Technical Report No. 15-09

Fish Presence Surveys in Proposed Timber Harvest Areas, Afognak Island, 2015

by

William D. Frost

Discoverer Bay, Afognak Island

January 2016

Alaska Department of Fish and Game **Division of Habitat**

Symbols and Abbreviations

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

Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

Mathematics, statistics

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

TECHNICAL REPORT NO. 15-09

FISH PRESENCE SURVEYS IN PROPOSED TIMBER HARVEST AREAS, AFOGNAK ISLAND, 2015

by

William D. Frost
Alaska Department of Fish and Game, Division of Habitat, Anchorage

Alaska Department of Fish and Game
Division of Habitat
333 Raspberry Road, Anchorage, Alaska, 99518-1565

January 2016

Funding through the Alaska Sustainable Salmon Fund

The Alaska Department of Fish and Game, Division of Habitat, publishes technical reports that are intended for fishery and other technical professionals. These reports available through the Alaska State Library and online at: http://www.adfg.alaska.gov/index.cfm?adfg=habitat_publications.main.

William D. Frost,
Alaska Department of Fish and Game, Division of Habitat,
333 Raspberry Road, Anchorage Alaska 99518 USA

This document should be cited as:
Frost, W. D. 2016. Fish presence surveys in proposed timber harvest areas, Afognak Island, 2015. Alaska Department of Fish and Game, Division of Habitat, Technical Report No. 15-09, Anchorage.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ACKNOWLEDGEMENTS

The ADF&G Division of Habitat thanks the Alaska Sustainable Salmon Fund for the financial support of this Anadromous Waters Catalog project—specifically, Cecelia Curtis and Deborah Maas.

We thank the Division of Habitat, Sport Fish, and Commercial Fisheries staff for assisting with fieldwork, including Josh Brekken, Jeanette Alas, Lisa Fox, Shane Hertzog, and Derick Williams.

We thank Afognak Native Corporation and Koncor Forest Products for their in-kind financial and logistical support for the 2015 sampling efforts. We specifically acknowledge the assistance provided by Greg Harris and Keith Coulter.

Finally, I would like to thank Michael J. Daigneault for his guidance and patience during the writing of this document.

The use of product, software, and company names throughout this report is not an Alaska Department of Fish and Game recommendation or implied endorsement. The Alaska Department of Fish and Game, in accordance with State of Alaska ethics laws, does not favor one group over another through endorsement or recommendation.

EXECUTIVE SUMMARY

In summer 2015, the Alaska Department of Fish and Game (ADF&G), Division of Habitat, sampled for the presence of anadromous fish on Afognak Island on land owned by Afognak Native Corporation, Natives of Kodiak Incorporated, Ouzinkie Native Corporation, and Koniag Native Corporation. The information gathered was used to submit nominations for inclusion in the ADF&G *Catalog of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes* and its companion Atlas (AWC).

Inclusion in the AWC will help to conserve salmon habitat by providing the 66-foot riparian retention area protection required under the Alaska Forest Resources and Practices Act. A water body listed in the AWC also is afforded protection under Alaska Statute 16.05.871.

Water bodies were sampled using a backpack electrofisher or baited minnow traps to target juvenile fish. Sampling was terminated at barriers to fish passage when such barriers were present. Absent a barrier, the sampling team determined the most appropriate location to terminate sampling based on an assessment of available habitat, stream gradient, and a failure to capture fish at a given sampling location. Adult salmonids observed were counted and their spawning activity noted.

During the 2015 season, 18 watersheds were sampled on Afognak Island. Fish presence sampling resulted in 54 nominations to the AWC. As a result of the sampling effort, 13 km of new anadromous fish habitat was nominated for inclusion in the AWC. The nominations include 11 specified water bodies that support additional life stages of anadromous fish, 12 specified streams whose locations were accurately mapped by Global Positioning System, and 4 new anadromous fish streams. The new streams are located in Kazakof Bay and Delphin Bay.

Adult and juvenile coho salmon (*Oncorhynchus kisutch)* and Dolly Varden (*Salvelinus malma)* were the most common salmonid species captured or observed. Other adult and juvenile salmonid species captured or observed were pink salmon (*O. gorbuscha)* and rainbow/steelhead trout (*O. mykiss)*. Additional species captured or observed were threespine stickleback (*Gasterosteus aculeatus)*, ninespine stickleback (*Pungitius pungitius)*, and sculpin (*Cottus* spp).

INTRODUCTION

The mission of the Alaska Department of Fish and Game (ADF&G) is to protect, maintain, and improve the fish, game, and aquatic plant resources of the state, and manage their use and development in the best interest of the economy and the well-being of the people of the state, consistent with the sustained yield principal. The mission of ADF&G Division of Habitat is to protect Alaska's valuable fish and wildlife resources and their habitats as Alaska's population and economy continue to expand.

In the winter of 2015, a 2-year grant was secured through the Alaska Sustainable Salmon Fund (AKSSF) for ADF&G to sample streams and lakes on Afognak Island and document the presence of anadromous fish in advance of timber harvest activity. Afognak Island is located about 390 km southwest of Anchorage, Alaska (Figure 1). The information gathered will be used to submit nominations for inclusion in the *Catalog of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes* and its companion Atlas (AWC; ADF&G 2015). Inclusion in the AWC will conserve salmon habitat by providing the 66-foot riparian retention area required under the Alaska Forest Resources and Practices Act (FRPA; 11 AAC 95.265(1)). A specified water body listed in the AWC is also afforded protection under State law at Alaska Statute (AS) 16.05.871 (ADF&G 2014–2015).

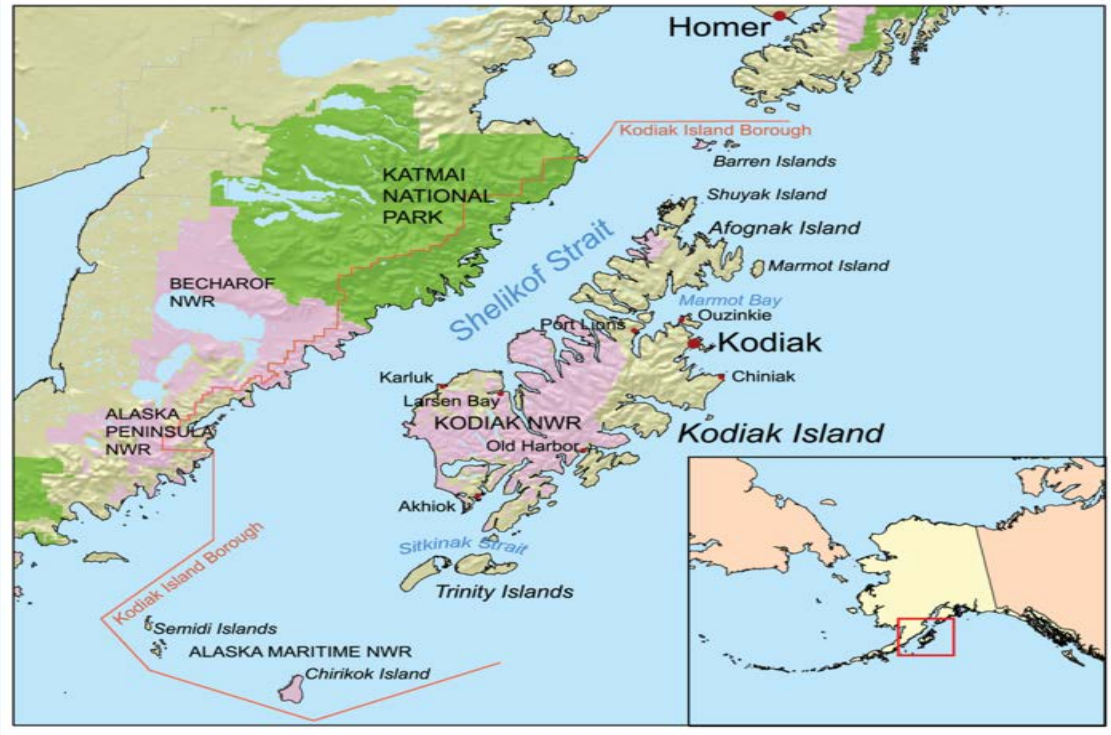


Figure 1.–Afognak and Kodiak Islands.

ADF&G initiated this project to document anadromous fish presence prior to timber harvest occurring on Afognak Island. ADF&G coordinated with 2 land managers in the region: Afognak Native Corporation and Koncor Forest Products. The coordination included a review of

upcoming timber harvest activities, prioritization of areas to be sampled, and field sampling logistics.

METHODS

ADF&G developed maps using Geographic Information Services (GIS) mapping software to assist with locating streams in the project area. The maps were produced by using georeferenced satellite imagery with the AWC data layer. Most streams sampled on Afognak Island in 2015 were small (< 8m wide) first-, second-, and third-order tributaries of known anadromous streams (Strahler 1957). Sampling was prioritized by cross-referencing the upcoming timber harvest activities with those water bodies likely to support anadromous fish. The length of each reach sampled was measured using the GIS measuring tool and field verified by a handheld Global Positioning System (GPS) unit.

Water bodies were sampled by a team of 2 ADF&G staff. Sampling was conducted using a Smith-Root LR-25 backpack electrofisher. Output voltage was adjusted to the minimum level necessary to achieve taxis (forced swimming), and continuous DC was used to minimize fish injury (NMFS 2000). A single electrofishing pass at each sample reach was completed, starting at the downstream end and working upstream.

Lakes and ponds were sampled using Gee-type minnow traps baited with betadine-treated salmon eggs. Traps soaked for a minimum of 2 hours. Trap size selected for smaller fish, but this outcome was considered adequate as an indicator of the presence of fish species (Bloom 1976). However, it is noted that juvenile sockeye salmon (*Oncorhynchus nerka*) may be missed by minnow trapping, potentially causing underestimation of sockeye distribution because of this species' tendency toward a planktivorous diet (Burgner 1991).

Captured juvenile salmon and Dolly Varden (*Salvelinus malma)* were identified to species and counted. Because of time constraints, a select number were measured to the nearest mm in fork length (FL). Threespine stickleback (*Gasterosteus aculeatus*), ninespine stickleback (*Pungitius pungitius*), and sculpin (*Cottus* spp) were noted as present but not measured or counted. All fish were released into a slack-water area at the point of capture. Adult salmonids observed were counted, and spawning activity was noted.

We used existing FRPA criteria (Table 1; FRPA 2013) and professional judgment to determine the upper extent of the water body to be sampled. Absent a barrier, the sampling team determined the most appropriate location to terminate sampling, based on an assessment of available habitat, stream gradient, and a failure to capture fish at a given sampling location.

Table 1.–Anadromous Fish Blockage (11 AAC 95.265(g) Table A).

Species requirements (in feet)					
Criterion	Coho	Steelhead	Sockeye	Chinook	Pink/Chum
Maximum fall height: a blockage may be presumed if fall height in feet exceeds:	11	13	10	11	a) 4 with deep jump pool b) 3 without pool
Pool depth: a blockage may be presumed if the unobstructed water column depth in feet within the pool is less than:	1.25 x jump height, except that no minimum pool depth exists for falls as follows: a) less than 4 in the case of coho and steelhead; and b) less than 2 in the case of other anadromous fish species.				
Steep channel: a blockage may be presumed at the upper end of the reach if channel steepness in feet is equal to or greater than the following without resting places for fish:	• 225 at 12% gradient • 100 at 16% gradient • 50 at 20% gradient • 25 at 24% gradient			100 at 9% gradient	

A hand-held Garmin GPS unit was used to record the geographic information to verify or correct the actual location of water bodies or add barriers to fish passage. Number and length of fish captured or observed were recorded with the GPS device to allow for georeferencing. These data were used to submit nominations to the AWC. Nominations included new water bodies, upstream extensions of existing anadromous waters, addition of species or life stages, and corrections of water body location. Nominations were completed according to the ADF&G submission guidelines and requirements (ADF&G 2015).

RESULTS

In 2015, monthly sampling events occurred on Afognak Island from May through October. A total of 64 reaches were sampled with a total length of 24 km (Table 2; Appendix A1 through A14). The total length that was documented as containing anadromous fish and nominated to the AWC was 13 km (Table 2). The pre-project AWC status of the surveyed streams and AWC nominations resulting from 2015 sampling are graphically shown in Appendix A.

Table 2.–Afognak Island watersheds sampled in 2015.

Watershed name	AWC number	# Reaches sampled	Total length sampled (meters)	Total new AWC length (meters)
McDonald Creek	252-31-10080	7	3,000	700
Big Kitoi Lake		2	600	0
Little Afognak River	252-32-10010	1	100	0
Unnamed (Mary Anderson Bay)	252-32-10008	1	560	0
Unnamed (Kazakok Bay)		1	150	150
Unnamed (Kazakof Bay)		1	150	150
Unnamed (Kazakof Bay)		1	1,435	1,085
Unnamed (Kazakof Bay)	252-33-10025	1	500	0
Unnamed (Kazakof Bay	252-33-10024	1	200	0
Unnamed (Discoverer Bay)	251-82-10057	1	290	290
Unnamed (Discoverer Bay)	251-82-10052	10	4,260	1,850
Unnamed (Discoverer Bay)	251-82-10053	1	210	0
Portage Creek	251-82-10050	19	5,910	3,255
Otter Creek	251-82-10045	3	375	190
Unnamed (Delphin Bay)	251-82-10036	2	1,150	1,150
Unnamed (Delphin Bay)		1	255	255
Paramanof River	251-40-10030	7	3,710	3,710
Unnamed (Marka Lake)	252-34-10005-2081	4	1,090	370
Total		64	23,915	13,155

During the 2015 sampling effort, 12 known anadromous streams on Afognak Island were determined by GPS to be mapped in the wrong location. The stream mapping has been revised and corrections were submitted to the AWC (Table 3).

Table 3.–Anadromous streams on Afognak Island corrected in 2015.

Streams Corrected 2015
252-32-10008*
252-32-10080
252-33-10025*
251-82-10052
251-82-10053*
251-82-10045
251-82-10045-2009
251-82-10036
251-40-10030
251-40-10030-2040
252-34-10005-2081
252-34-10005-2083

*Note: Stream Nos. 252-32-10008, 251-82-10053, and 252-33-10025 were revised because of a barrier blocking fish passage.

In 2015, 4 new streams that support anadromous fish were located on Afognak Island and nominated to the AWC. These 4 streams are located in Kazakof Bay and Delphin Bay (Appendix A3, A4, and A12).

In 2015, there were 54 nominations submitted to the AWC as a result of these surveys. All of the nominations were accepted for inclusion into the 2015 AWC update, except for 10 that will be reviewed in 2016 for the 2017 AWC revision. Juvenile and adult coho salmon (*O. kisutch*) and Dolly Varden were the most common salmonid species captured or observed. Other adult and juvenile salmonid species captured or observed were pink salmon (*O. gorbuscha*) and rainbow/steelhead trout (*O. mykiss*). Length measurements were taken for a portion of the juvenile salmon and Dolly Varden that were captured (Table 4). Stickleback and sculpin were noted as present but not measured or counted.

Table 4.–Afognak Island fork length measurements, by month and species.

	Length range (mm)	
Month	Coho	Dolly Varden
May	45–70 (*n* = 23)	40–120 (*n* = 29)
June	45–85 (*n* = 41)	45–120 (*n* = 13)
July	75–95 (*n* = 23)	35–195 (*n* = 41)
August	65–110 (*n* = 7)	45–60 (*n* = 9)
September	55–110 (*n* = 23)	55–140 (*n* = 20)
October	45–90 (*n* = 10)	35–110 (*n* = 24)

In 2015, 11 known anadromous water bodies were found to support additional species or life stages (Table 5). The streams were updated in the AWC.

Table 5.–Additional species or life stages located on Afognak Island.

Afognak stream no.	Species added	Life stage added
252-32-10008	Pink salmon	Rearing
251-82-10052	Coho salmon	Rearing
252-34-10005-2081	Coho salmon	
252-34-10005-2083	Dolly Varden	Spawning
251-40-10030	Dolly Varden	
251-40-10030-2040	Dolly Varden	
251-82-10050	Coho salmon	Rearing
251-82-10057-2009	Coho salmon	Rearing
251-82-10045	Coho salmon	Rearing
251-82-10036	Coho salmon	Rearing
252-33-10025	Pink salmon	Spawning

DISCUSSION

Sampling conducted in 2015 on Afognak Island identified new anadromous water bodies, extended existing anadromous waters, added species or life stages to existing anadromous waters, and corrected existing anadromous water body locations. Nominations were completed according to ADF&G submission guidelines and requirements. All nominations submitted prior to the 2015 nomination deadline have been accepted, approved, and scheduled for inclusion in the 2016 AWC revision. Ten nominations submitted after the 2015 deadline will be reviewed by the ADF&G and, if accepted, included in the 2017 AWC revision. This sampling year resulted in the addition of 13 km of new anadromous fish habitat to the AWC, plus the addition of species and life stages.

Inclusion in the AWC affords the water body protection under AS 16.05.871 by requiring notification and ADF&G approval for proposed activities below ordinary high water, in order to provide proper protection of fish and game. Inclusion in the AWC also results in a 66-foot riparian retention area regulated by FRPA under 11 AAC 95.265. Streams that were sampled on Afognak Island in 2015 that did not result in the capture or observation of anadromous fish but flowed into a specified water body were voluntarily given a 66-foot riparian retention area by the landowner up to the point where a physical blockage was determined by FRPA criteria. Thus, this project resulted in additional protection for more water bodies than just the 13 km being added to the AWC.

Riparian habitat provides streambank stability, filters pollutants, and maintains water quality for fish and wildlife habitat. To function properly, buffers must have an effective vegetative cover and sufficient width and continuity along the stream. Vegetative cover filters sediment and pollutants reducing the amount of material that may enter a stream. The rate of surface erosion is closely correlated with vegetative cover on the soil surface, such as plant litter. Litter and the stems of vegetation reduce the downslope movement of surface soils. Accelerated surface erosion occurs when these barriers are removed (Strahler et al. 1971).

Riparian vegetation provides shade to help maintain air and water temperature and prevent excessive algal blooms. Reduced shade leads to increased water temperatures. Increased water temperatures can obstruct adult migration and limit spawning success, trigger early juvenile outmigration resulting in decreased survival rates, change juvenile sheltering behavior, reduce disease resistance, and increase metabolic requirements (Taylor 1988). Riparian vegetation also provides allochthonous input to the base of the food web, terrestrial insects for fish consumption, and cover for aquatic vertebrates.

This project has been a successful example of collaboration between the timber industry and ADF&G. By sampling in advance of timber harvest operations, ADF&G has provided the operators with information for planning the layout of proposed timber harvest units. Additionally, the operators and land owners support of this project has been invaluable to identifying and prioritizing waters to sample, which has resulted in aquatic habitat protections required by ADF&G statutes and FRPA requirements.

REFERENCES CITED

ADF&G (Alaska Department of Fish and Game). 2015. Anadromous Waters Catalog: Nominations. http://www.adfg.alaska.gov/sf/SARR/AWC/index.cfm?ADFG=noms.home

ADF&G (Alaska Department of Fish and Game). 2015. Anadromous Waters Catalog: Overview. http://www.adfg.alaska.gov/sf/SARR/AWC/ (Accessed 1 June 2015).

Alaska Fish and Game Laws and Regulations Annotated. 2014–2015. Fish and Game. Title 16, Chapter 05, Article 8, Section 871. Protection of fish and game.

Alaska Forest Resources & Practices Regulations. October 2013. Division of Forestry, Department of Natural Resources. Table A: Anadromous Fish Blockage. Page 20.

Bloom, A. M. 1976. Evaluation of minnow traps for estimating populations of juvenile coho salmon and Dolly Varden. The Progressive Fish-Culturist 38:99–101.

Burgner, R. L. 1991. Life history of sockeye salmon (*Oncorhynchus nerka*). Pages 1–117 [*In*] C. Groot and L. Margolis, editors. Pacific salmon life histories. University of British Columbia Press, Vancouver.

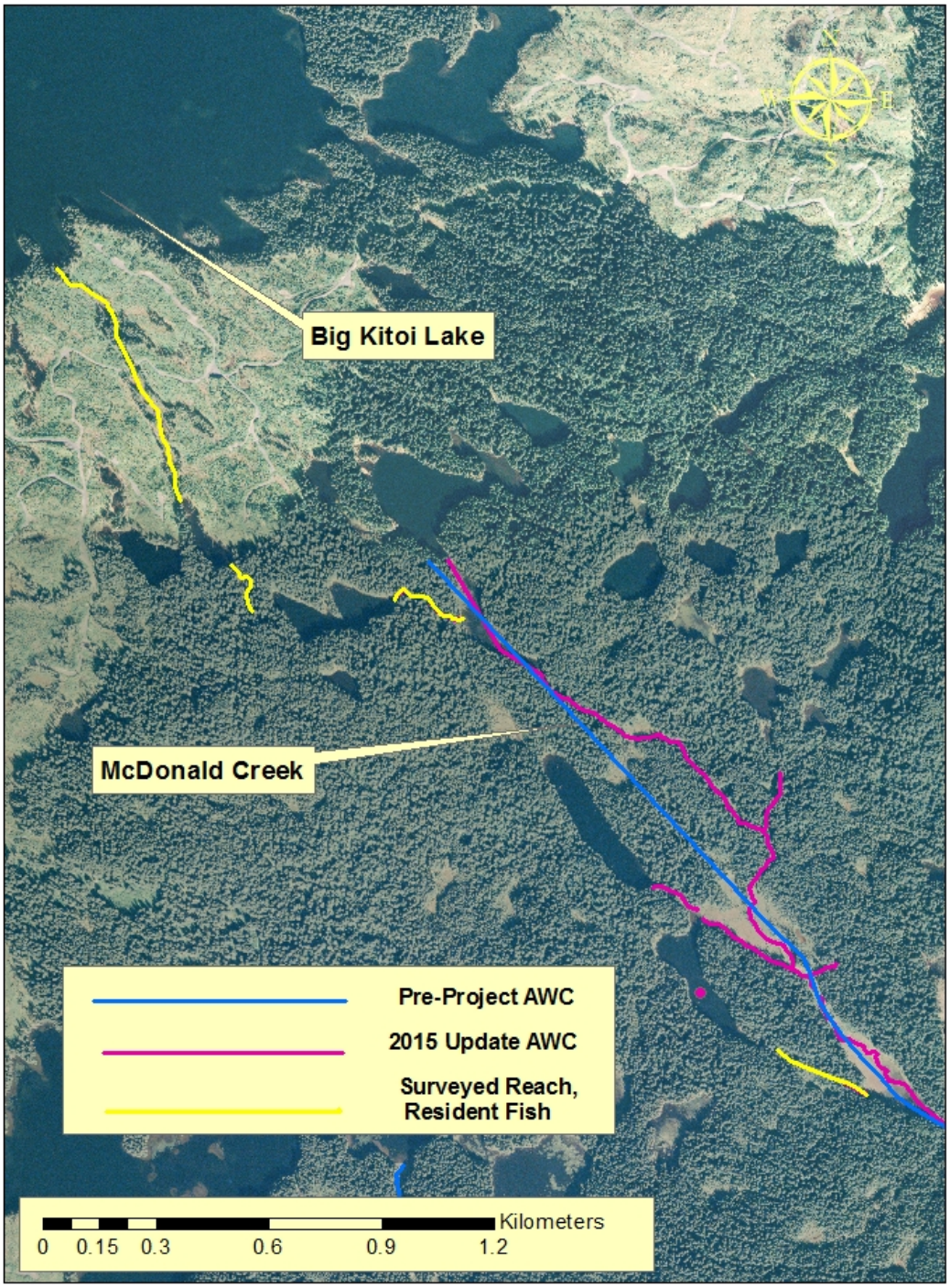
NMFS (National Marine Fisheries Service). 2000. Guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act, June 2000.

Strahler, A. N. 1957. Quantitative analysis of watershed geomorphology. Transactions, American Geophysical Union 38: 913–920.

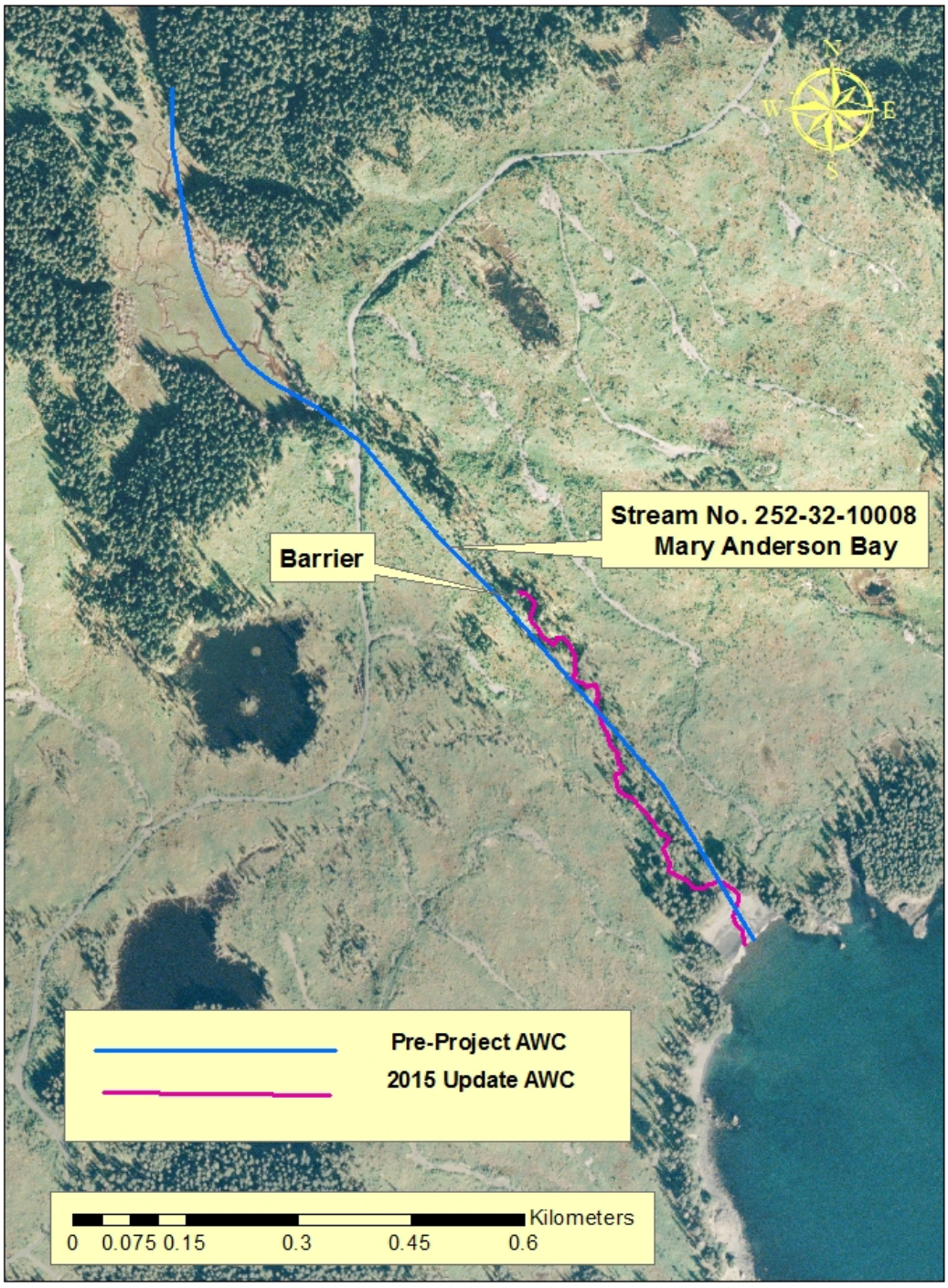
Strahler, A., R. M. Rice, J. S. Rothacher, and W. F. Megahan. 1971. Erosional consequences of timber harvesting: an appraisal. National Symposium on Watersheds in Transition.

Taylor, E. B. 1988. Water temperature and velocity as determinants of microhabitats of juvenile chinook and coho salmon in a laboratory stream channel. Transactions of the American Fisheries Society 117:22–28.

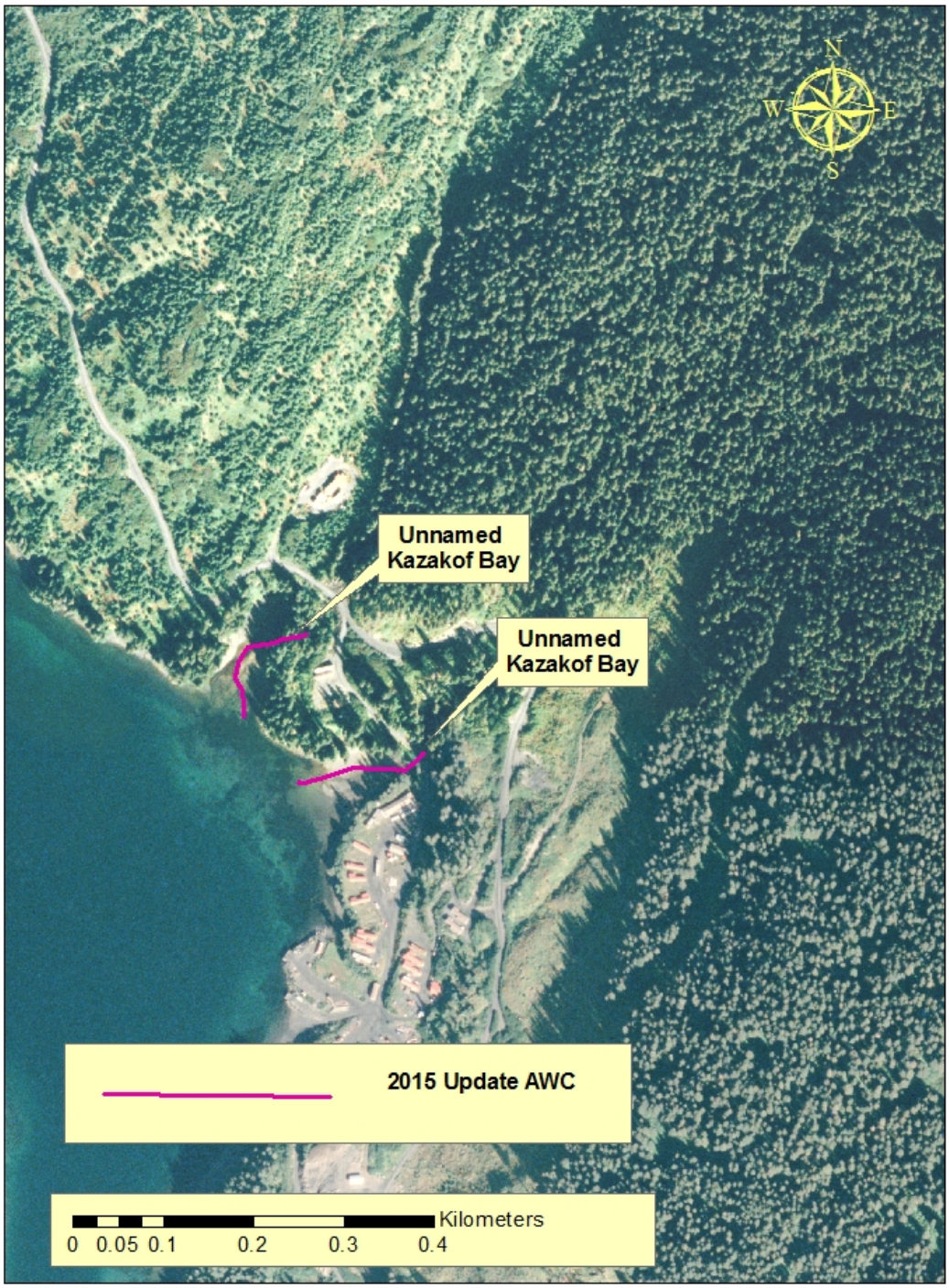
APPENDIX A:
STATUS OF SURVEYED REACHES



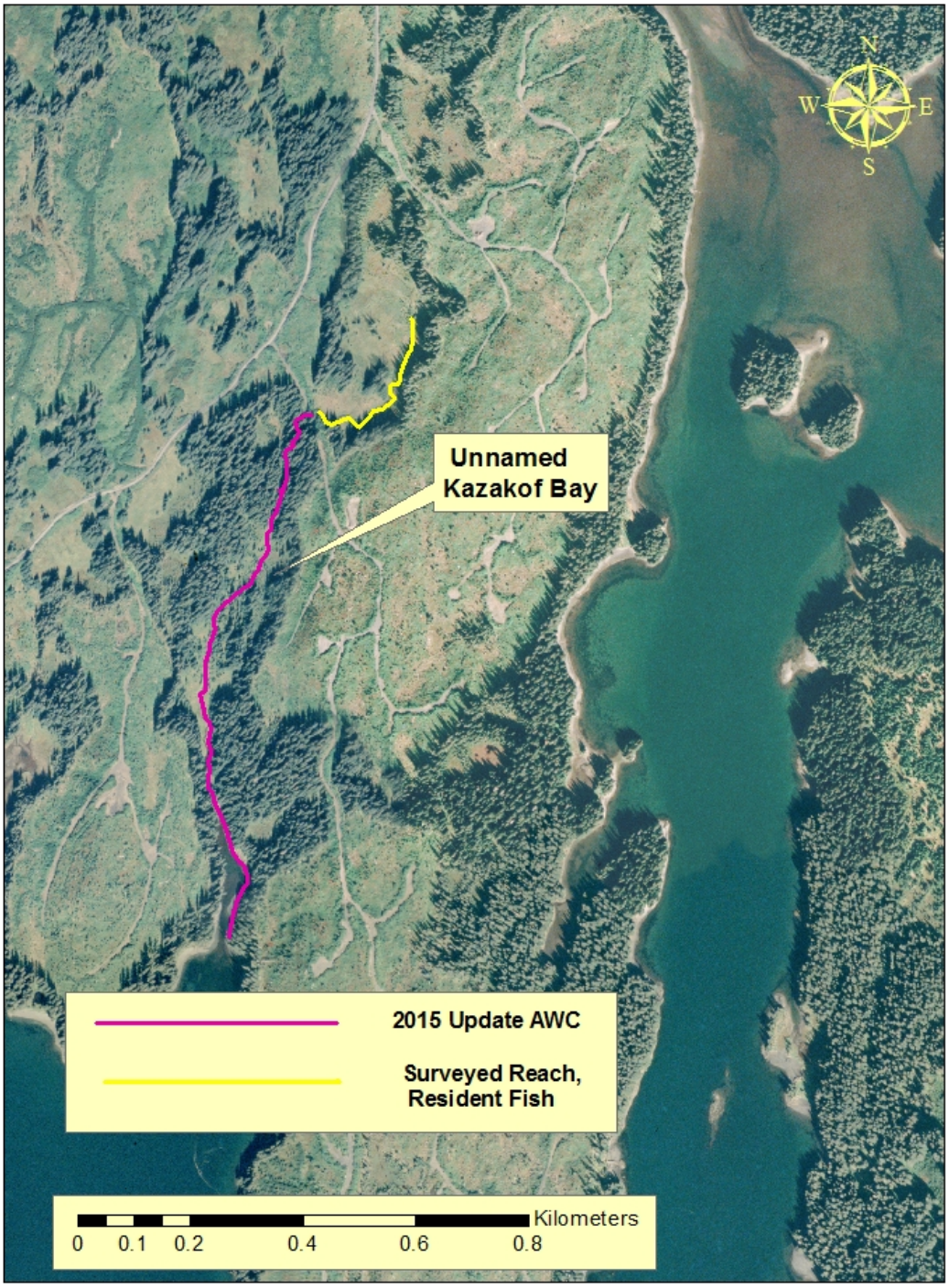
Appendix A1.–Status of surveyed reaches within McDonald Creek, Afognak Island.



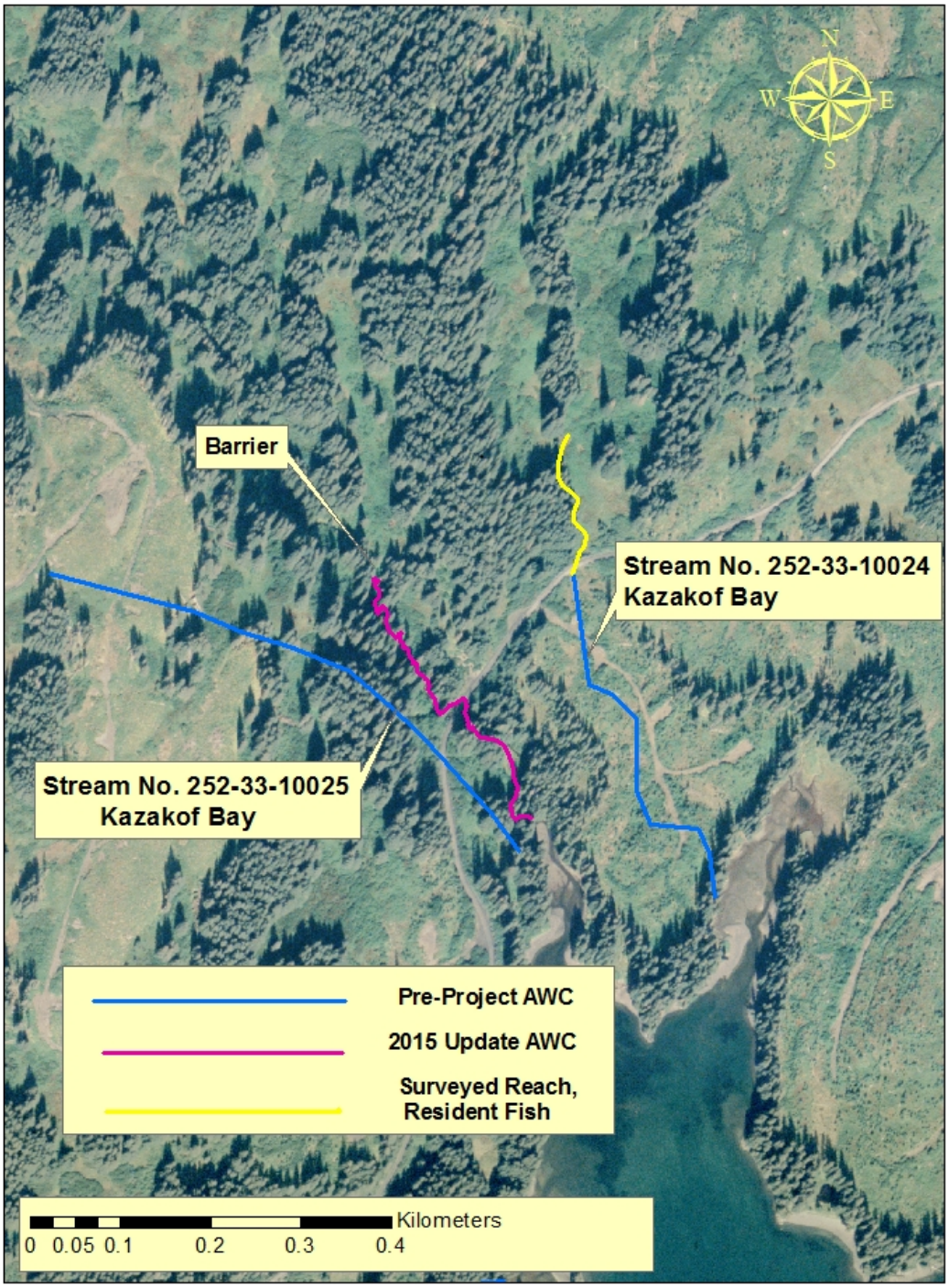
Appendix A2.–Status of surveyed reach within Stream No. 252-32-10008, Afognak Island.



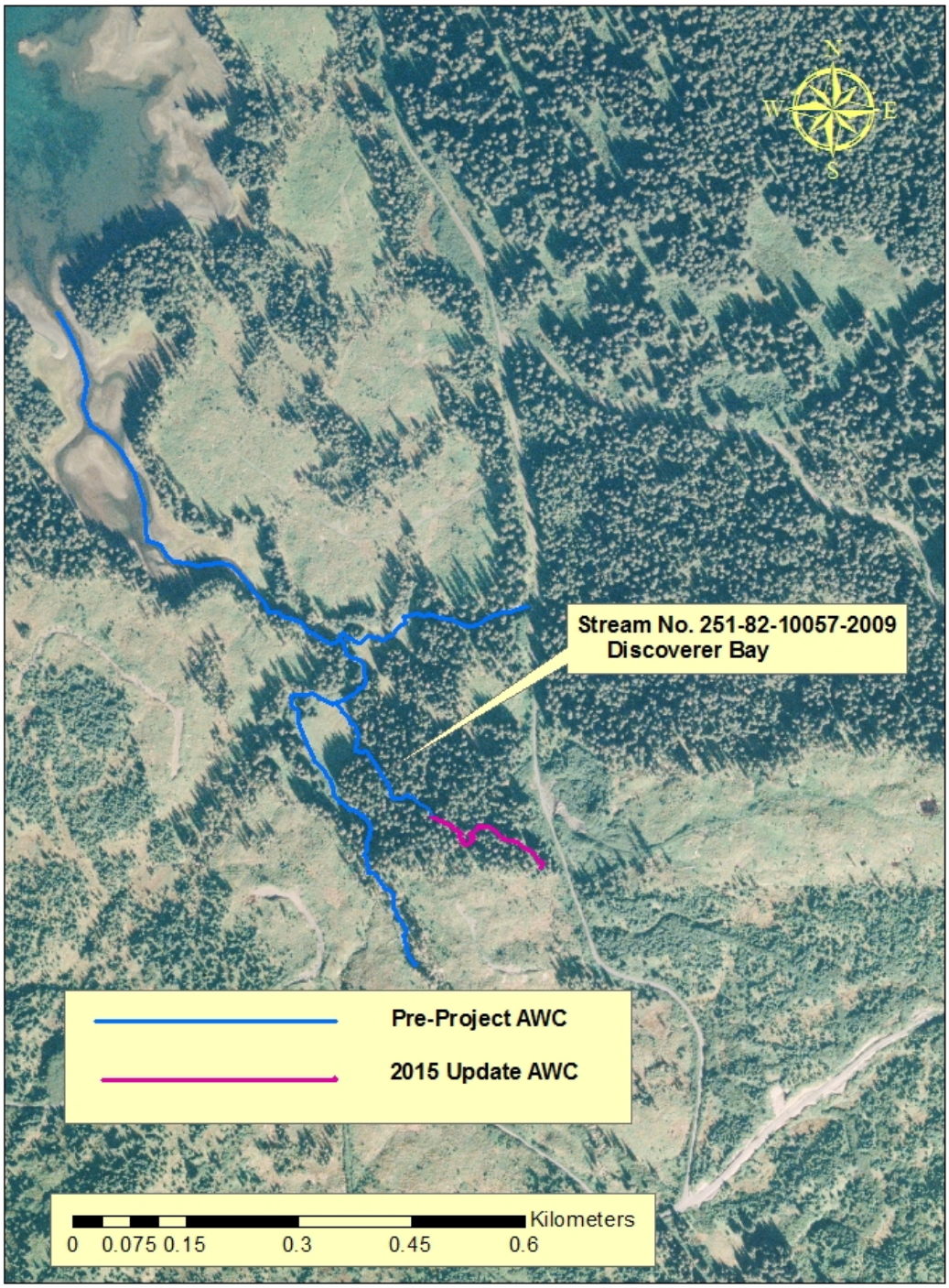
Appendix A3.–Status of surveyed reaches within unnamed streams, Kazakof Bay, Afognak Island.



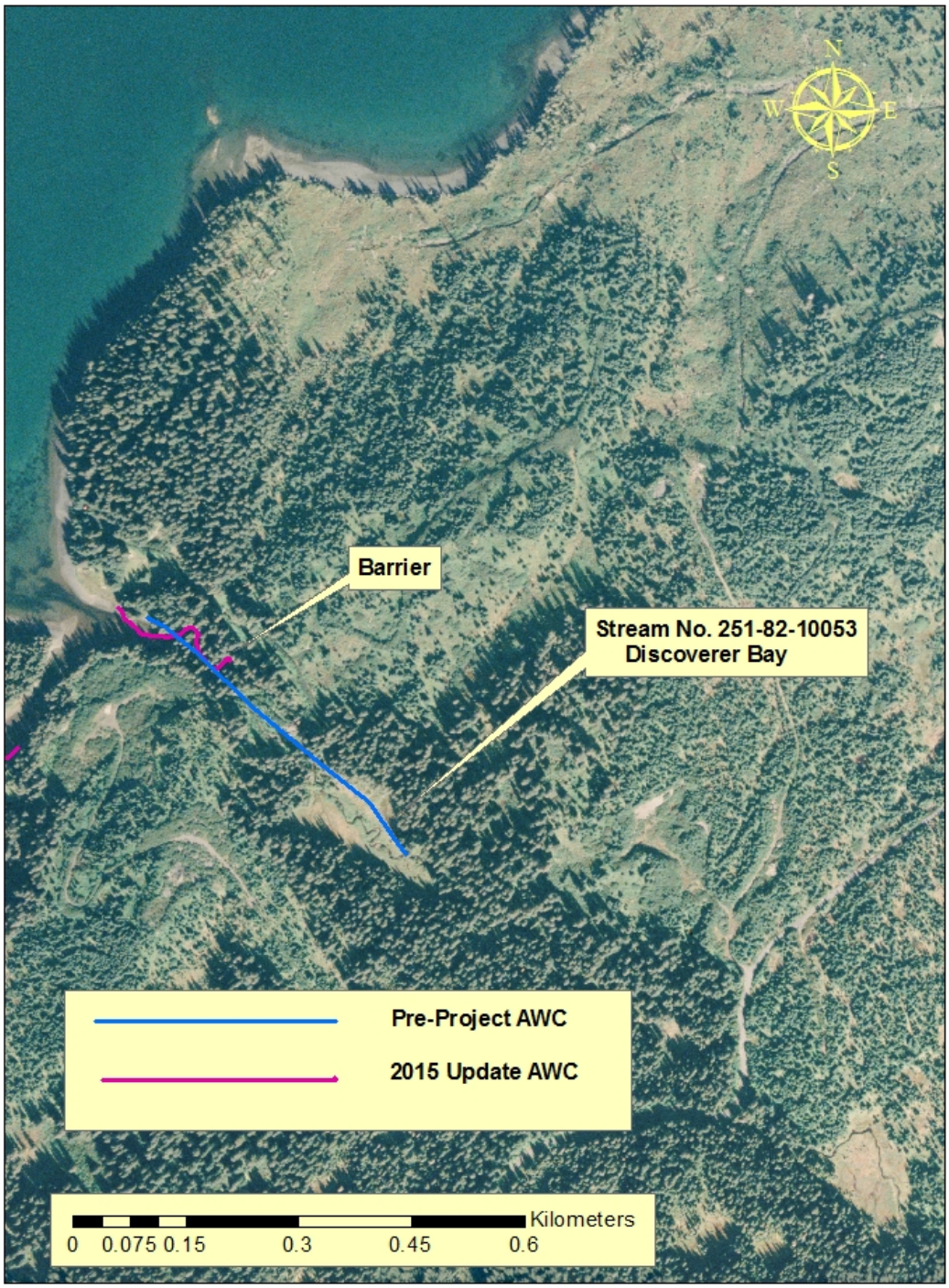
Appendix A4.–Status of surveyed reach within unnamed stream, Kazakof Bay, Afognak Island.



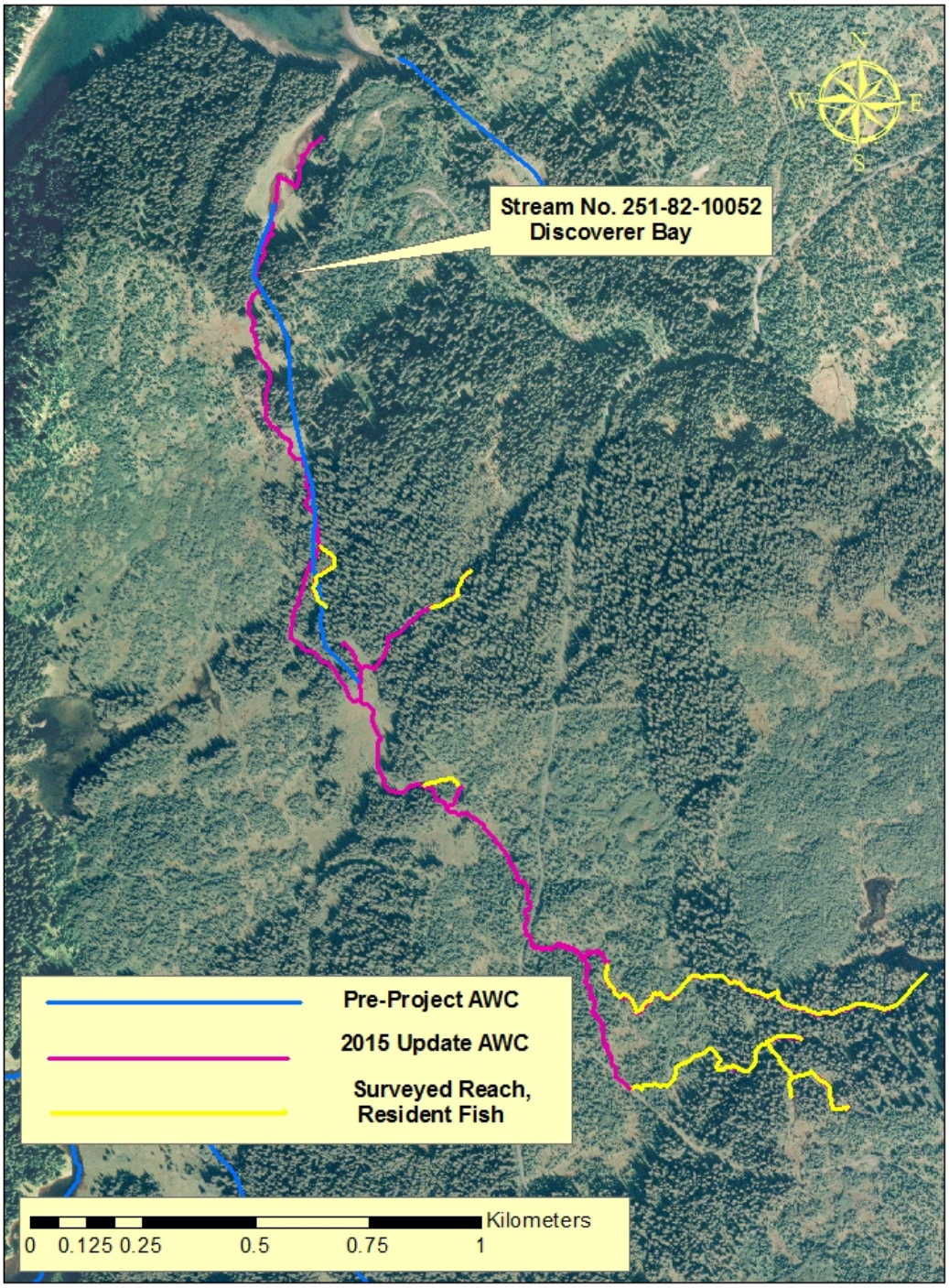
Appendix A5.–Status of surveyed reaches within Stream Nos. 252-33-10024 and 252-33-10025, Afognak Island.



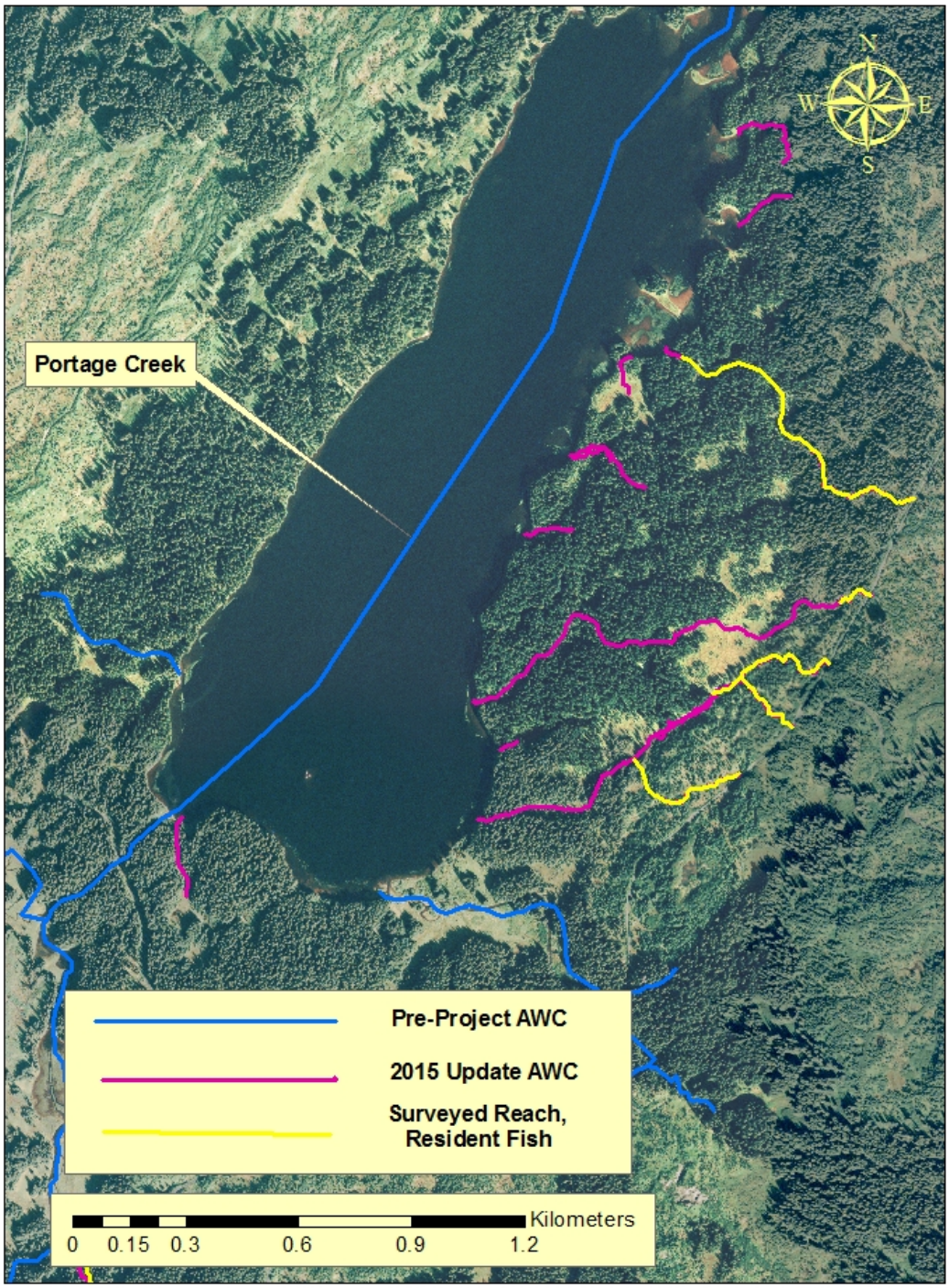
Appendix A6.–Status of surveyed reach within Stream No. 251-82-10057-2009, Afognak Island.



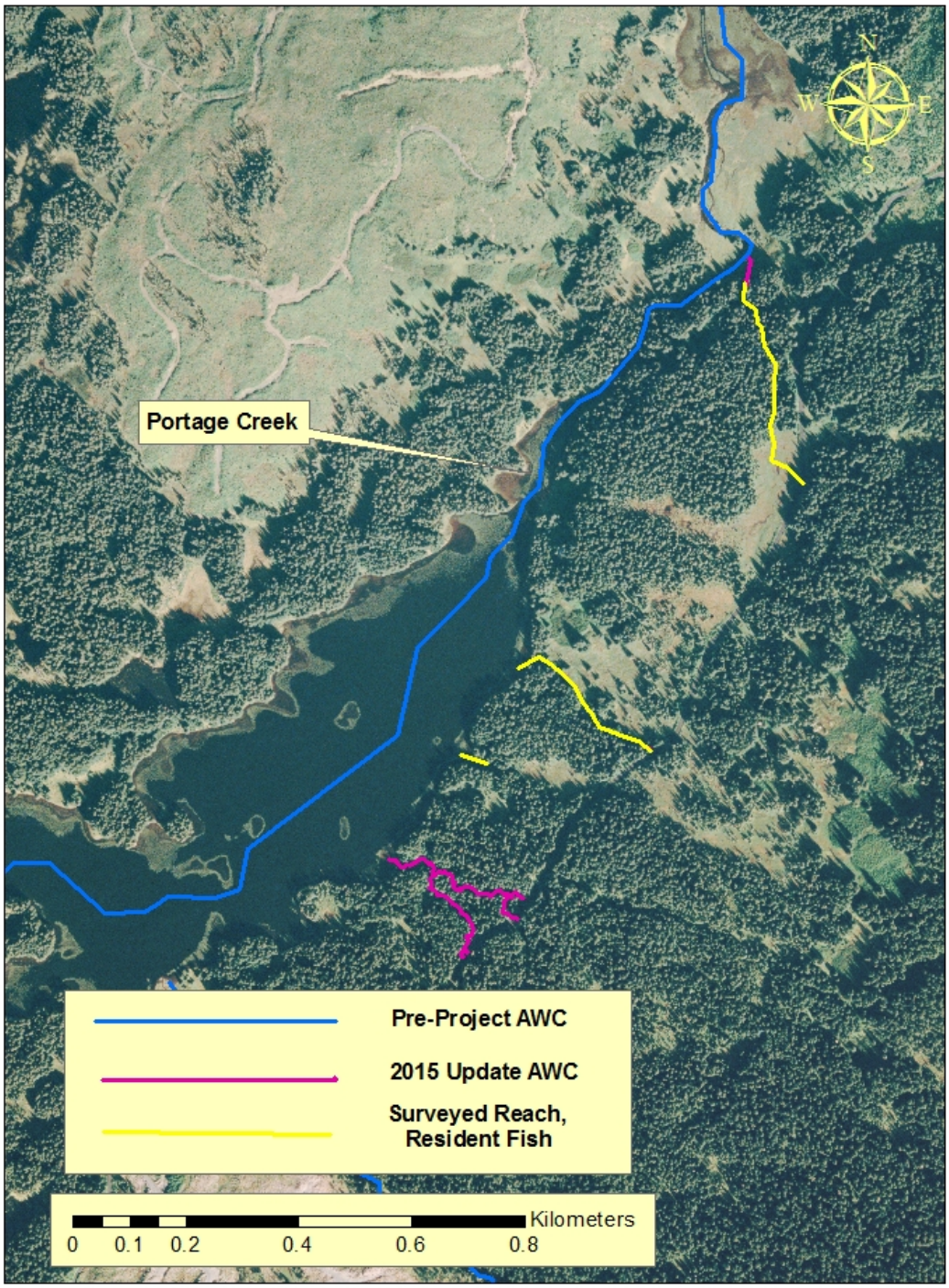
Appendix A7.–Status of surveyed reach within Stream No. 251-82-10053, Afognak Island.



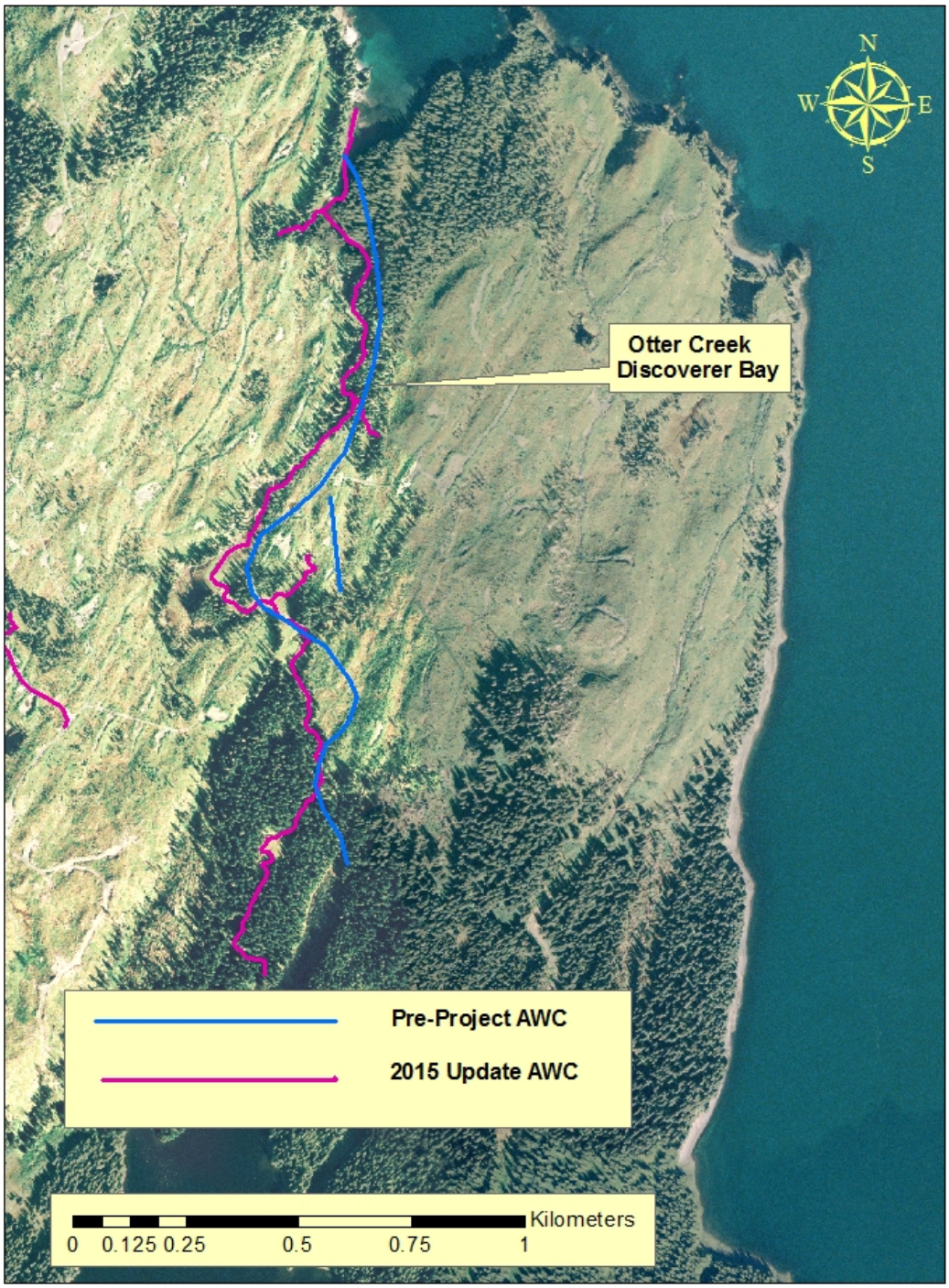
Appendix A8.–Status of surveyed reaches within Stream No. 251-82-10052, Afognak Island.



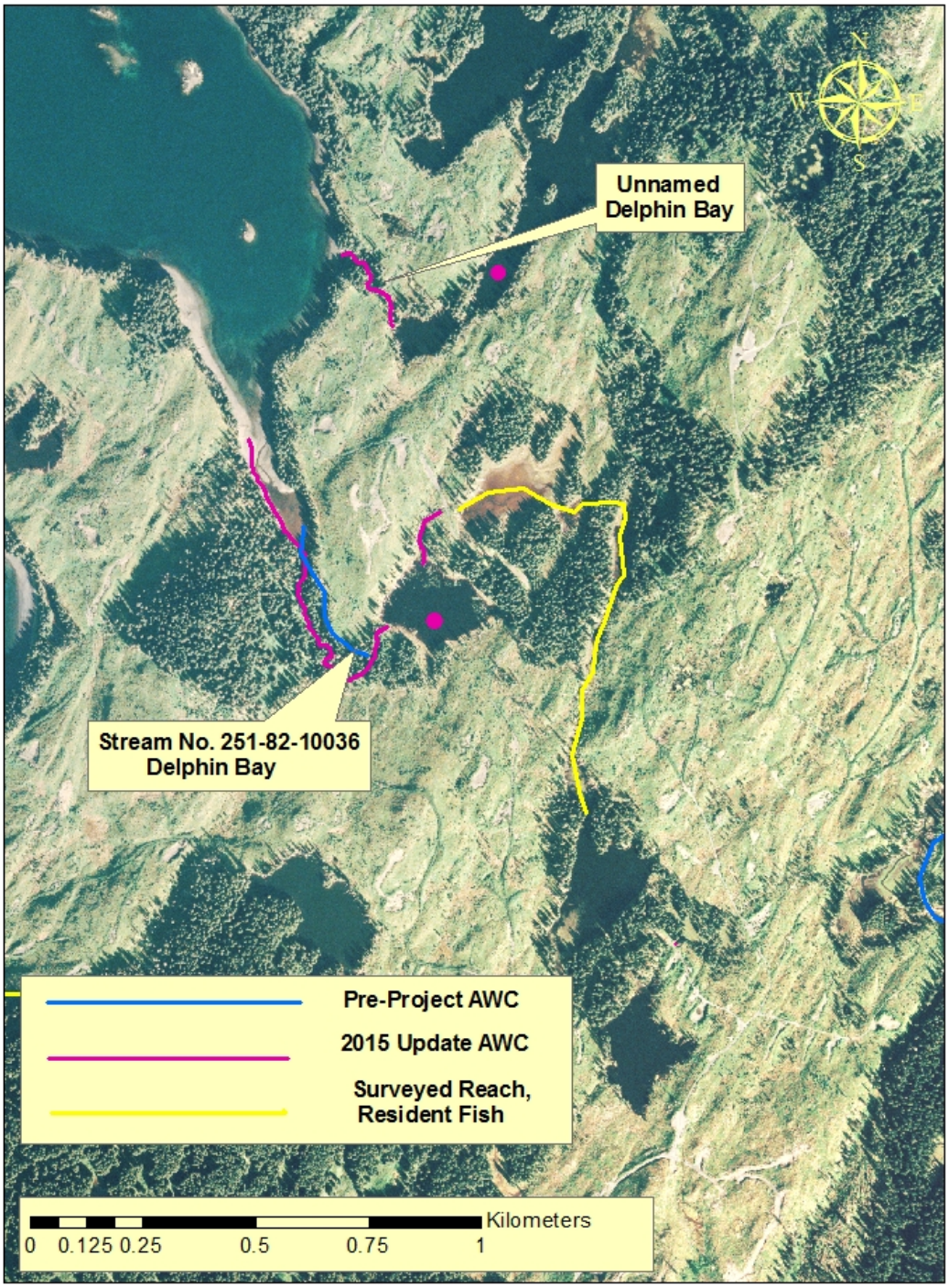
Appendix A9.–Status of surveyed reaches within Portage Creek and Portage Lake, Afognak Island.



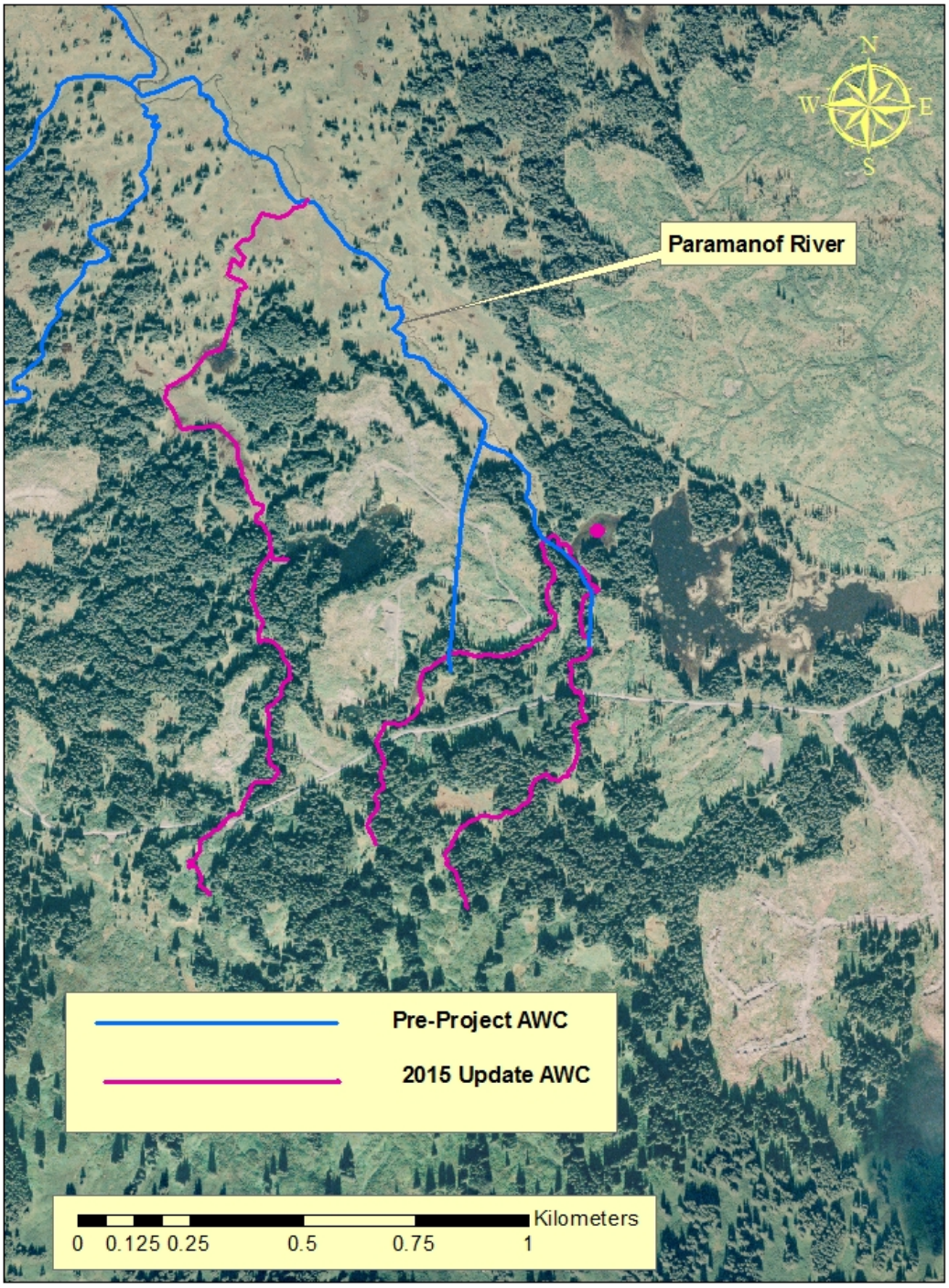
Appendix A10.–Status of surveyed reaches within upper Portage Creek, Afognak Island.



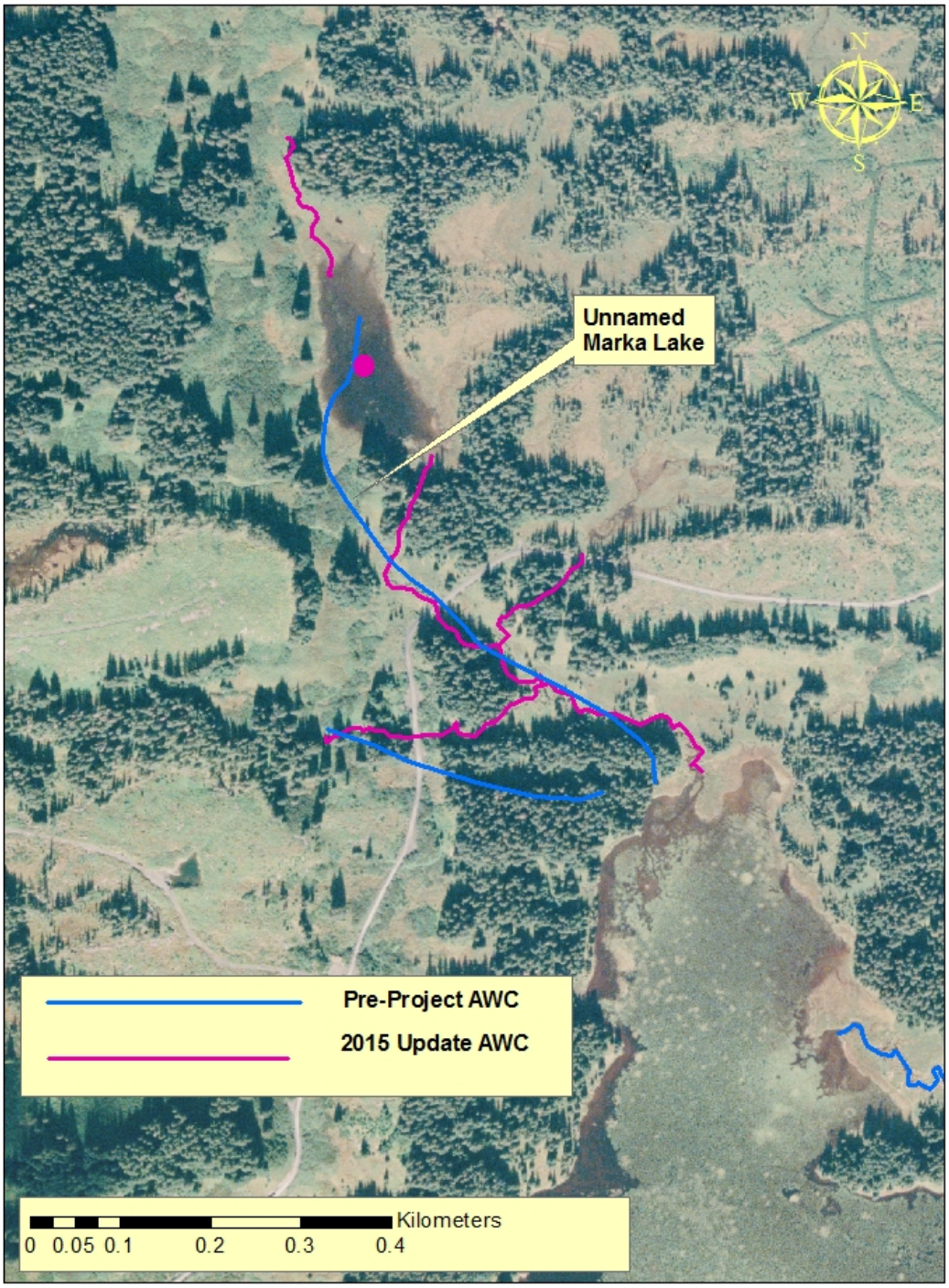
Appendix A11.–Status of surveyed reaches within Otter Creek, Afognak Island.



Appendix A12.–Status of surveyed reaches within Stream No. 251-82-10036 and unnamed stream, Delphin Bay, Afognak Island.



Appendix A13.–Status of surveyed reaches within Paramanof River, Afognak Island.



Appendix A14.–Status of surveyed reaches within unnamed tributaries, Marka Lake, Afognak Island.