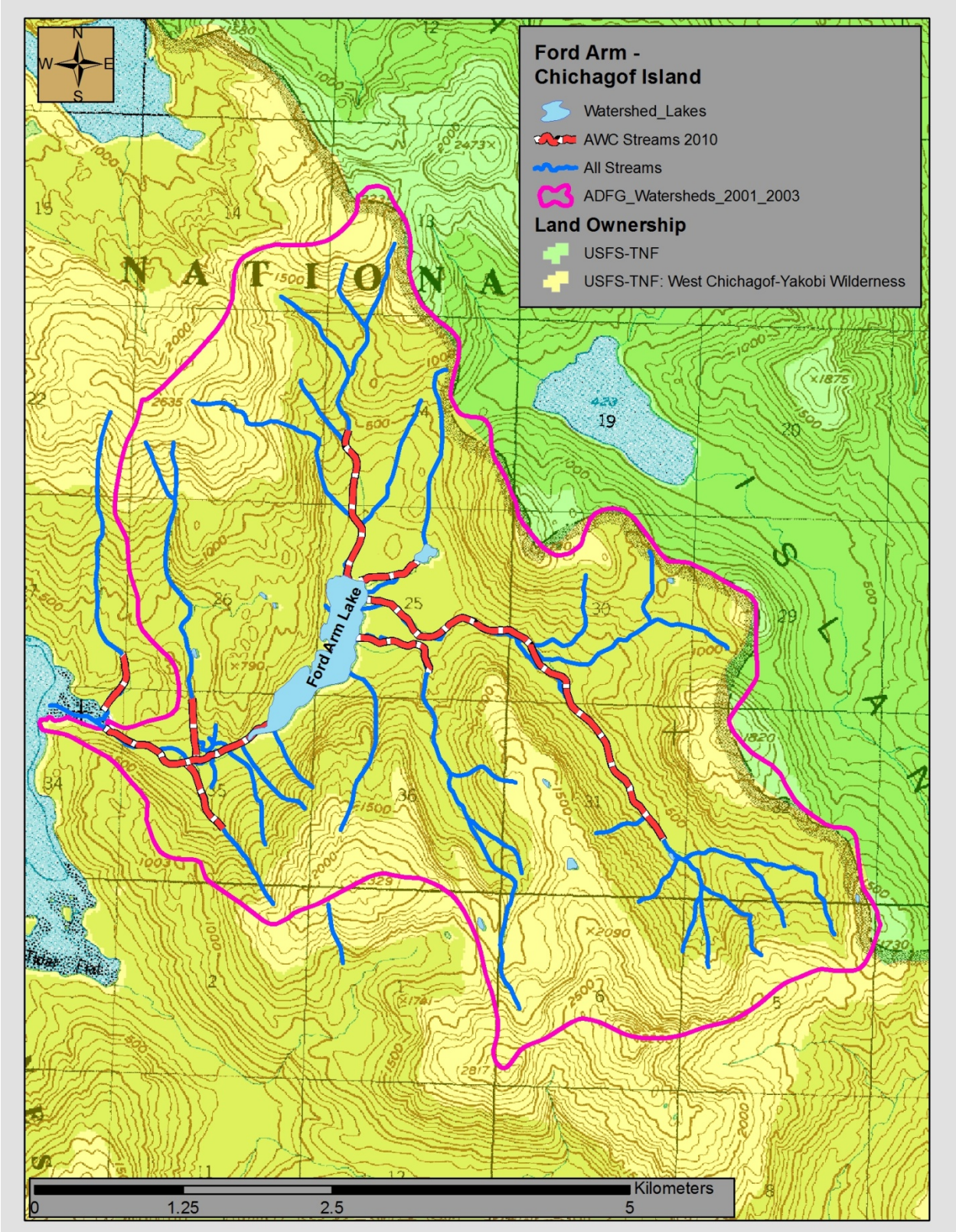
Appendix A2.–Watershed hydrography, roads, and land ownership in the Big (108) Creek watershed on Prince of Wales Island, Southeast Alaska.



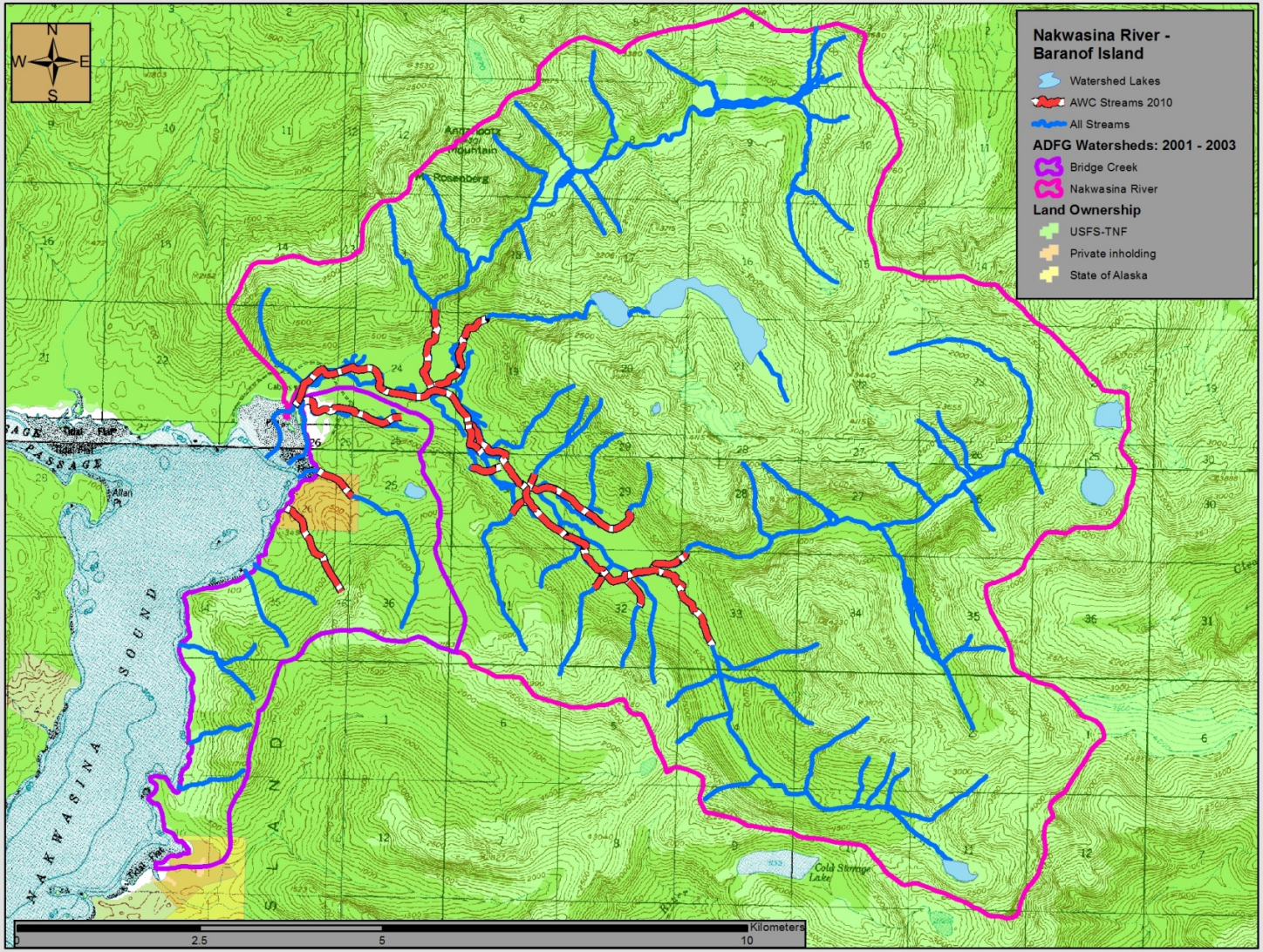
Appendix A3.–Watershed hydrography, roads, and land ownership in Soda Bay watersheds on Prince of Wales Island, Southeast Alaska.



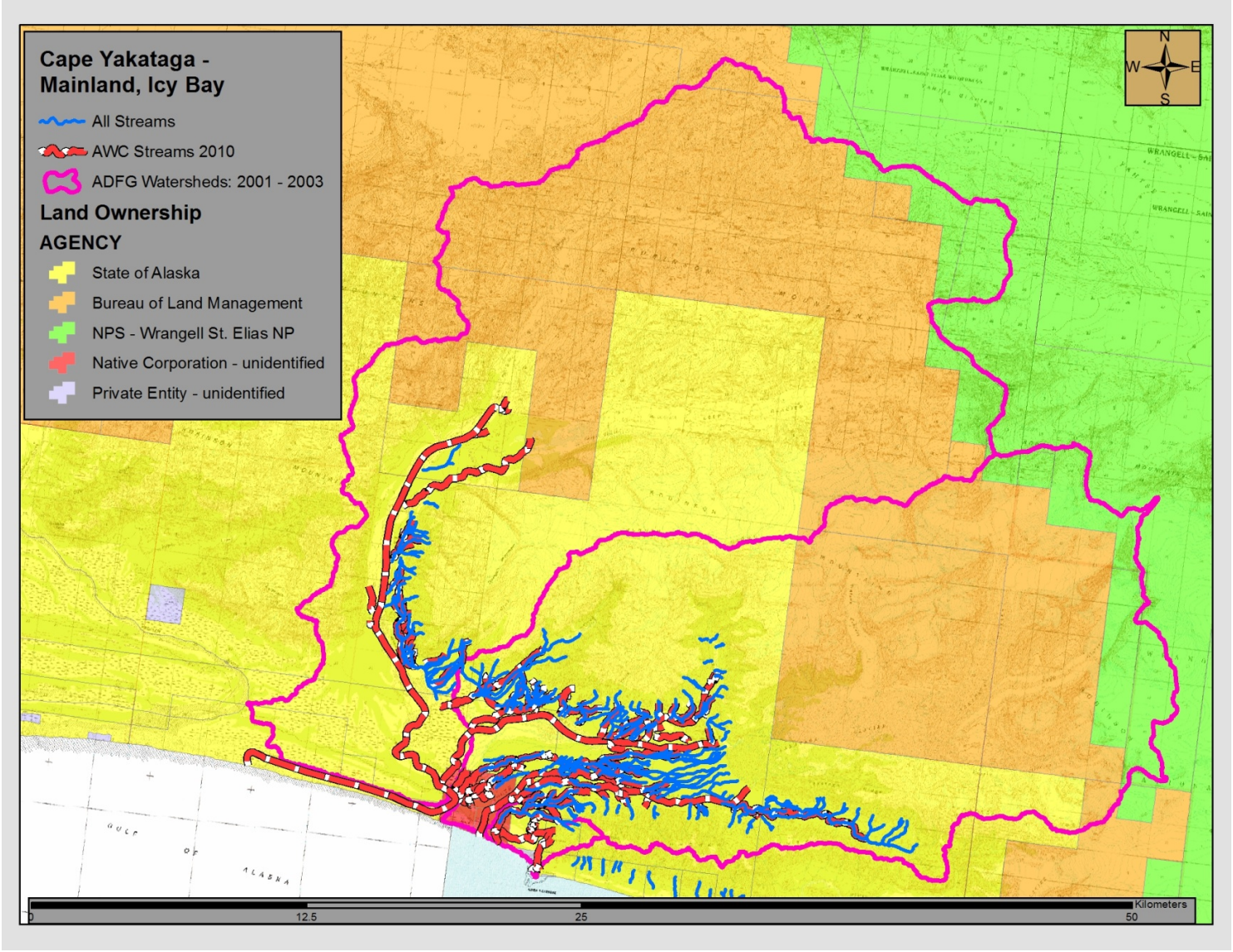
Appendix A4.–Watershed hydrography, roads, and land ownership in the Warm Chuck Creek watershed on Heceta Island, Southeast Alaska.



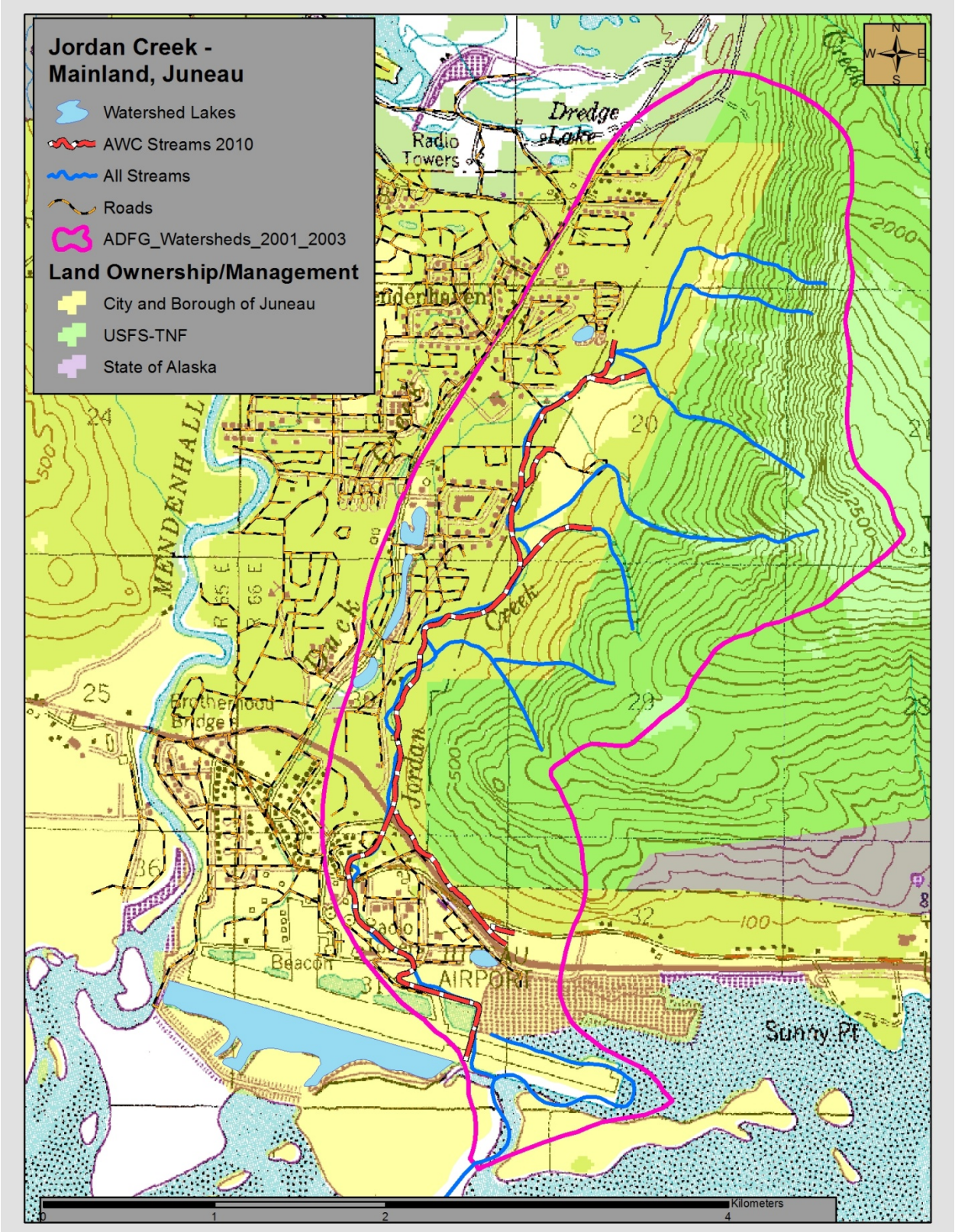
Appendix A5.–Watershed hydrography and land ownership in the Ford Arm watershed on Chichagof Island, Southeast Alaska.



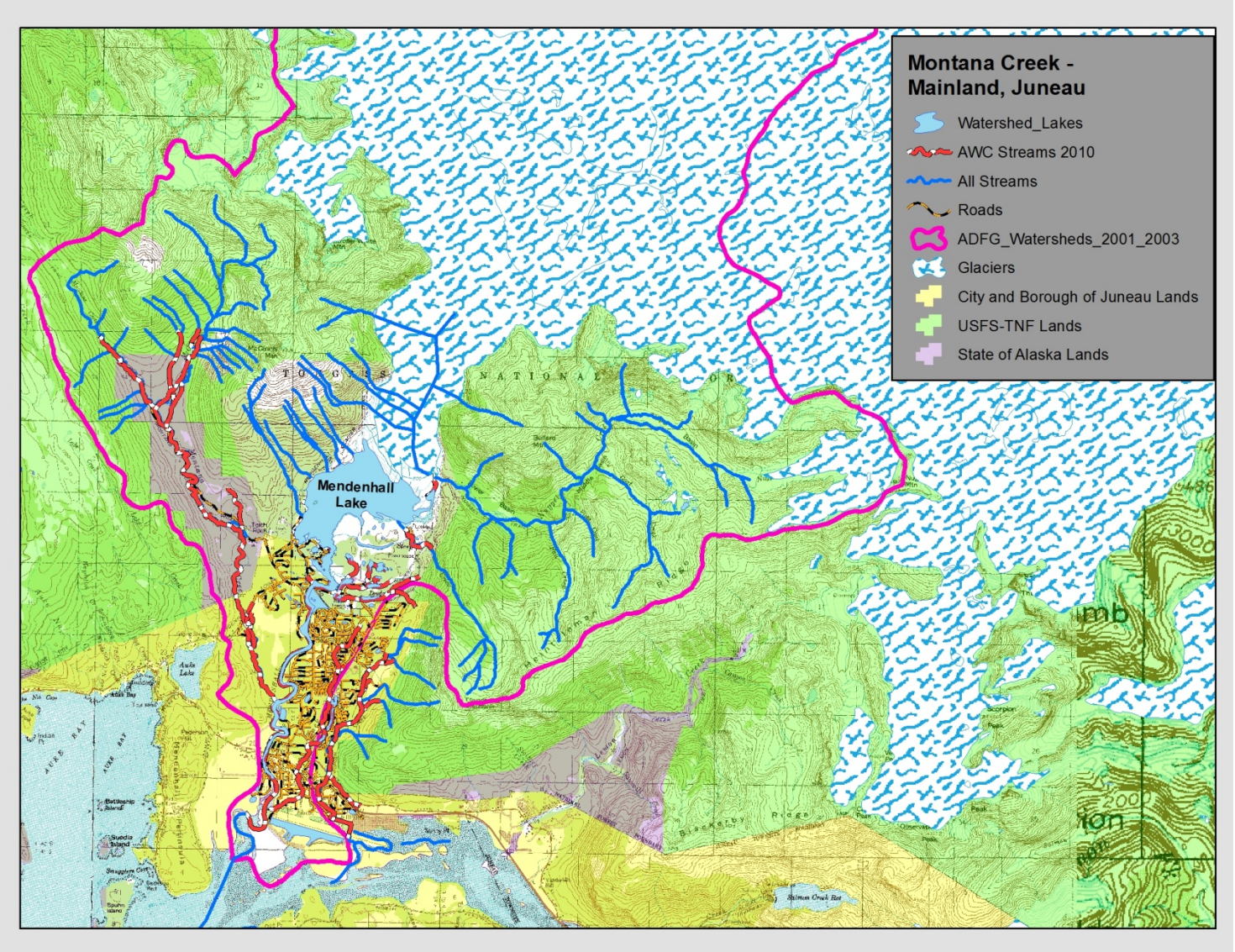
Appendix A6.–Watershed hydrography, roads, and land ownership in the Nakwasina River watershed on Baranof Island, Southeast Alaska.



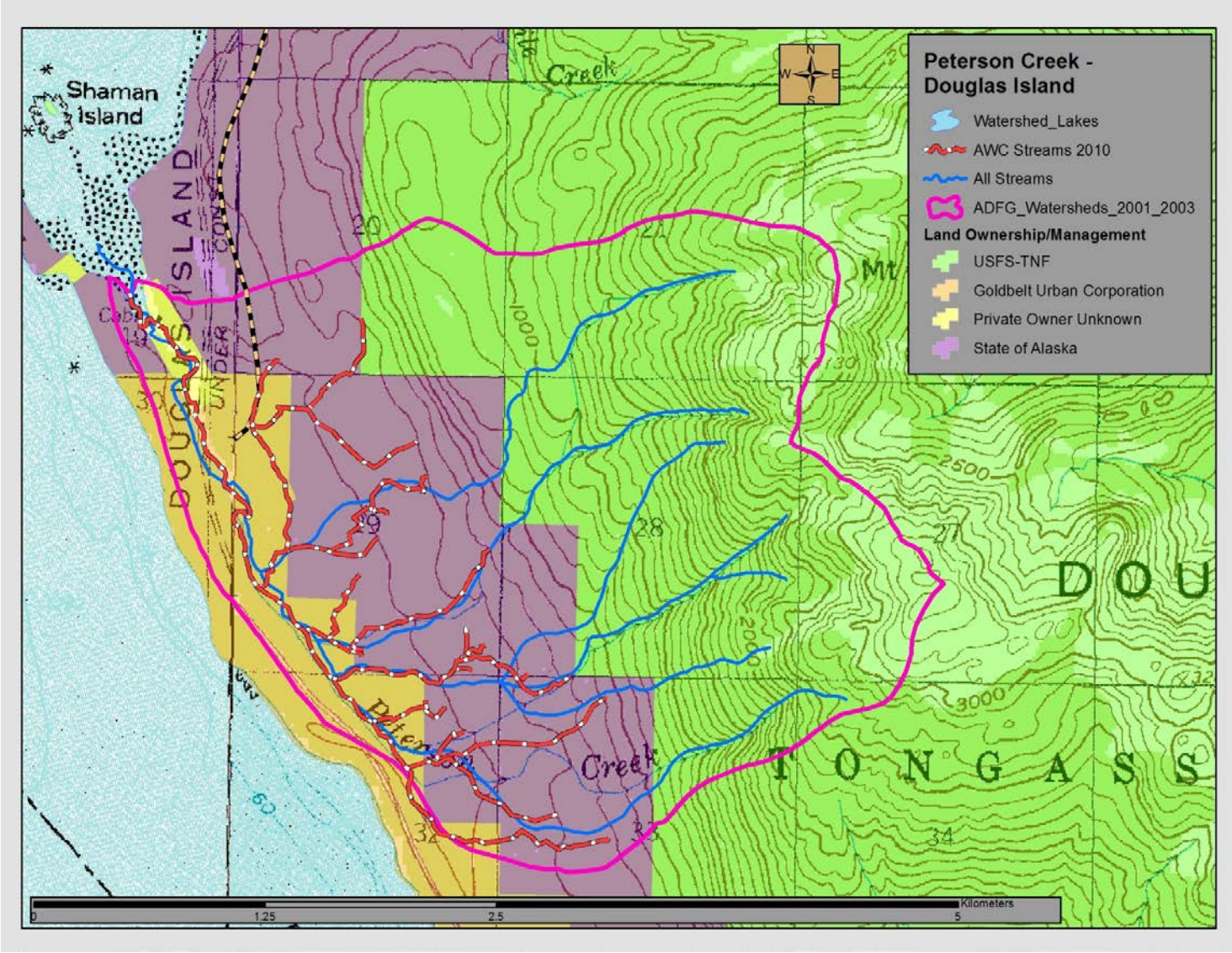
Appendix A7.–Watershed hydrography and land ownership in the Cape Yakataga watersheds on the mainland of Southeast Alaska near Icy Bay.



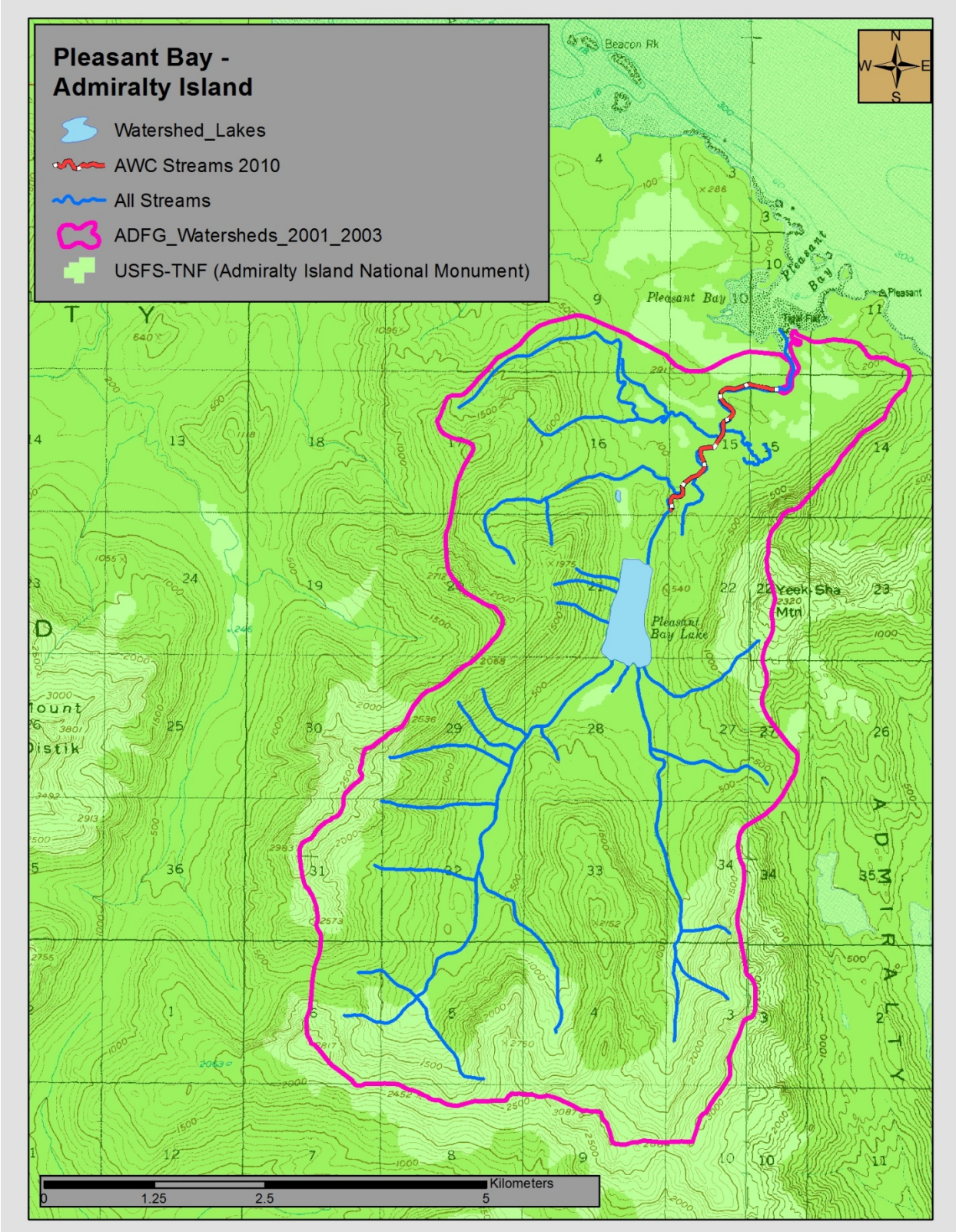
Appendix A8.–Watershed hydrography, roads, and land ownership in the Jordan Creek watershed on the mainland of Southeast Alaska, near Juneau.



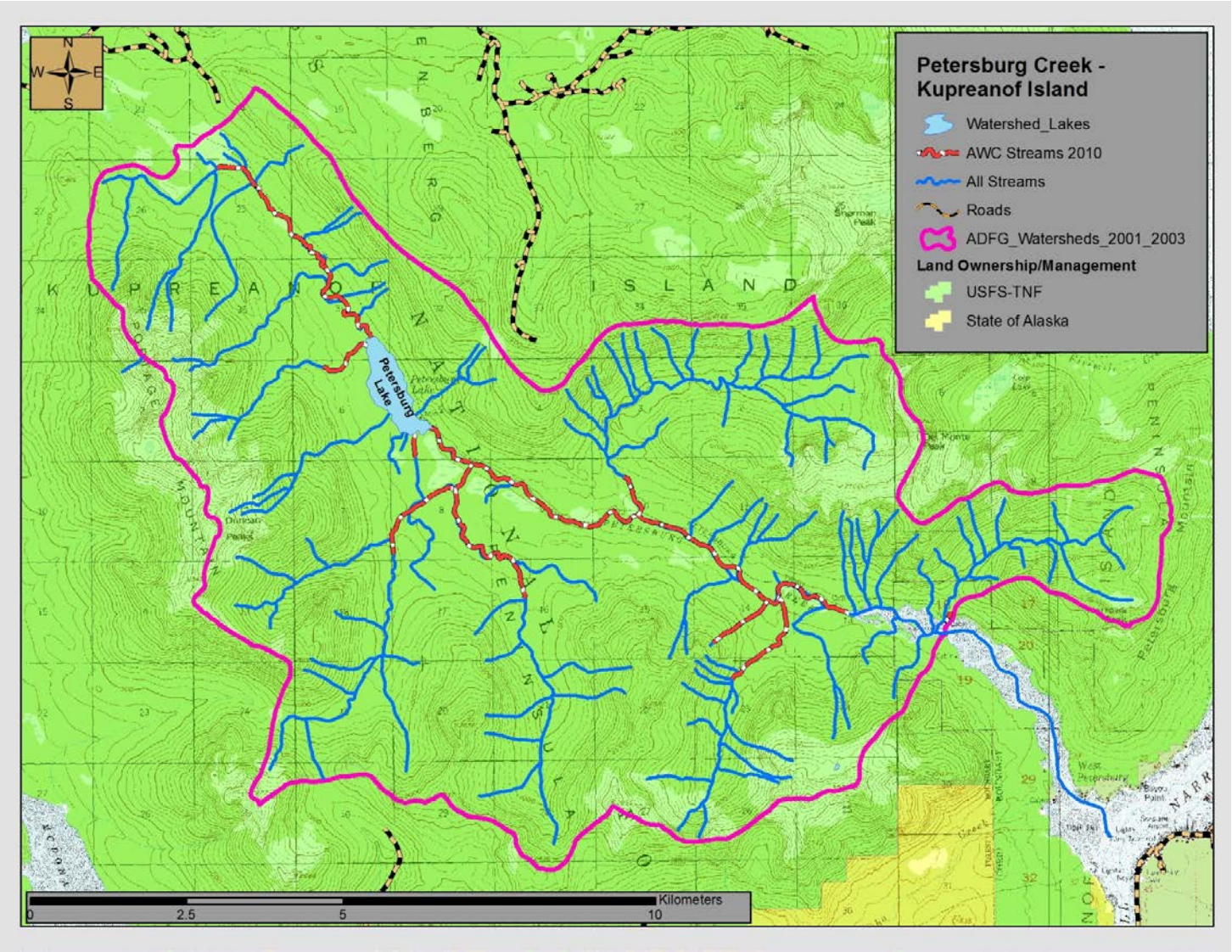
Appendix A9.–Watershed hydrography, roads, and land ownership in the Montana Creek watershed on the mainland of Southeast Alaska, near Juneau.



Appendix A10.–Watershed hydrography, roads, and land ownership in the Peterson Creek watershed on Douglas Island, Southeast Alaska.



Appendix A11.–Watershed hydrography and land ownership in the Pleasant Bay watershed on Admiralty Island, Southeast Alaska.



Appendix A12.–Watershed hydrography, roads, and land ownership in the Petersburg Creek watershed on Kupreanof Island, Southeast Alaska.

Appendix A13.–Survey schedule for the 12 watersheds where stream habitat/fish distribution surveys were conducted for this project during 2001–2003, Southeast Alaska.

Watershed name	Location	Year surveyed	Dates surveyed
Black Bear Creek	Prince of Wales Island (POW)	2002	July 24–31
Big (108) Creek	POW	2003	September 17–22; October 30
Soda Creek	POW	2002	August 7–16
Warm Chuck Creek	Heceta Island	2003	August 20–25
Ford Arm	Baranof Island	2003	July 23–July 30
Nakwasina River	Baranof Island	2003	June 19–June 30; November 17–19
Cape Yakataga	Mainland – Icy Bay	2002	June 5–14 June 24–July 3
Jordan Creek	Mainland – Juneau	2003	May 12–14
Montana Creek	Mainland – Juneau	2003	August 7–12; September 23; October 3; October 16; October 29
Peterson Creek	Douglas Island – Juneau	2001	Multiple trips occurred between April 1–December 19
Pleasant Bay	Admiralty Island	2003	April 25 May 1 May 8 May 19 July 9–10
Petersburg Creek	Kupreanof Island	2003	April 29; September 3–11

APPENDIX B –
DATA ARCHIVE FILES

Appendix B1.–Data files generated during project, 2001–2003, in all project areas. Data files (*.shp) archived at Alaska Department of Fish and Game, Division of Sport Fish, Southeast Regional Office, Island Center Building, P.O. Box 240020, Douglas, AK 99824-0020.

File	Description
SHP2001-2003_watersheds.shp	GIS polygon shapefile (ArcMap 10; NAD83 State Plane, FIPS 5001 projection) containing watershed areas and associated attribute data for all project watersheds (n=12).
SHP2001-2003_streams.shp	GIS polyline shapefile (ArcMap 10; NAD83 State Plane, FIPS 5001 projection) containing all stream hydrography and associated attribute data for all project watersheds (n=12).
SHP2001-2003_AWC.shp	GIS polyline shapefile (ArcMap 10; NAD83 State Plane, FIPS 5001 projection) containing all stream hydrography and associated attribute data for all project watersheds (n=12).
SHP2001-2003_lakes.shp	GIS polygon shapefile (ArcMap 10; NAD83 State Plane, FIPS 5001 projection) containing all lake hydrography and associated attribute data for all project watersheds (n=12).
SHP2001-2003_ADFG_features.shp	GIS point shapefile (ArcMap 10; NAD83 State Plane, FIPS 5001 projection) containing attribute data for all watershed features recorded during stream habitat and fish distribution surveys in all project watersheds (n=12).
SHP2001-2003_ADFG_fop.shp	GIS point shapefile (ArcMap 10; NAD83 State Plane, FIPS 5001 projection) containing attribute data for all fish observation points (FOP's) recorded during fish distribution surveys in all project watersheds (n=12).

Note: Data files are aggregated across all the project areas (Black Bear Creek (big (108) Creek, Soda Bay, Warm Chuck Creek, Nakwasina River, Ford Arm, Cape Yakataga, Jordon Creek, Montana Creek, Peterson Creek, Pleasant Bay, Petersburg Creek), and therefore contain specific data for each of the individual watersheds that can be extracted or queried spatially in a GIS.