Climate Monitoring - Climate Station Site Identification and Evaluation for the Southwest Alaska Inventory and Monitoring Network

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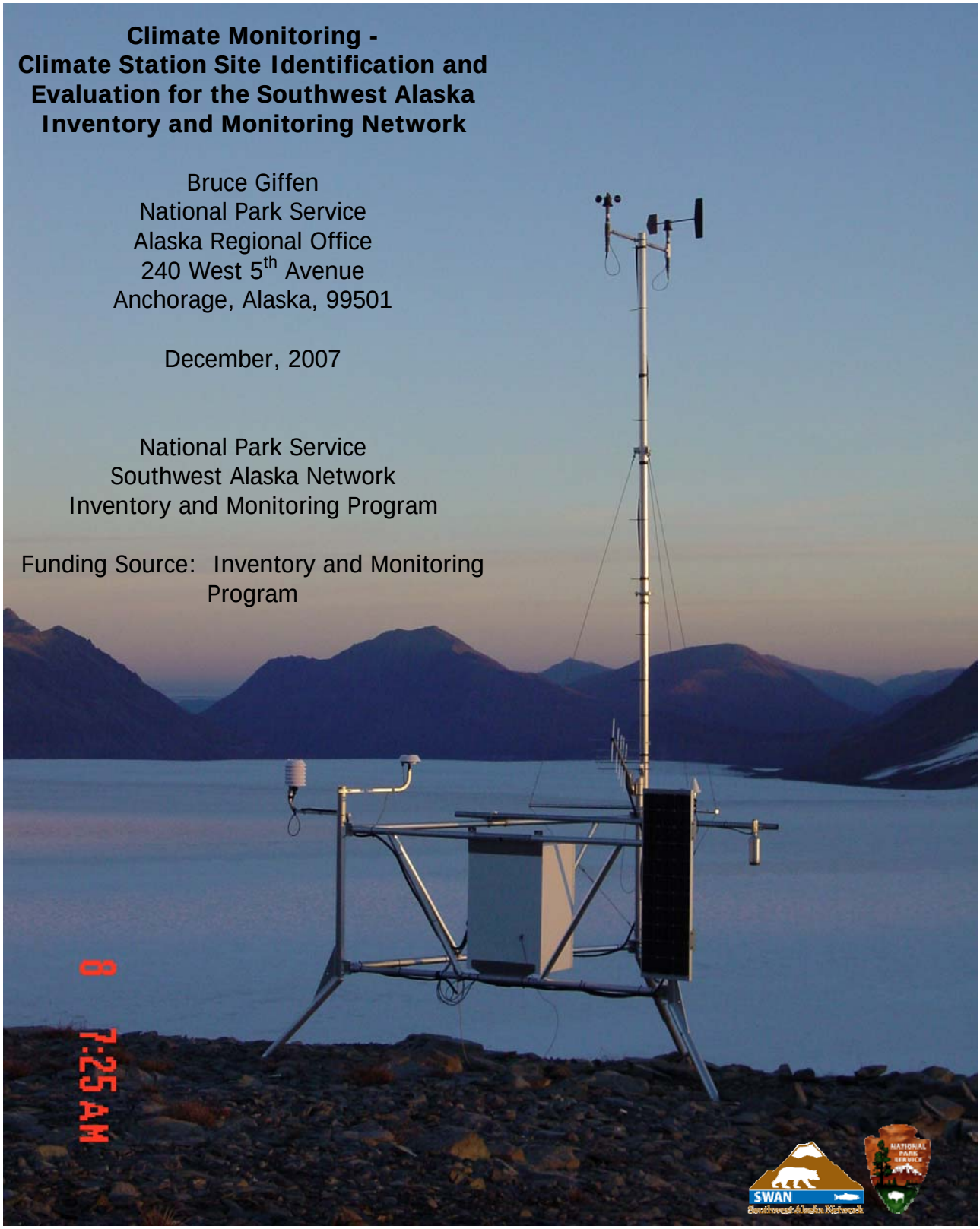

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Acronyms:

SWAN	Southwest Alaska Network
KATM	Katmai National Park and Preserve
KEFJ	Kenai Fjords National Park
LACL	Lake Clark National Park and Preserve
WRCC	Western Regional Climate Center
NWS	National Weather Service
NRCS	Natural Resource Conservation Service

Initial Distribution:

SWAN	Southwest Alaska Network
KATM	Katmai National Park and Preserve
KEFJ	Kenai Fjords National Park,
LACL	Lake Clark National Park and Preserve.

Cover: Harding Icefield Weather Station, Kenai Fjords National Park

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ABSTRACT

Weather and climate is a vital sign identified by the Southwest Alaska Network (SWAN). The purpose of this document is to describe the process employed by the Southwest SWAN to identify potential climate monitoring sites throughout the SWAN parks. Forty-six potential weather station deployment sites were initially identified SWAN-wide. Each site was visited in the field (ground inspection or aerial inspection) in 2006/07. A panel of experts evaluated each site for its ability to monitor climate and climate change in the SWAN region and identified the highest priority sites throughout the SWAN parks.

EXECUTIVE SUMMARY

Climate is widely recognized as one of the most fundamental drivers of ecological condition. This report provides a description of how potential climate monitoring sites were identified, evaluated and prioritized in the Southwest Alaska Network (SWAN) region in support of the Weather and Climate vital sign of the Inventory and Monitoring Program. The SWAN, made up of Katmai National Park and Preserve (KATM), Kenai Fjords National Park (KEFJ), Lake Clark National Park and Preserve (LACL), Alagnak Wild River (ALAG), and Aniakchak National Monument and Preserve (ANIA), covers a large region (600 km north to south and 550 km east to west) with very diverse climate regimes ranging from maritime to continental. Currently, only two park units of the SWAN, KEFJ and LACL, have operating weather stations within the park boundaries. Most of the operating weather stations within the SWAN region are operated by the Federal Aviation Administration (FAA) and the National Weather Service (NWS). This existing network of weather stations is intended to support the mission of the FAA and NWS - safe aviation travel throughout the state of Alaska. Aviation is the only reliable means of transportation to many rural communities in southwest Alaska, thus weather stations are located primarily at lower elevations in towns and villages in this region. This leaves vast areas across the SWAN region unmonitored for climate, particularly at higher elevations.

During 2006 and 2007, several meetings were held with park staff, SWAN staff and climatologists from the NWS, Natural Resource Conservations Service (NRCS) and the State Climatologist from the University of Alaska-Anchorage (UAA) in an attempt to identify potential climate monitoring sites in the SWAN parks. These meetings identified 46 potential sites, all of which were visited during the field seasons of 2006 and 2007. The same panel of experts from the NWS, NRCS and UAA evaluated characteristics specific to each site and identified the top sites best suited to fill in the climate monitoring gaps inherent in the existing network of weather stations in the region. Thirteen sites priority sites were identified within the SWAN parks, KATM (6), KEFJ (3), LACL (4).

INTRODUCTION

The Southwest Alaska Network (SWAN) is one of 32 inventory and monitoring networks established by the National Park Services' Inventory and Monitoring Program. The Inventory and Monitoring Program is the result of the National Parks Omnibus Management Act, which was passed by Congress in 1998. This act directs the National Park Service "to establish baseline [resource] information and to provide information on the long-term trends in the condition of National Park System resources." The 270 NPS units nation-wide have been grouped into 32 inventory and monitoring networks which are characterized by their ecological similarities, four of these networks are in Alaska. The Southwest Alaska Network is composed of five NPS units, Kenai Fjords National Park (KEFJ), Katmai National Park and Preserve (KATM) and Lake Clark National Park and Preserve (LACL), Aniakchak National Monument and Preserve (ANIA) and the Alagnak National Wild and Scenic River (ALAG).

The park units of the SWAN span an area measuring approximately 600 km (370 miles) from north to south and 550 km (341 miles) from east to west (Figure 1). Elevations range from sea level to over 3,050 m (10,000 feet). These parks contain 6 of the 32 unified ecoregions of Alaska (Figure 2). Climate in this vast area is extremely variable, ranging from strongly maritime to continental, with large differences in temperature and precipitation (Figures 3 and 4).

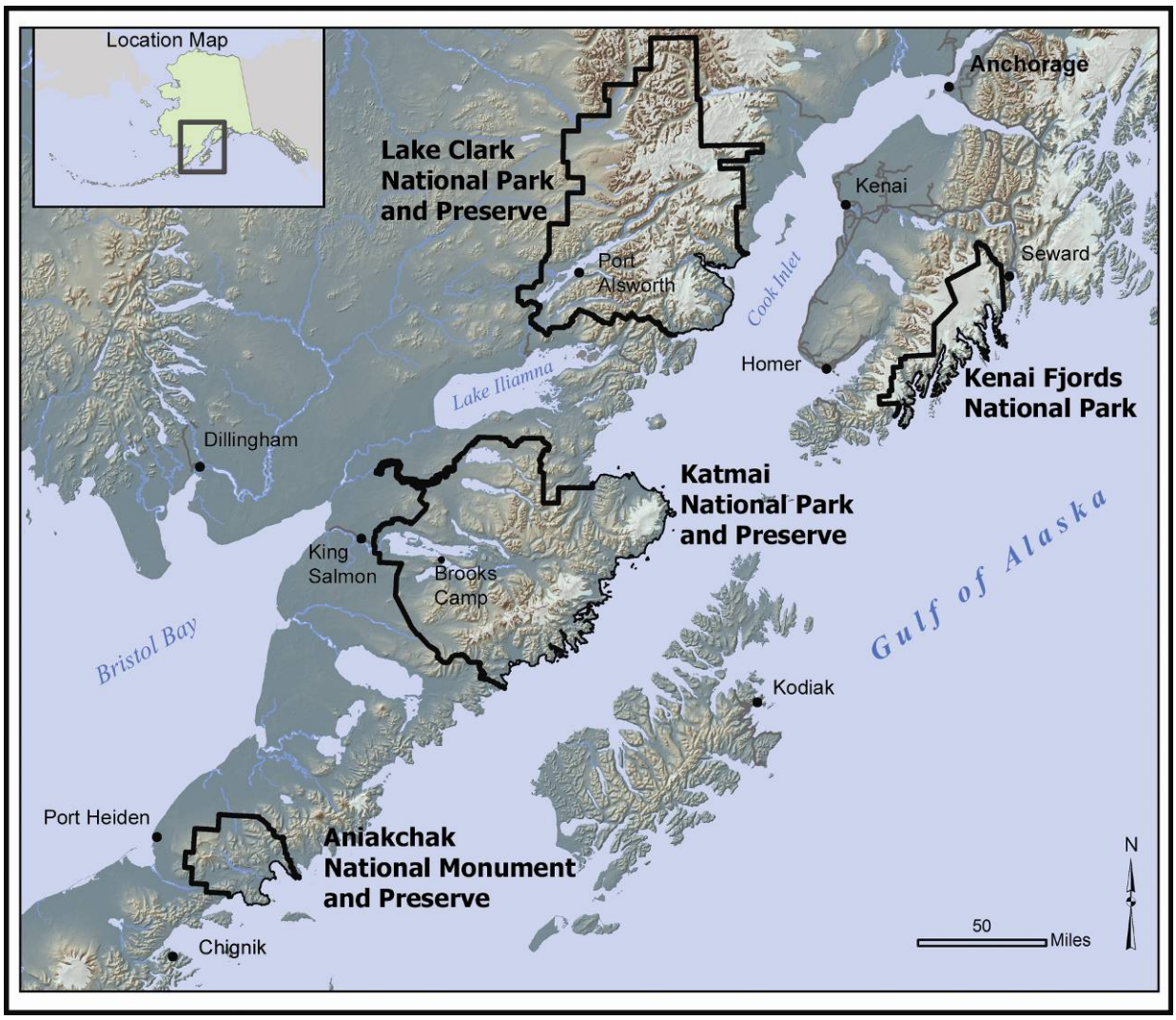

Figure 1. Southwest Alaska Inventory and Monitoring Network park boundaries.

There are five climate zones in Alaska: maritime, maritime-continental, transition between maritime and continental, continental and arctic zones. The maritime zone includes coastal southeast and the northern gulf coast of Alaska. The continental-maritime zone is that western portion of the Bristol Bay region and west-central Alaska where summers are moderated by the open waters of the Bering Sea, but in winter the area is dominated by a continental when the Bering Sea is ice-covered. The transition between maritime and continental climates occurs as you move inland from the northern gulf coast. The continental zone is characterized as interior Alaska and is beyond the influences of the maritime region. The arctic zone is dominated by arctic conditions and is located north of the Brooks Range. (http://www.wrcc.dri.edu/narratives/ALASKA.htm)

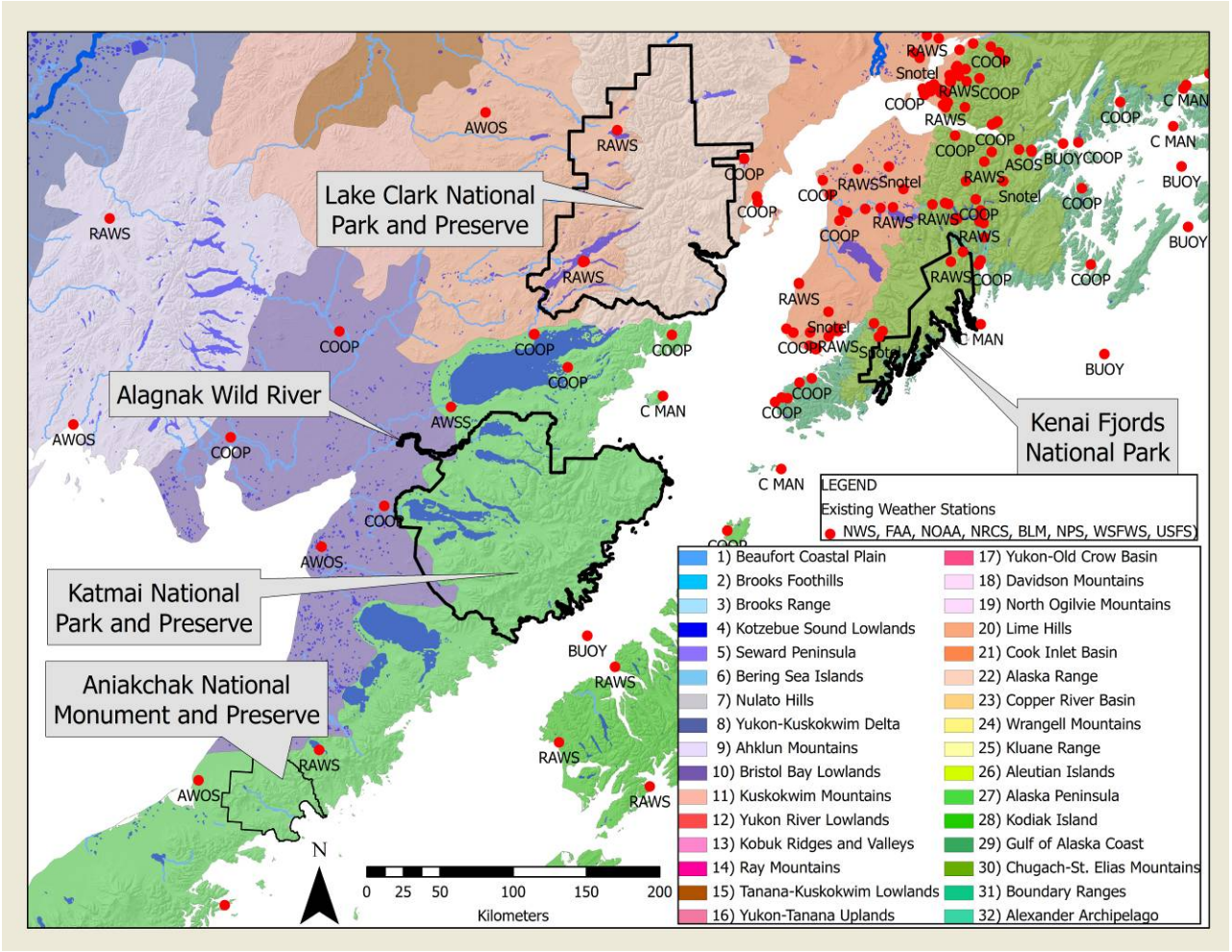

Figure 2. Location of existing weather stations in relation to ecoregions of the Southwest Alaska Inventory and Monitoring Network.

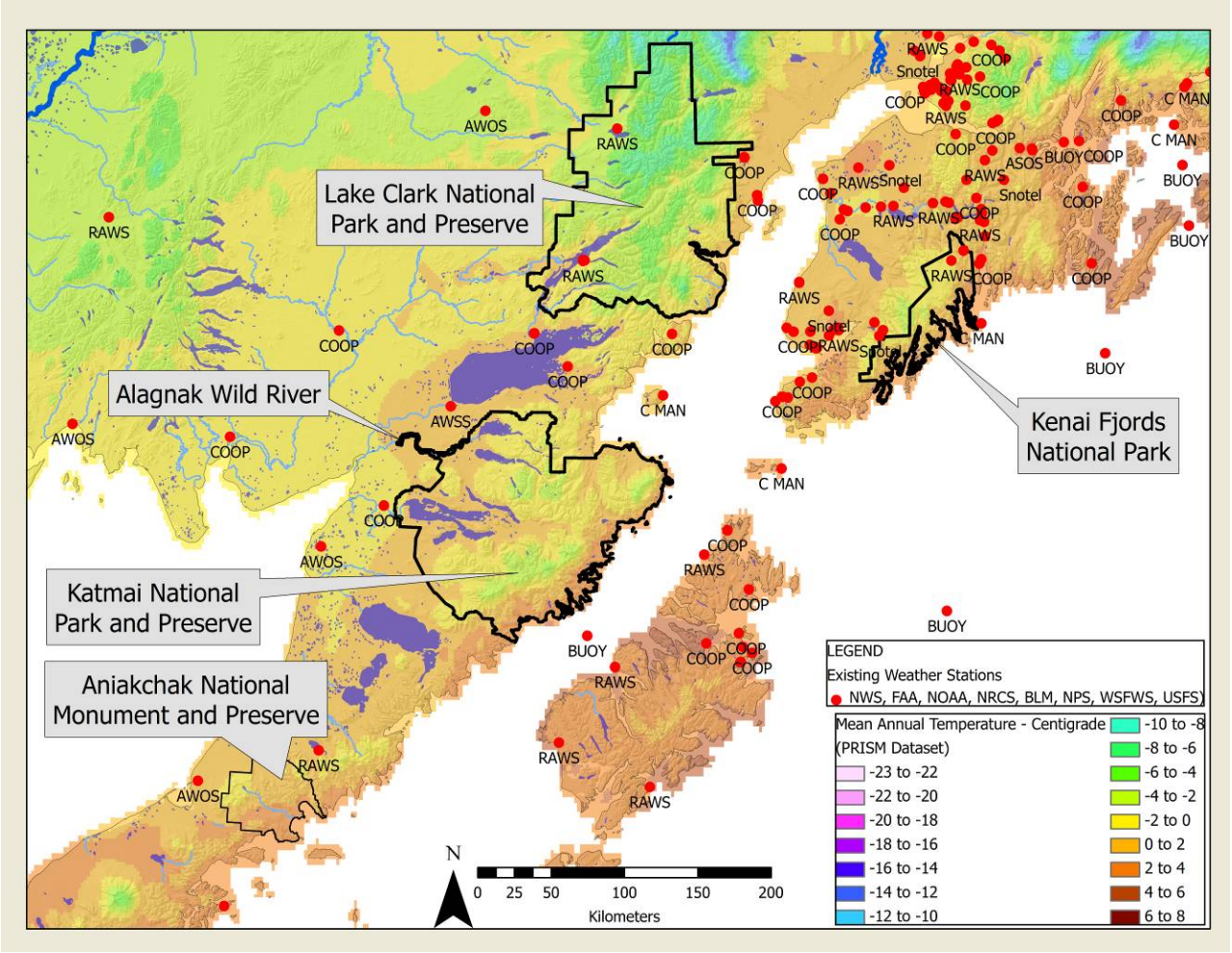

Figure 3. Location of existing weather stations in relation to Alaska Mean Annual Temperature (PRISM Dataset), Southwest Alaska Inventory and Monitoring Network.

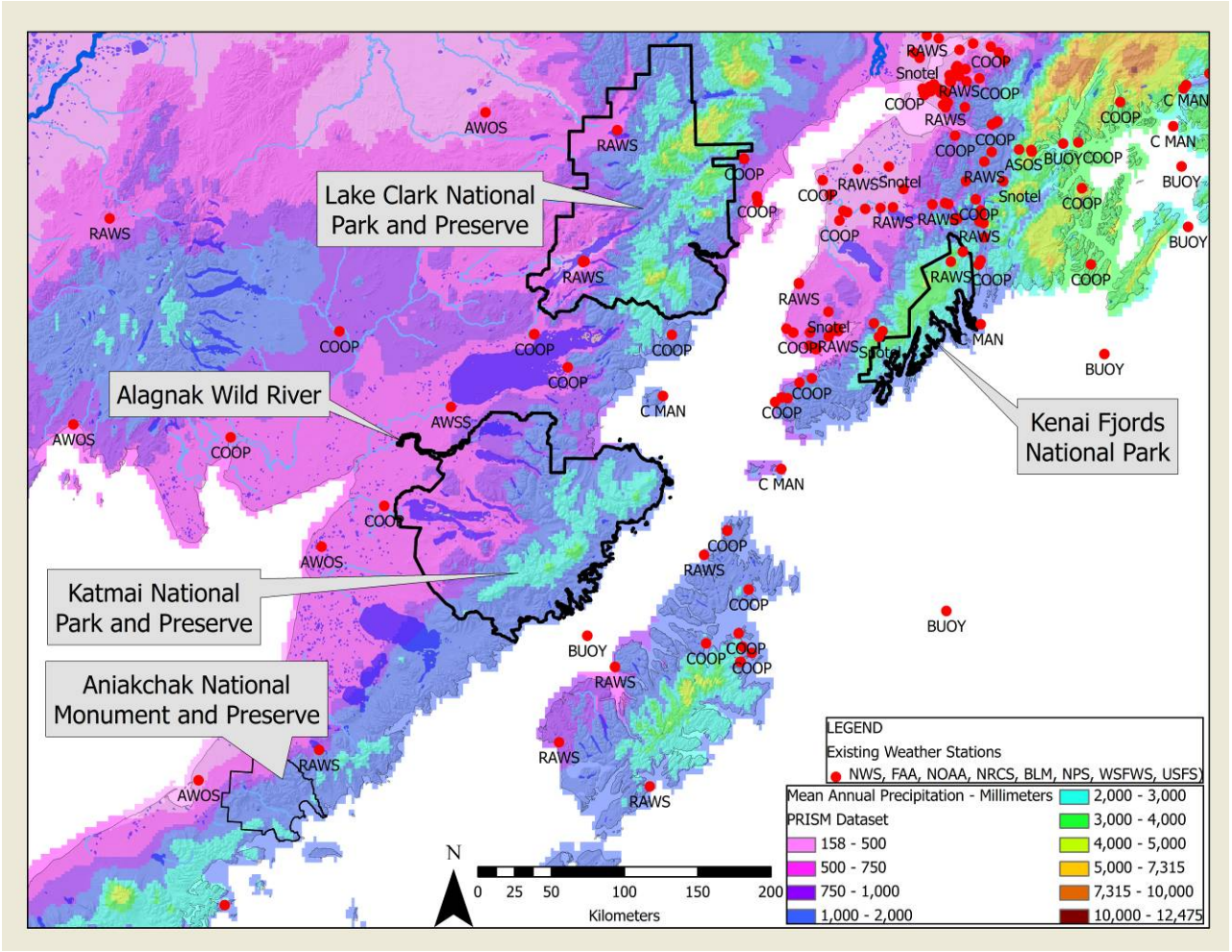

Figure 4. Location of existing weather stations in relation to Alaska Annual Precipitation (PRISM Dataset), Southwest Alaska Inventory and Monitoring Network.

Three climatic zones occur across the SWAN parks. Maritime zone occurs in KEFJ, and coastal sections of ANIA, KATM and LACL. The transition between the maritime and continental zones occurs in KATM and LACL. The northern interior portion of LACL is dominated by the continental zone. The ALAG and the western portions of KATM and most of ANIA may fit into the continental-maritime zone.

To better understand climate variation and how these variations effect the changes in ecosystems (plant and animal communities and patterns) of the Southwest Alaska Network (SWAN), permanent climate monitoring stations will be installed throughout the SWAN parks in the coming years. During the summers of 2006 and 2007, potential weather station deployment sites were visited in KATM, in KEFJ and LACL to obtain specific information on the suitability of each site for the installation of a climate monitoring station. The initial site selection process involved conversations with park staff and climate experts in Alaska. This document reports on the process of identifying

potential climate monitoring sites and the priority ranking of the sites for permanent installation of climate monitoring stations.

Climate Monitoring Objectives

- Monitor and record weather conditions at representative locations
- Capture average climate and climate variability (short- and long-term) across the SWAN region
- Provide reliable climate data to other researchers
- Contribute to larger scale climate monitoring and modeling efforts
- Contribute near real-time weather observations to enhance day-to-day park operations, public and private operators and other government agencies, enhancing safe travel (aviation and marine operations) in the parks
- Maintain stations for the long-term (decades)

EXISTING CLIMATE MONITORING SITES

A recent report by the Western Regional Climate Center (Davey, Redmond, and Simeral, 2007), has a complete description of the currently active and inactive weather station network occurring in the SWAN region. Table 1 identifies active weather stations occurring in and around KATM, KEFJ, LACL, ANIA and ALAG. Figure 5 shows the location of existing weather stations in and around the SWAN.

Table 1. Existing Weather Stations in and around the Southwest Alaska Inventory and Monitoring Network.

Aniakchak National Monument and Preserve					
Station Name	**Station Type**	**Latitude**	**Longitude**	**Agency**	**Inside Park Unit?**
CHIGNIK	AWOS	56.200	-158.233	FAA	NO
PORT HEIDEN	AWOS	56.950	-158.617	FAA	NO
MOTHER GOOSE	RAWS	57.179	-157.278	FWS	NO
Alagnak Wild River					
Station Name	**Station Type**	**Latitude**	**Longitude**	**Agency**	**Inside Park Unit?**
KING SALMON APT	ASOS	58.684	-156.654	NWS	NO
IGIUGIG	AWSS	59.300	-155.900	FAA	NO
KING SALMON AP	COOP	58.684	-156.654		NO
Katmai National Park and Preserve					
Station Name	**Station Type**	**Latitude**	**Longitude**	**Agency**	**Inside Park Unit?**
KING SALMON APT	ASOS	58.684	-156.654	NWS	NO
ILIAMNA APT	ASOS	59.753	-154.915	FAA	NO

Katmai National Park and Preserve (continued)					
Station Name	**Station Type**	**Latitude**	**Longitude**	**Agency**	**Inside Park Unit?**
EGEGIK(AWOS)	AWOS	58.417	-157.367	FAA	NO
IGIUGIG	AWSS	59.300	-155.900	FAA	NO
SHELIKOF STRAI	BUOY	57.920	-154.250	NOAA	NO
BIG BAY RANGER STATION	COOP	58.552	-152.608		NO
KING SALMON AP	COOP	58.684	-156.654		NO
ILIAMNA AIRPORT	COOP	59.754	-154.907		NO
INTRICATE BAY	COOP	59.555	-154.498		NO
CHIEF COVE	RAWS	57.729	-153.933	FWS	NO
BLACK CAPE	RAWS	58.407	-152.886	FWS	NO
Lake Clark National Park and Preserve					
Station Name	**Station Type**	**Latitude**	**Longitude**	**Agency**	**Inside Park Unit?**
PORT ALSWORTH	Apaid	60.200	-154.300	NWS	ACTIVE
BIG RIVER LAKE	Apaid	60.817	-152.300	NWS	NO
ILIAMNA APT	ASOS	59.753	-154.915	FAA	NO
SPARREVOHN AFS	AWOS	61.100	-155.567	AF	NO
INTRICATE BAY	COOP	59.555	-154.498		NO
ILIAMNA AIRPORT	COOP	59.754	-154.907		NO
CHINITNA BAY	COOP	59.750	-153.233		NO
PORT ALSWORTH	COOP	60.203	-154.316		YES
DRIFT RIVER	COOP	60.583	-152.150		NO
BIG RIVER LAKES	COOP	60.814	-152.297		NO
PORT ALSWORTH	RAWS	60.196	-154.320	NPS	YES
STONEY STRIP	RAWS	61.001	-153.896	NPS	YES
Kenai Fjords National Park					
Station Name	**Station Type**	**Latitude**	**Longitude**	**Agency**	**Inside Park Unit?**
SELDOVIA APT	ASOS	59.443	-151.702	FAA	NO
HOMER APT	ASOS	59.647	-151.477	NWS	NO
SEWARD APT	ASOS	60.128	-149.417	FAA	NO
NANWALEK	COOP	59.356	-151.921		NO
KASITSNA BAY	COOP	59.467	-151.550		NO
HOMER AP	COOP	59.643	-151.487		NO
HOMER 2NW	COOP	59.666	-151.564		NO
HOMER 9 E	COOP	59.716	-151.326		NO

Kenai Fjords National Park (continued)					
Station Name	**Station Type**	**Latitude**	**Longitude**	**Agency**	**Inside Park Unit?**
ANCHOR POINT 4 SE	COOP	59.747	-151.754		NO
ANCHOR POINT 4 SE	COOP	59.747	-151.754		NO
HOMER 8 NW	COOP	59.744	-151.551		NO
ANCHOR POINT RIVER	COOP	59.772	-151.836		NO
ANCHOR POINT RIVER	COOP	59.772	-151.836		NO
HOMER 13 NE	COOP	59.762	-151.210		NO
NINILCHIK R AT NINILCHI	COOP	60.048	-151.665		NO
SEWARD	COOP	60.104	-149.444		NO
SEWARD 8 NW	COOP	60.188	-149.628		YES
SEWARD 19 N	COOP	60.354	-149.348		NO
COOPER LAKE PROJECT	COOP	60.392	-149.666		NO
LAWING TRAIL RIVER	COOP	60.407	-149.370		NO
LAWING TRAIL RIVER 2 N	COOP	60.432	-149.373		NO
FUNNY RIVER	COOP	60.482	-150.806		NO
KENAI KEYS RIVER	COOP	60.483	-150.617		NO
COOPER LANDING 5 W	COOP	60.487	-149.968		NO
COOPER LANDING KENAI R	COOP	60.492	-149.809		NO
MOOSE PASS 3 NW	COOP	60.503	-149.426		NO
KENAI 9N	COOP	60.669	-151.323		NO
HARDING ICEFIELD	RAWS	60.130	-149.780	NPS	YES
HOMER	RAWS	59.746	-151.208	S&PF	NO
NINILCHIK	RAWS	60.043	-151.666	S&PF	NO
KENAI LAKE	RAWS	60.367	-149.400	USFS	NO
SKILAK GUARD STATION	RAWS	60.484	-150.461	DNR	NO
BROADVIEW	RAWS	60.483	-149.767	USFS	NO
KENAI NWR	RAWS	60.592	-150.317	FWS	NO
GRANITE	RAWS	60.727	-149.287	USFS	NO
PORT GRAHAM	Snotel	59.350	-151.850	NRCS	NO
NUKA GLACIER	Snotel	59.700	-150.717	NRCS	NO
KACHEMAK CREEK	Snotel	59.733	-150.667	NRCS	NO
MCNEIL CANYON	Snotel	59.750	-151.267	NRCS	NO
MF BRADLEY RIVER	Snotel	59.783	-150.767	NRCS	NO
ANCHOR RIVER DIVIDE	Snotel	59.867	-151.317	NRCS	NO
GROUSE CREEK DIVIDE	Snotel	60.267	-149.350	NRCS	NO
COOPER LAKE	Snotel	60.383	-149.700	NRCS	NO
GRANDVIEW	Snotel	60.600	-149.067	NRCS	NO
SUMMIT CREEK	Snotel	60.617	-149.533	NRCS	NO

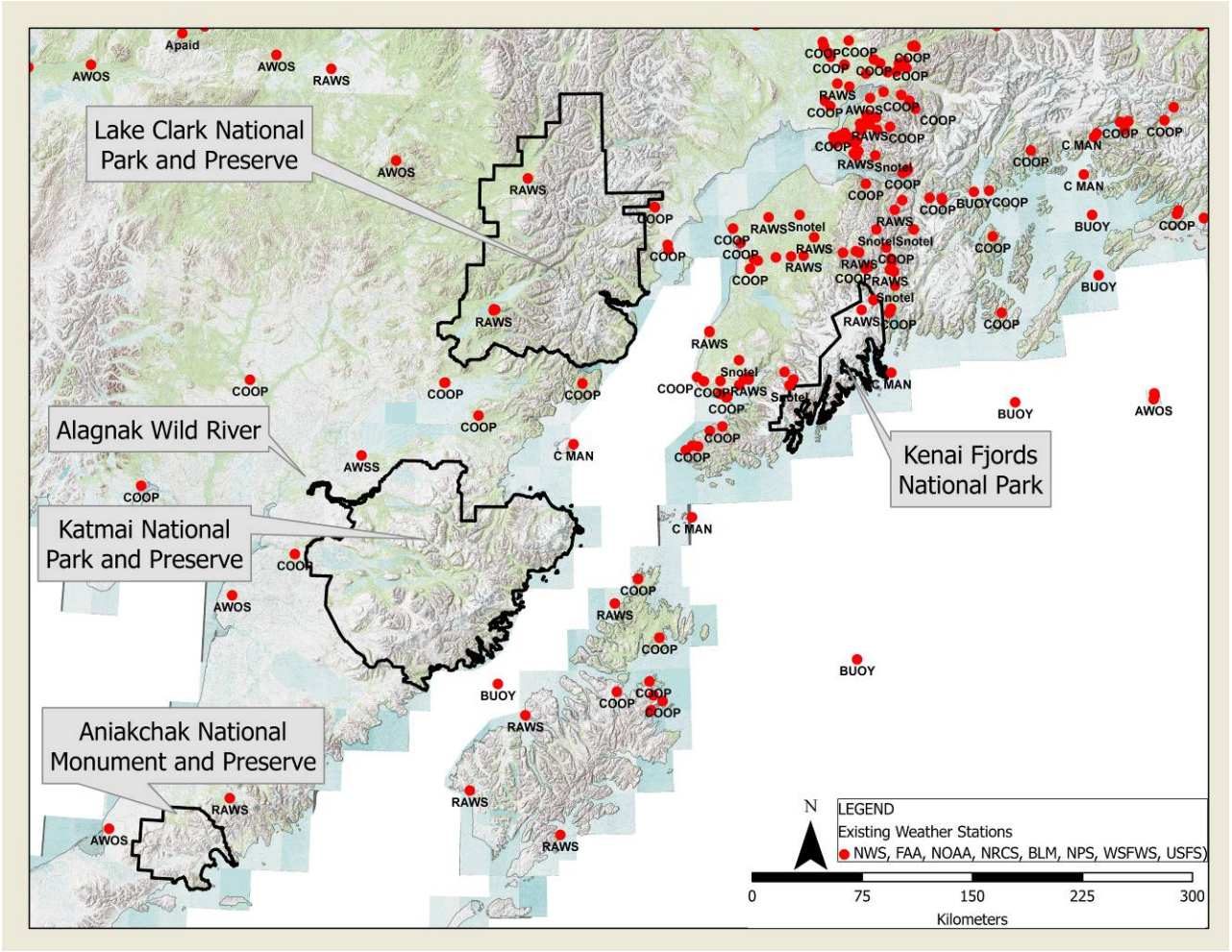

Figure 5. Location of existing weather stations in the Southwest Alaska Inventory and Monitoring Network.

POTENTIAL NEW CLIMATE MONITORING SITES

Initially, the Western Regional Climate Center (WRCC) was contracted by the SWAN in 2004 in an effort to identify potential weather station deployment sites across the SWAN parks which would help to fill in climate monitoring gaps existing in the current network of operating weather stations across the SWAN region. WRCC prepared a report (Redmond et al, 2005) characterizing climate in the SWAN region, reviewed the existing network of operating weather stations in southwest Alaska and identified potential areas within the SWAN parks which would fill in gaps in the ability of the currently operating network of weather stations to monitor climate and climate change in the SWAN parks. Figures 8, 47, 70 (Appendixes A, B, and C), show the areas in KATM, KEFJ, and LACL identified by the WRCC as areas suitable for potential weather station deployments with the ability to fill in gaps in the existing network of weather stations to monitor climate and climate change.

Potential weather station deployments sites were identified in 2006, which will fill climate monitoring gaps in the existing network of currently operating weather stations and increase our knowledge of climate and climate variability across the SWAN parks (Figure 6). This effort to identify potential climate monitoring sites was multifaceted utilizing multiple datasets including: vegetation, ecoregions, precipitation models and temperature models (PRISM), topography, land management units, park personnel expertise, and professionals from the National Weather Service, Natural Resource Conservation Service the WRCC (Redmond, 2005), and the University of Alaska-State Climatologist. Several criteria were used in identifying potential sites:1) regional exposure while minimizing local influences, 2) ecoregions, 3) higher elevation sites as compared to the existing weather station network, 4) ease of access (critical for the long-term success of climate monitoring) and 5) temperature and precipitation models.

The ability to build a data set of weather observations well into the future is the primary challenge. Ease of access to each site in the field will likely be the single most important factor in creating a valuable dataset. Easily accessible areas mean fixed-wing access by a pilot with average skills, capable of landing small single-engine aircraft at unimproved remote sites (lakes, gravel, beach, snow). Helicopter access only sites were not considered due to the high cost associated with maintaining these types of sites decades into the future.

Initially, meetings were held with resource professionals and staff at each park to identify areas within the parks suitable for permanent climate station deployment. Landscapes, ecoregions, vegetation patterns, temperature and precipitation models, wilderness, access, visitor use, and topography were some of the factors considered. Site identification near ecoregion boundaries may capture observations that will be significant in efforts to understand ecosystem change. Another important boundary may be where the mean annual temperature is equivalent to freezing.

On-the-ground site surveys and over-flights were conducted in KATM, KEFJ and LACL in 2006 and 2007.

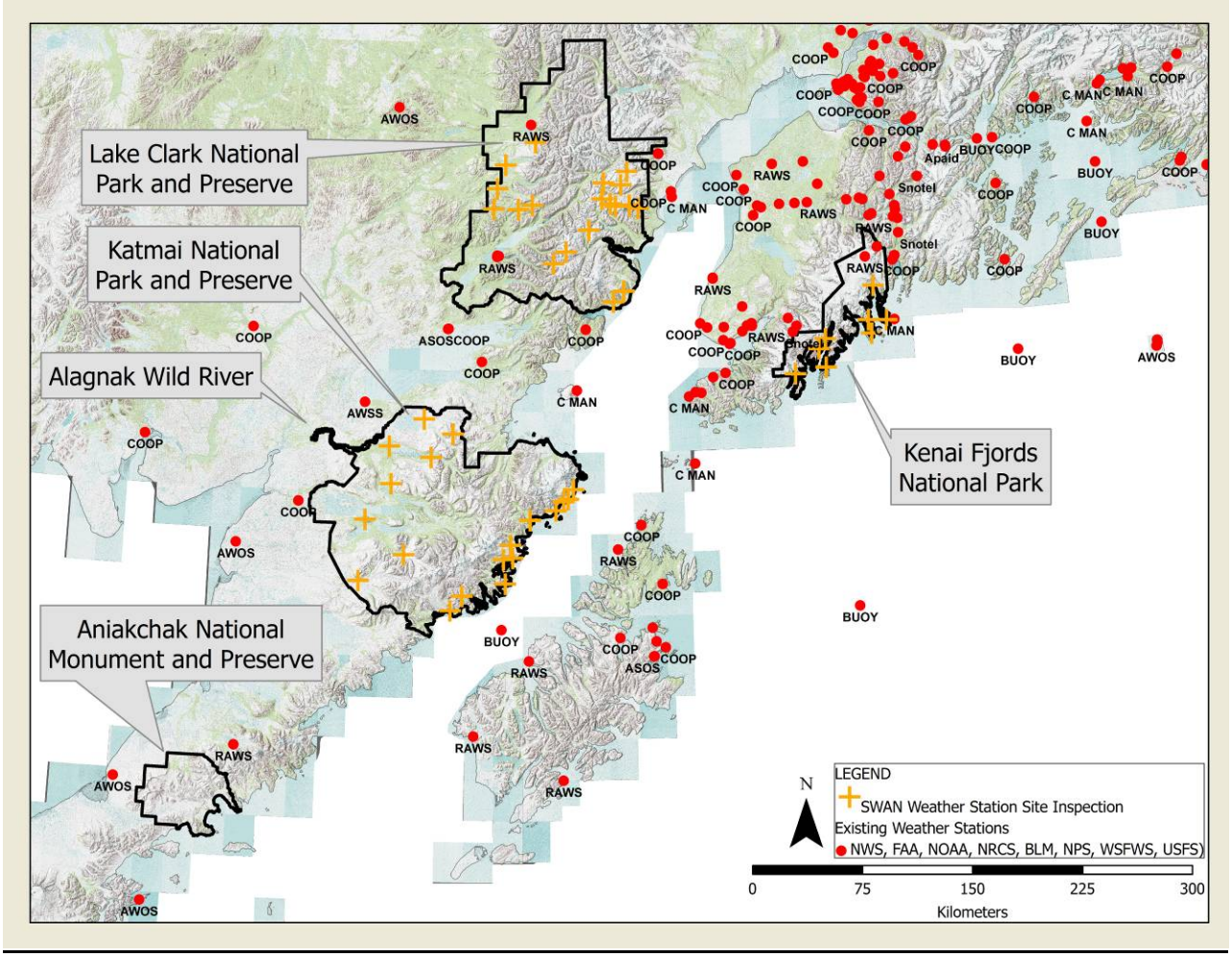

Figure 6. Location of existing weather stations in relation to the location of potential climate monitoring sites, Southwest Alaska Inventory and Monitoring Network.

Katmai National Park and Preserve

KATM has both a maritime climatic zone (eastern side of the park) and a continental-maritime zone (western side of the park). The Pacific Ocean is the eastern boundary of KATM. Active volcanoes, 6.2 to 12.4 km (10 to 20 miles) west of the Pacific Ocean rise to elevations of over 2,133 m (7,000 feet). These volcanic mountains capture high amounts of precipitation and are the source areas of over 800 sq km (200,000 acres) of glacier ice occurring within KATM. West of the volcanic mountains, the landscape is less dramatic with lower elevation mountains and hills and large lake systems in the glaciated valleys.

Initially, 17 potential climate monitoring sites were identified within the park: ten coastal sites, two mountain sites and five lower elevation sites. The coast sites will characterize the maritime conditions along the Pacific Coast. Though no high mountain sites were identified due to ease-of-access concerns, the lower mountain sites west of the higher mountains will characterize moderate elevation conditions in the continental-maritime

climate zone. The low elevation sites in the western portion of the park will characterize low elevation conditions in the continental-maritime climate zone.

There are no currently operating weather stations within the KATM (WRCC, 2007). There are stations west of the park, which capture conditions at low elevation sites only.

Table 2 lists all potential climate monitoring sites considered in KATM and summarizes key points for each. Maps depicted in Figures 8 through 12 (Appendix A) show the location of potential and priority climate monitoring sites and how these sites relate to the existing network of weather stations, wilderness boundaries, ecoregions and temperature and precipitation models.

Table 2. Potential climate monitoring sites – Katmai National Park and Preserve.

National Park Service Climate Monitoring
Southwest Alaska Network - Potential Weather Station Sites

Interior Sites - Katmai National Park and Preserve

Site Name	Elevation (ft)	Latitude	Longitude	Site Type	Ground Cover	Access for Maintenance	Land Status	Wilderness	Concurrent Land Uses/Improvement
Moraine Creek	840	59.20068246N	155.18281155W	Inland/low	Tundra/low shrub	Fixed-wing wheels	Preserve, NPS (fee simple)	No	None
Phaff Mine	1900	59.11027199N	154.83991787W	Inland/mod elevation	Tundra	Fixed-wing wheels existing strip at Phaff Mine	Preserve, NPS (fee simple)	No	Abandoned mine site
Kulik	700	58.96794585N	155.09317221W	Inland/low	Tundra/Shrub	Fixed-wing wheels	Park, NPS (fee simple)	No	None
Coville	1500	58.802572N	155.562799W	Inland/mod elevation	Tundra	Fixed-wing floats on unnamed lake	Park, NPS (fee simple)	Yes	None
Dumpling Mtn	2400	58.581663N	155.859888W	Inland/mod elevation	Tundra/rock	Helicopter or hike from Brooks Camp	Park, NPS (fee simple)	Yes	NPS Radio Repeater Site
Three Forks	1300	58.370499N	155.397862W	Inland/mod	Shrub	Fixed-wing and Truck	Park, NPS (fee simple)	Yes	None
Contact Creek	670	58.20937288N	155.92106419W	Inland/low elevation	Tundra	Fixed-wing wheels on existing unimproved landing site	Park, NPS (fee simple)	Yes	None

Coastal Sites - Katmai National Park and Preserve

Site Name	Elevation (ft)	Latitude	Longitude	Site Type	Ground Cover	Access for Maintenance	Land Status	Wilderness	Concurrent Land Uses/Improvement
Fourpeaked Glacier	100	58.773410N	153.399960W	coastal/low	Alder	Helicopter	Park, NPS (fee simple)	Yes	None
Dark	500	58.704557N	153.452527W	coastal/low	Grass/Alder	Fixed-wing wheels	Park, NPS (fee simple)	Yes	None
Dark South	500 - 1000	58.691444N	153.504050W	coastal/low elevation	Grass/rock	Fixed-wing wheels on beach	Park, NPS (fee simple)	Yes	None
Swikshak	1000	58.645174N	153.610255W	coastal/med	Grass	Fixed-wing wheels	Park, NPS (fee simple)	Yes	None
Hallo Bay Lodge	50	58.587639N	153.914962W	coastal/low	Grass/Alder	Fixed-wing wheels	Park, NPS (fee simple)	Yes	None
Hallo Glacier	50	58.40N	154.14W	coastal/low	Alder	Helicopter	Park, NPS (fee simple)	Yes	None
Katmai Wilderness Lodge	50	58.343733N	154.114736W	coastal/low	Alder	Fixed-wing floats	Park, NPS (fee simple)	Yes	None
Cape Gull	1300	58.204392N	154.200093W	coastal/mod elevation	Grass/tundra/rock	Helicopter	Park, NPS (fee simple)	Yes	Coast Guard Communication Site
Devil's Cove Lake	100	58.350858N	154.230313W	coastal/low	Alder	Fixed-wing floats	Park, NPS (fee simple)	Yes	None
Dakavak Lake	400	58.13N	154.70W	coastal/low	Alder	Fixed-wing floats	Park, NPS (fee simple)	Yes	None

On-the-ground site surveys were conducted in 2006 and 2007 by Helen Lons (biologist-KATM), Daniel Noon (biologist-KATM), Chuck Lindsay (Physical Science Tech-SWAN), Allen Gilliland (pilot-KATM) and Bruce Giffen (geologist-AKRO). Site surveys, site photos and maps of each site are located in Appendix A, Figures 13-46.

Kenai Fjords National Park

KEFJ is dominated by maritime conditions. The eastern boundary of KEFJ is the coastline of the Pacific Ocean - Gulf of Alaska. The Harding Icefield is the dominate feature of the

park, covering approximately 44 percent of the park, lying approximately 6.2 km (10 miles) west of the coast at elevations in excess of 1,525 m (5,000 feet). Being proximal to the Pacific Ocean, large amounts of precipitation fall on the Harding Icefield. Much of the Harding Icefield (1,875 km sq) lies beyond the park boundary spawning several dozen valley glaciers terminating on land, in lakes and at tide-water.

Initially, seven potential climate monitoring sites were identified within the park: six sites were identified along the coast and one in the mountains. The sites will characterize the maritime conditions along the northern Gulf of Alaska coast, both at low and high elevations. The sites also have the potential to capture down-fjord gradients, which could potentially capture increased precipitation at stations located distal from the outer coast and further into the fjords.

Table 3 lists all potential climate monitoring sites considered in KEFJ and summarizes key points for each. Maps depicted in Figures 47 through 51 (Appendix B) show the location of potential and priority climate monitoring sites and how these sites relate to the existing network of weather stations, wilderness boundaries, ecoregions and temperature and precipitation models.

Table 3. Potential climate monitoring sites – Kenai Fjords National Park.

National Park Service Climate Monitoring
Southwest Alaska Network - Potential Weather Station Sites

Coastal Sites - Kenai Fjords National Park

Site Name	Elevation (ft)	Latitude	Longitude	Site Type	Ground Cover	Access for Maintenance	Land Status	Wilderness	Concurrent Land Uses/Improvement
Cliff Bay	600	59.737429N	149.564608W	coastal/low	Tundra/open forest	Boat	Park, NPS (fee simple)	No	None
Harris Peninsula	1500	59.744971N	149.786446W	coastal/mod	Tundra/bedrock	Boat	Park, NPS (fee simple)	No	None
Fire Cove	900	59.661548N	149.756831W	coastal/low	Tundra/open forest	Boat or Helicopter	Park, NPS (fee simple)	No	None
McArthur Pass	1300	59.472653N	150.333587W	coastal/mod elevation	Tundra/bedrock	Boat or Helicopter	Park, NPS, Subsurface – Patent/IC, Chugach Alaska Corp (Native); Surface – Acquired Federal (English Bay Corp)	No	NPS Radio Repeater Site
Dinglstadt Glacier	400	59.646352N	150.323406W	coastal/low elevation	Alder/bedrock	Boat or Fixed-wing floats	Park, NPS (fee simple)	No	None
James Lagoon	<25	59.586956N	150.407669W	coastal/low	Grass	Boat	Park - Subsurface Pat/IC (Chugach Alaska Corp)	No	None
Yalik	100	59.441285N	150.707861W	coastal/low	Tundra/open forest	Boat	Park - Surface Selected (Port Graham)	No	None

On-the-ground site surveys were conducted in 2006 by Meg Hahr (biologist-KEFJ), Mat Gray (biology tech-KEFJ), Amy Wright (biologist-KEFJ) and Bruce Giffen (geologist-AKRO). Site surveys, site photos and maps of each site are located in Appendix B, Figures 52-69.

Lake Clark National Park and Preserve

LACL has a maritime climatic zone along the eastern park boundary, adjacent to Cook Inlet (Pacific Ocean). There is a transition zone between maritime and continental zones in the central portion of the park and a continental climatic zone in the west and northwest portion of the park. Active volcanoes (Iliamna and Redoubt Volcanoes) lie 6.2 to 12.4 km (10 to 20 miles) west of the Cook Inlet coast rise to elevations of over 3,048 m (10,000 feet). The northern reaches of the Aleutian Mountains and the southern reaches of the Alaska Range meet in the central portion of the park. The Alaska and Aleutian Ranges make up the dominating feature of the park – rugged, glaciated mountains. These mountains capture high amounts of precipitation and are the source areas of several hundred-thousand acres of glacier ice occurring within LACL. West of the

mountains, the landscape is less dramatic characterized by a broad, gently rolling glaciated landscape.

Initially 19 potential climate monitoring sites were identified within the park: two coastal sites, 11 mountain sites and six lower elevation site. The coastal sites will characterize the maritime conditions along the Pacific Coast (Cook Inlet). High mountain sites will characterize higher elevation conditions of the northern Aleutian Range. No high elevation sites were identified in the southern Alaska Range due to the intense rugged nature of the area and thus lack of accessible terrain. Also, the Federal Aviation Administration has installed weather sensors (temperature and wind speed/direction) in the southern Alaska Range at two web-cam mountain sites within the park (Merrill Pass and Lake Clark Pass–West). The lower elevation sites in the western portion of the park will fill in a data-gap between currently operating weather stations in the western portion of the park and will characterize lower elevation conditions in the continental climate zones.

Table 4 lists all potential climate monitoring sites considered in LACL and summarizes key points for each. Maps depicted in Figures 70 through 74 (Appendix C) show the location of potential and priority climate monitoring sites and how these sites relate to the existing network of weather stations, wilderness boundaries, ecoregions and temperature and precipitation models.

Table 4. Potential climate monitoring sites – Lake Clark National Park and Preserve.

National Park Service Climate Monitoring
Southwest Alaska Network - Potential Weather Station Sites

Mountain Sites - Lake Clark National Park and Preserve

Site Name	Elevation (ft)	Latitude	Longitude	Site Type	Ground Cover	Access for Maintenance	Land Status	Wilderness	Concurrent Land Uses/Improvement
Gladiator Basin	3000	60.15091N	153.623701W	Mountain/high	Bedrock/tundra	Fixed-wing skis	Park, NPS (fee simple)	Yes	None
Chigmit Mtns	4500	60.223321N	153.466436W	Mountain/high	Numutak/bedrock	Fixed-wing on skis	Park, NPS (fee simple)	Yes	None
Crescent West	3500	60.355593N	153.180136W	Mountain/high	Bedrock/tundra	Fixed-wing skis	Park, NPS (fee simple)	Yes	None
Redoubt	4600	60.49843N	152.847952 W	Mountain/high	Numutak/bedrock	Fixed-wing skis	Park - Selected (Cook Inlet Region)	Yes	None
North Fork Crescent River	4000	60.514223N	152.908669 W	Mountain/high	Bedrock/tundra	Fixed-wing skis	Park, NPS (fee simple)	Yes	None
Drift River - South	4900	60.543643N	153.011637 W	Mountain/high	Numutak/bedrock	Helicopter	Park, NPS (fee simple)	Yes	None
Chigmit Mtns North	4400	60.641982N	152.991716W	Mountain/high	Numutak/bedrock	Fixed-wing on skis	Park, NPS (fee simple)	Yes	None
Double Glacier North	3500	60.710083N	152.696139 W	Mountain/high	Numutak/bedrock	Helicopter	Park, NPS (fee simple)	Yes	None
Double Glacier South	5000	60.628083N	152.777232 W	Mountain/high	Numutak/bedrock	Helicopter	Park, NPS (fee simple)	Yes	None
Harriet Creek	4500	60.484061N	152.56714 W	Mountain/high	Numutak/bedrock	Helicopter	Park - Selected (Cook Inlet Region)	Yes	None
Reboudt East	4500	60.50376N	152.676237 W	Mountain/high	Numutak/bedrock	Helicopter	Park - Selected (Cook Inlet Region)	Yes	None

Coastal Sites - Lake Clark National Park and Preserve

Site Name	Elevation (ft)	Latitude	Longitude	Site Type	Ground Cover	Access for Maintenance	Land Status	Wilderness	Concurrent Land Uses/Improvement
Saddle Mtn	1300	59.98N	152.76W	coastal/mod	Low shrub/alder	Helicopter	Park - Selected (Cook Inlet Region)	No	None
Hickerson Lake	1000	59.914785N	152.892598W	coastal/mod	Low shrub/alder	Fixed-wing on floats	Park - Selected (Cook Inlet Region)	No	None

Interior Sites - Lake Clark National Park and Preserve

Site Name	Elevation (ft)	Latitude	Longitude	Site Type	Ground Cover	Access for Maintenance	Land Status	Wilderness	Concurrent Land Uses/Improvement
Trail Creek	3400	60.892927N	153.84059W	Inland/high	Tundra	Fixed-wing wheels	Preserve, NPS (fee simple)	No	None
Square Lake	2800	60.754809N	154.214713W	Inland/mod	Tundra	Fixed-wing floats	Preserve, NPS (fee simple)	No	None
Snipe Lake	2300	60.61024N	154.319868W	Inland/mod	Tundra	Fixed-wing on floats	Preserve, NPS (fee simple)	No	None
Portage Lake	1500	60.509265N	153.881066W	Inland/mod	Low shrub/alder	Fixed-wing floats	Park, NPS (fee simple)	Yes	None
Lachbuna Lake	2000	60.483526N	154.055304W	Inland/mod	Low shrub/alder	Fixed-wing floats	Preserve, NPS (fee simple)	Yes	None
Fish Trap Lake	1700	60.486051N	154.362305W	Inland/mod	Low shrub/alder	Fixed-wing floats	Preserve, NPS (fee simple)	No	None

On-the-ground site surveys were conducted in 2007 by Page Spencer (biologist-LACL), Chuck Lindsay (Physical Science Tech-SWAN), Leon Alsworth (pilot-LACL) and Bruce Giffen (geologist-AKRO). Site surveys, site photos and maps of each site are located in Appendix C, Figures 75-113.

CLIMATE MONITORING SITE REVIEW AND PRIORITY RANKING PROCESS

The NPS-SWAN invited Alaskan weather and climate professionals to review and prioritize the potential weather station deployment sites in support of the climate monitoring effort. This review was conducted in a couple of phases. Initially, in preparation for face-to-face meetings, information characterizing each potential site was disseminated to the panel of experts to give these folks the opportunity to become familiar with the sites. A meeting was then held to discuss the pros and cons of each site amongst the group. The potential climate monitoring sites were priority ranked by the experts with the SWAN climate monitoring objectives used for guidance.

It is worth noting that a simple but common point of agreement between panel members was ease of site access. A dataset with longevity is valuable. If a site is difficult and

expensive to access, the potential for maintaining such a site for decades into the future is not realistic.

In addition to descriptions, maps and photographs of each site, data used in the site ranking process included ecoregion maps, temperature and precipitation models, topography, land status, and maps showing existing weather stations in the SWAN region. All this information is located throughout this report and appendices. Table 5 and Figure 7 identifies the top ranked sites in KATM, KEFJ and LACL.

Table 5. Priority ranked climate monitoring sites, Southwest Alaska Inventory and Monitoring Network.

National Park Service Priority-Ranked Climate Monitoring Sites
Southwest Alaska Network

Katmai National Park and Preserve - Interior Sites Site	Elevation (ft)	Latitude	Longitude	Site Type	Land Status	Wilderness
Coville	1,500	58.802572N	155.562799W	Inland/mod elevation	Park	Yes
Phaff Mine	1,900	59.11027199N	154.83991787W	Inland/mod elevation	Preserve	No
Contact Creek	670	58.20937288N	155.92106419W	Inland/low elevation	Park	Yes
Dumpling Mtn	2,400	58.581663N	155.859888W	Inland/mod elevation	Park	Yes
Katmai National Park and Preserve - Coastal Sites						
Site	**Elevation (ft)**	**Latitude**	**Longitude**	**Site Type**	**Land Status**	**Wilderness**
Cape Gull	1,300	58.204392N	154.200093W	coastal/mod elevation	Park	Yes
Dark South	500 - 1000	58.691444N	153.504050W	coastal/low elevation	Park	Yes
Kenai Fjords National Park						
Site	**Elevation (ft)**	**Latitude**	**Longitude**	**Site Type**	**Land Status**	**Wilderness**
McArthur Pass	1,300	59.472653N	150.333587W	coastal/mod elevation	Subsurface – Patent/IC, Chugach Alaska Corp (Native); Surface – Acquired Federal (English Bay Corp)	No
Dinglstadt Glacier	400	59.646352N	150.323406W	coastal/low elevation	Federal, NPS (fee simple)	No
Fire Cove	900	59.661548N	149.756831W	coastal/low	Federal, NPS (fee simple)	No
Lake Clark National Park and Preserve						
Site	**Elevation (ft)**	**Latitude**	**Longitude**	**Site Type**	**Land Status**	**Wilderness**
Chigmit Mtns	4,500	60.223321N	153.466436W	Mountain/high	Park	Yes
Chigmit Mtns North	4,400	60.641982N	152.991716W	Mountain/high	Park	Yes
Hickerson Lake	1,000	59.914785N	152.892598W	coastal/mod	Park	No
Snipe Lake	2,300	60.61024N	154.319868W	Inland/mod	Preserve	No

Sites that didn't rank high in the ranking process were in areas that did not have good regional exposure as compared to other sites, thus weather observations would likely be influenced by local topographic conditions. Other sites may have proved too challenging to maintain due to available access. A site in KATM was removed from consideration due to high bear activity (Swikshak in KATM). One site, located in KEFJ (Yalik), is located on native-selected lands, so surface ownership/management of this land into the future is unsure.

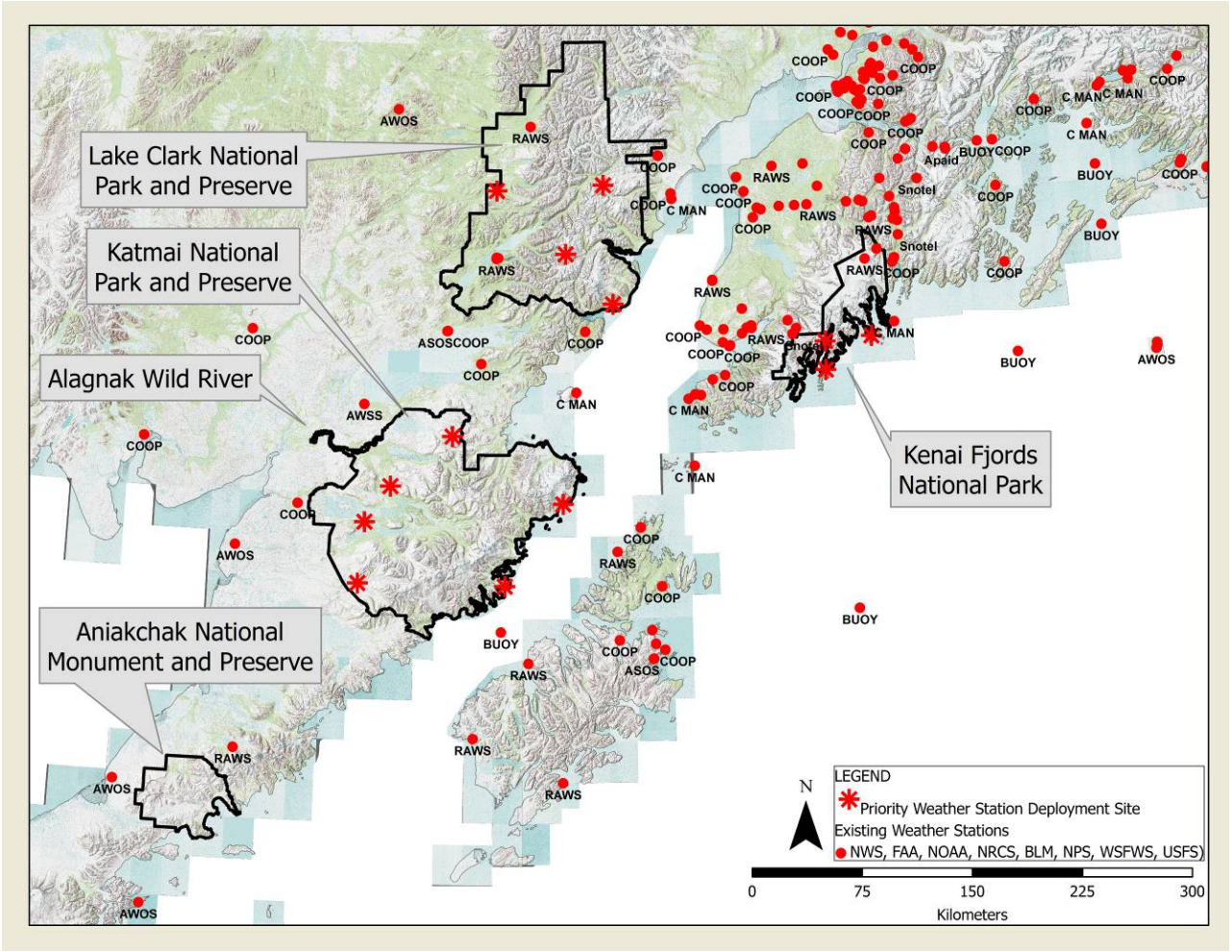

Figure 7. Location of priority weather station/climate monitoring sites, Southwest Alaska Inventory and Monitoring Network.

Looking northwest across Mt. Katmai towards the Valley of 10,000 Smokes

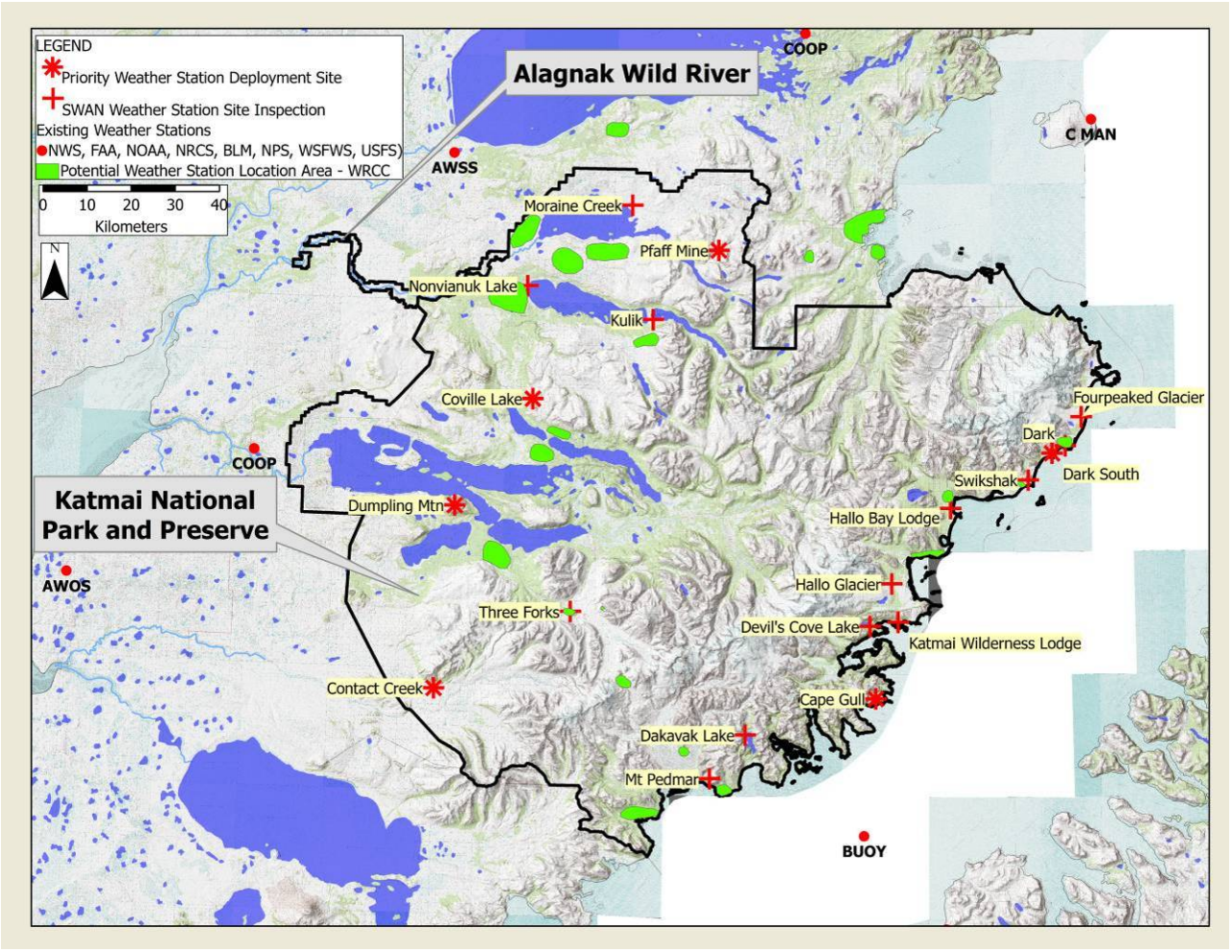

Figure 8. Katmai National Park and Preserve with potential and priority weather station sites.

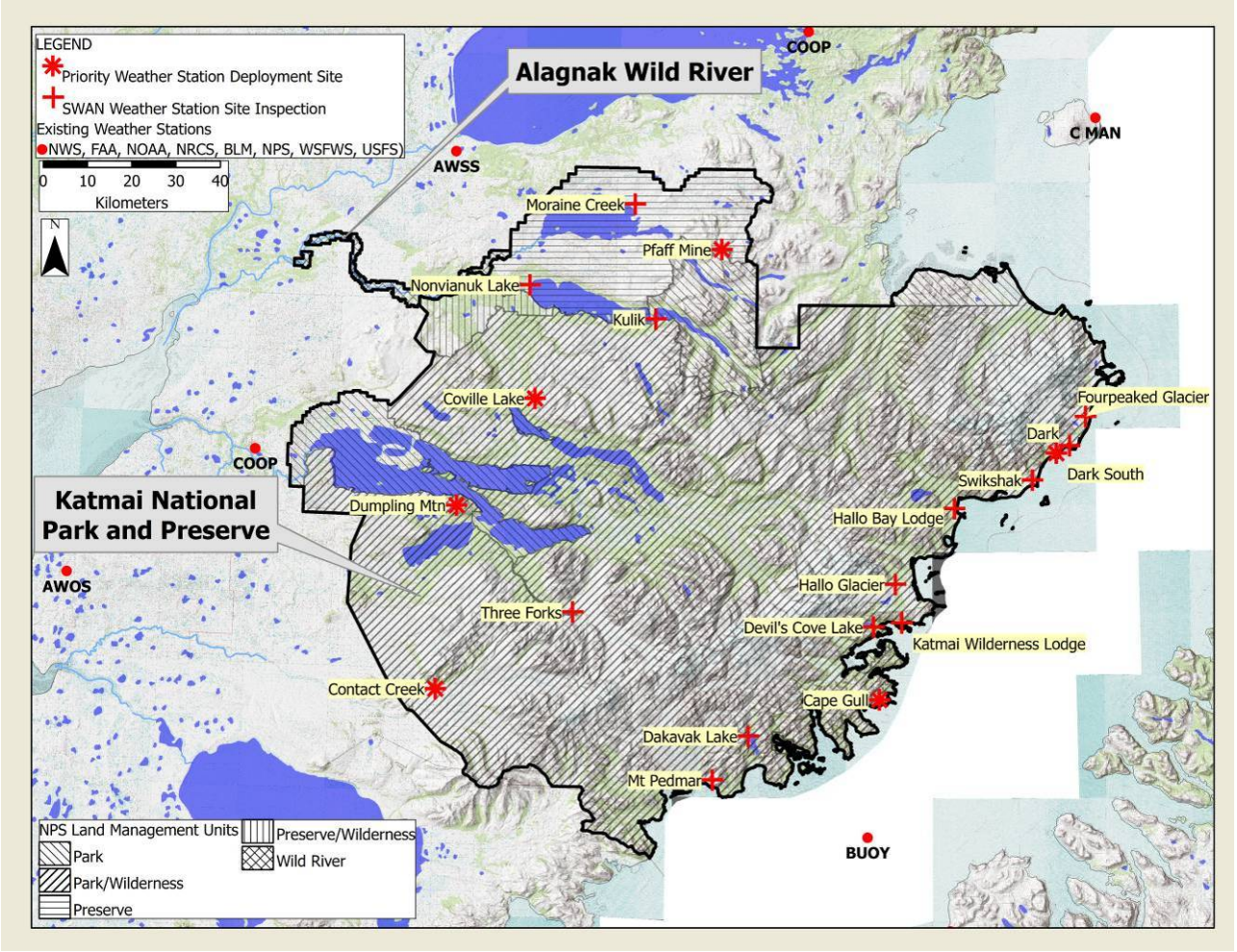

Figure 9. Land Management Units of Katmai National Park and Preserve with potential and priority weather station sites.

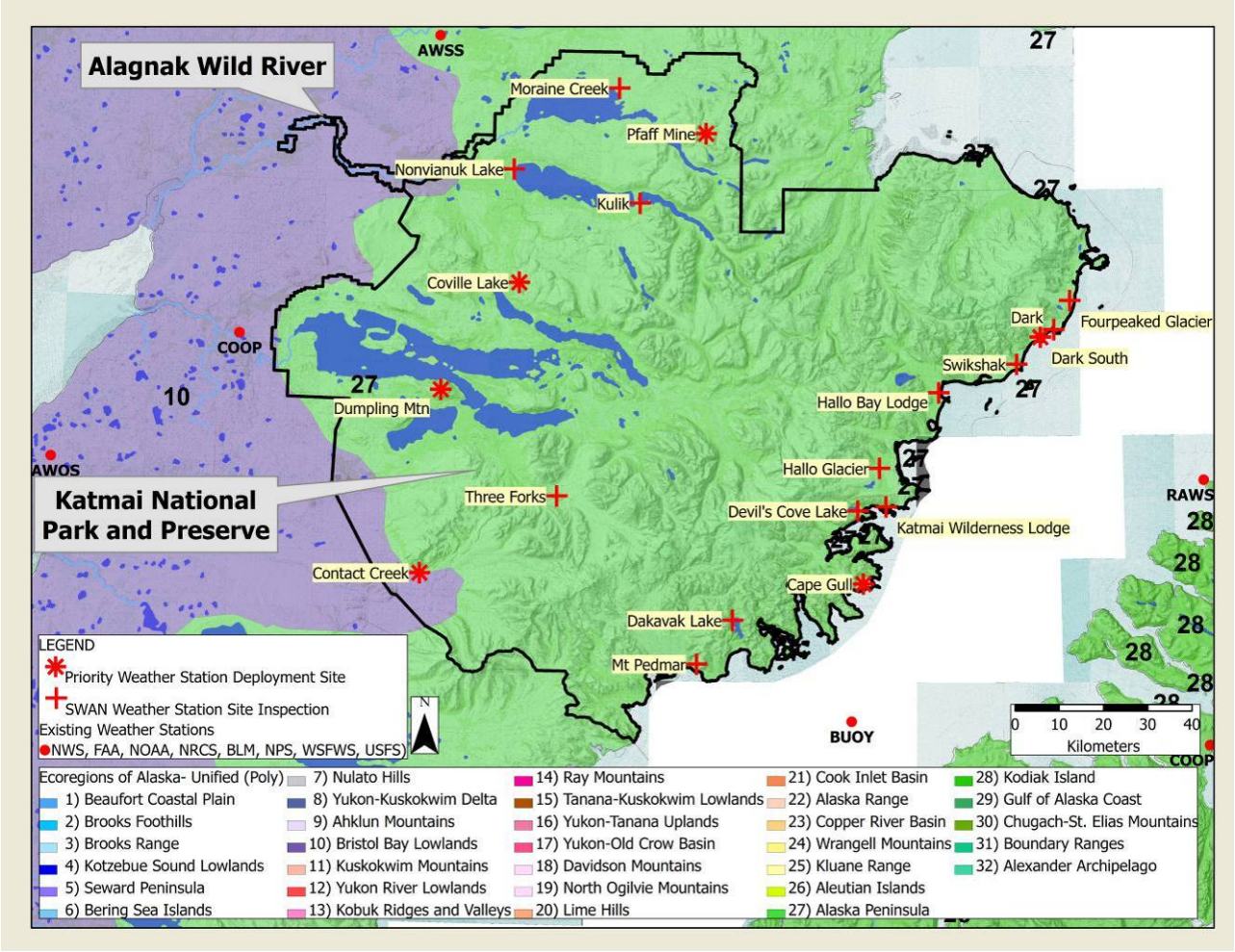

Figure 10. Ecoregions of Katmai National Park and Preserve with potential and priority weather station sites.

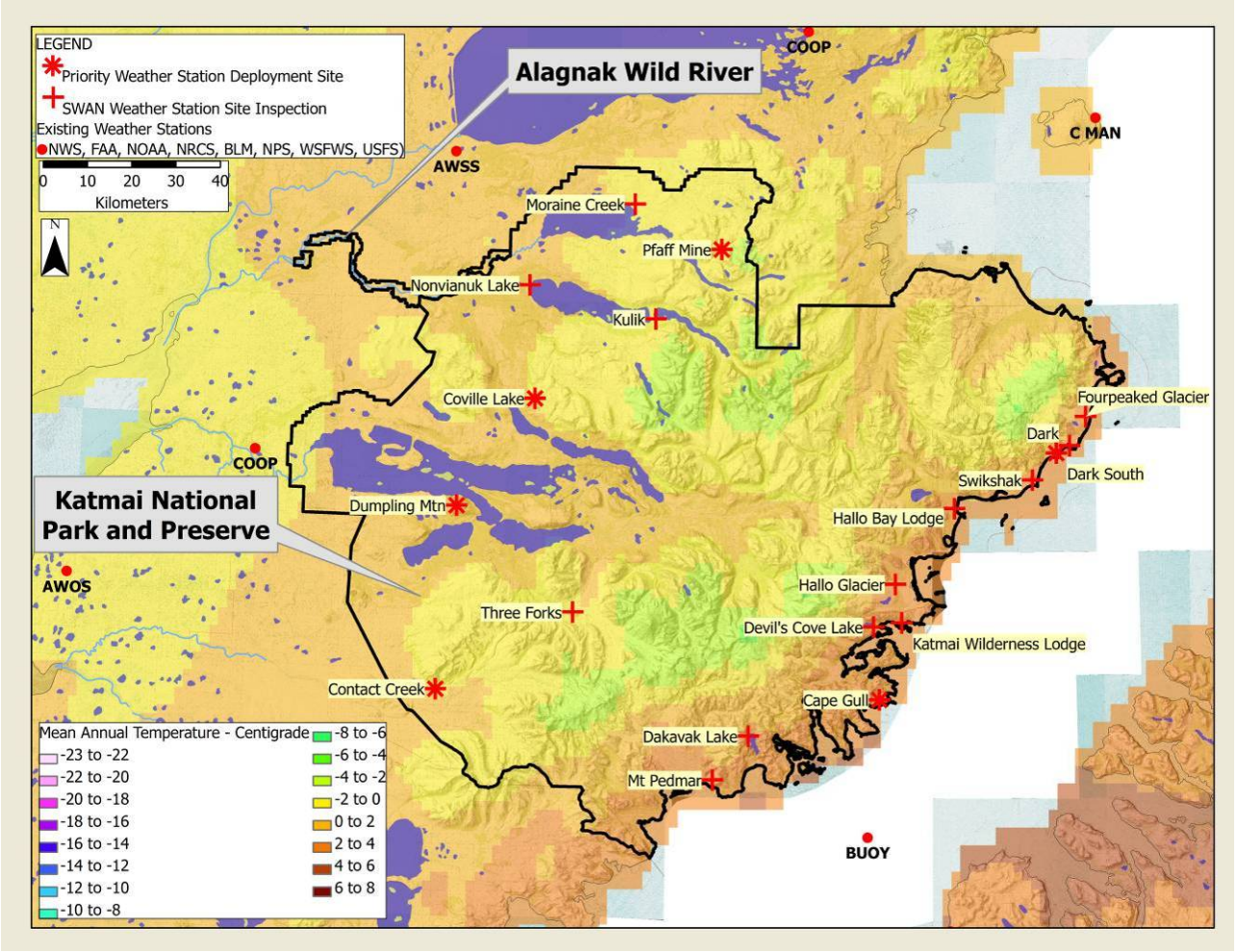

Figure 11. PRISM Temperature Model of Katmai National Park and Preserve with potential and priority weather station sites.

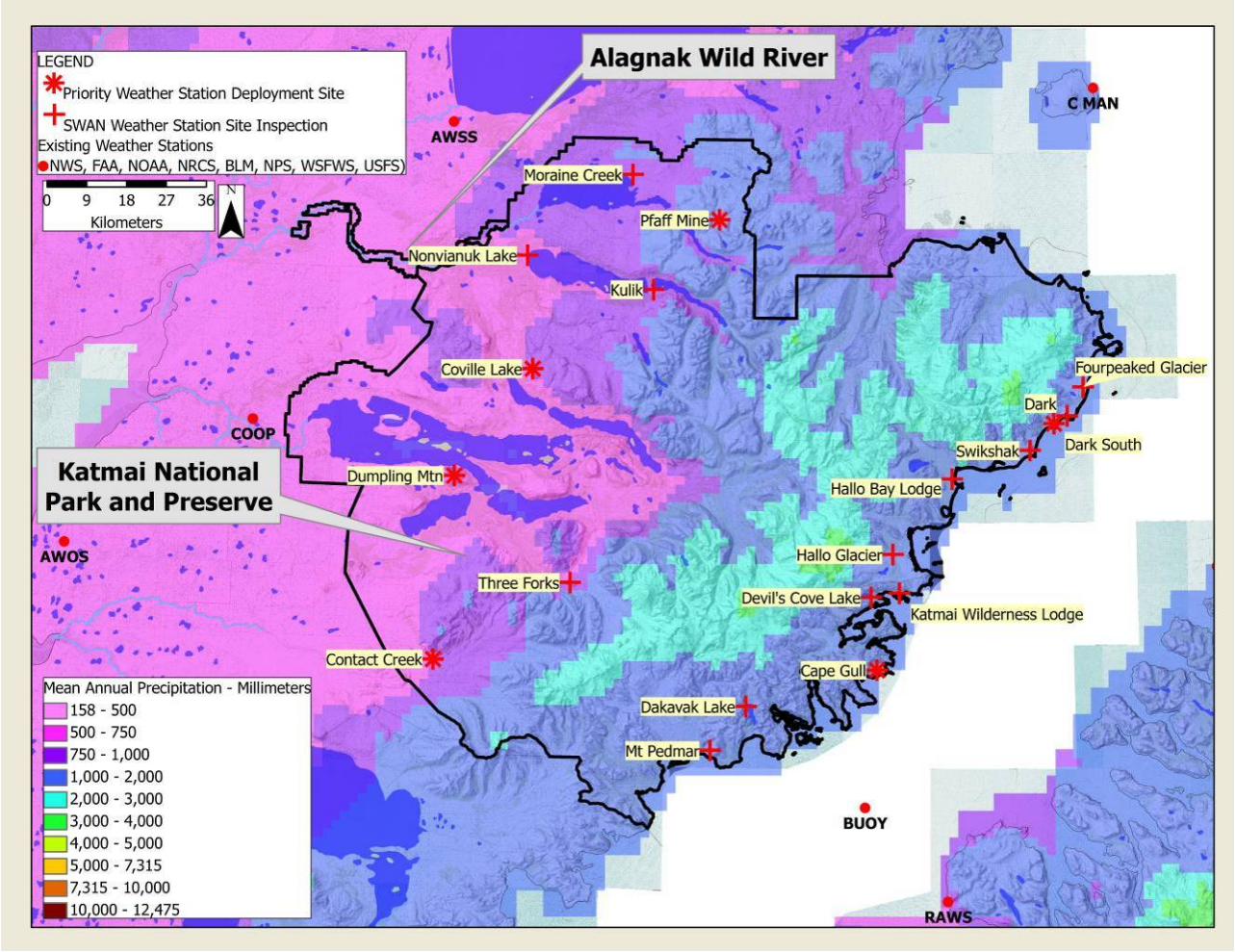

Figure 12. PRISM Precipitation Model of Katmai National Park and Preserve with potential and priority weather station sites.

KATMAI NATIONAL PARK AND PRESERVE

SITE NAME: Moraine Creek

LOCATION: 59.20068246N; 155.18281155W

Elevation: 840 ft
Slope: 1%
Aspect: SW

Description:
Terrain is gently rolling in the area, sloping to the southwest. Unobscured horizon.

Site has very good regional exposure for 365 degrees. No significant topographic feature nearby that will locally effect weather observations. Very large (43,000 acre +) lake to the southwest and west within ½ mile of this site.

Vegetation/Cover Conditions:
Low tundra ground cover. Crowberry, blueberry, willow, dwarf birch and bearberry lichen, grass. Rare isolated spruce.

Surface Water:
Dry. A small stream is <1/4 mile to the north. Moraine Creek is ½ mile to the south. Kukaklek Lake is ½ mile to the southwest. Kukaklek Lake is a very large lake covering 43,000 acres.

Obstructions:
None

Satellite antenna transmission:
Clear horizon for satellite transmission
Access:
Fixed-wing or helicopter
Unimproved landing strip
Sand blow.

Land Status
Katmai National Preserve - not wilderness

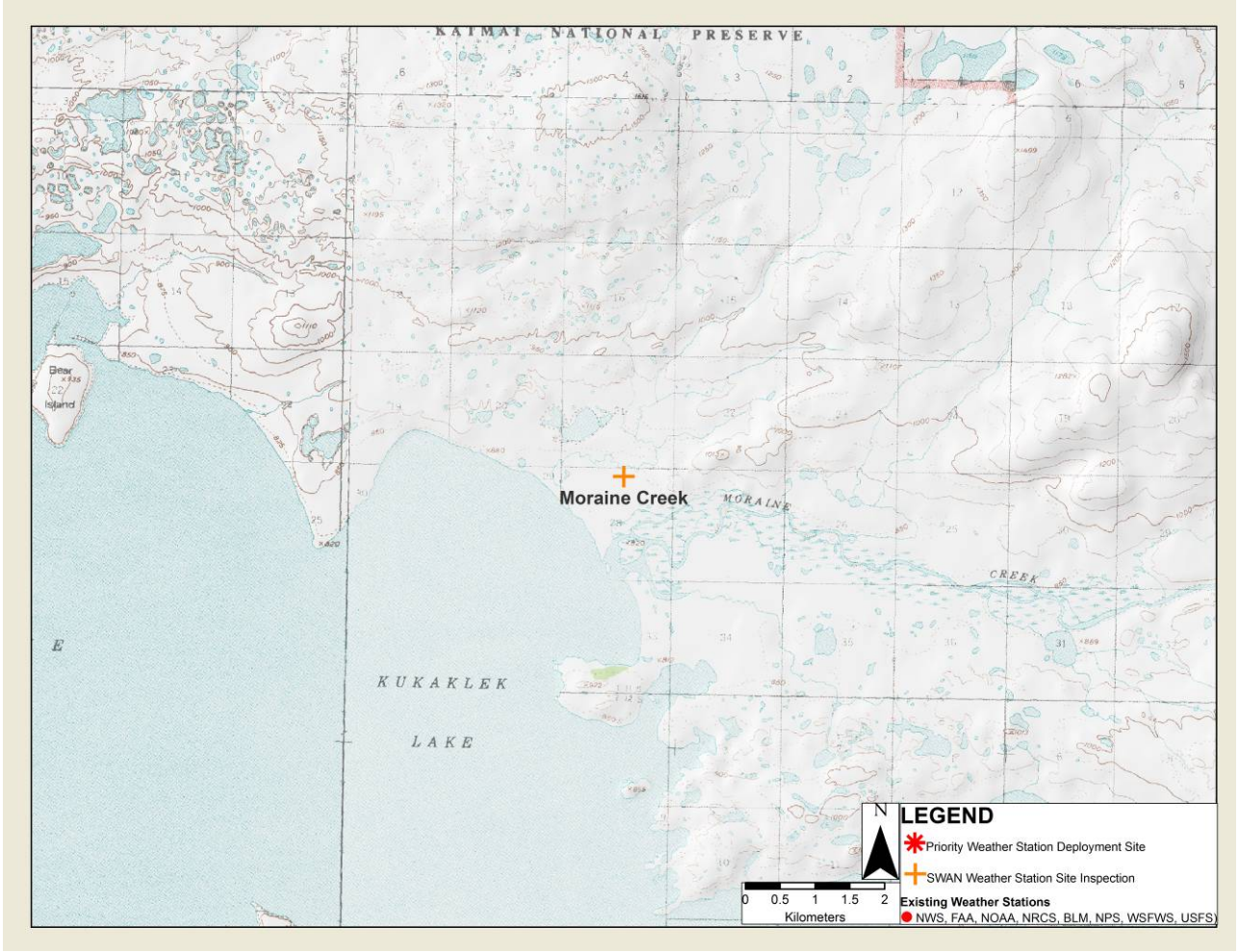

Figure 13. Detailed location of the Moraine Creek site, Katmai National Park and Preserve.

Figure 14. Aerial view of the Moraine Creek site looking west, Katmai National Park and Preserve.

KATMAI NATIONAL PARK AND PRESERVE

SITE NAME: Pfaff Mine

LOCATION: 59.11027199N; 154.83991787W

Elevation: 1,900 ft
Slope: None, gently rounded hilltop
Aspect:

Description:
Site is located in a mountainous location being surrounded by mountains exceeding 3,200 feet elevation within two miles of the site. The site is on a tundra covered bench (approx 160 acres) located on the northwest side of a mountain side rising to an elevation of 3,400 within 2 miles. The site is located within a valley oriented in a northeast-southwest direction. The narrow "V" shape valley floor adjacent to the site is 300 vertical feet below the site.

Vegetation/Cover Conditions:
Low tundra ground cover. Crowberry, lichen, grass.

Occasional willow and alder bush (1 meter height) along sides of airstrip associated with disturbed ground.

Surface Water:
Dry.

Obstructions:
None

Satellite antenna transmission:
Horizon: S30E = 14 degrees.
Access:
Fixed-wing on wheels (Cessna 185, Dehavilland Beaver and/or Otter)
Good gravel airstrip. No maintenance

Land Status
Katmai National Preserve - not wilderness

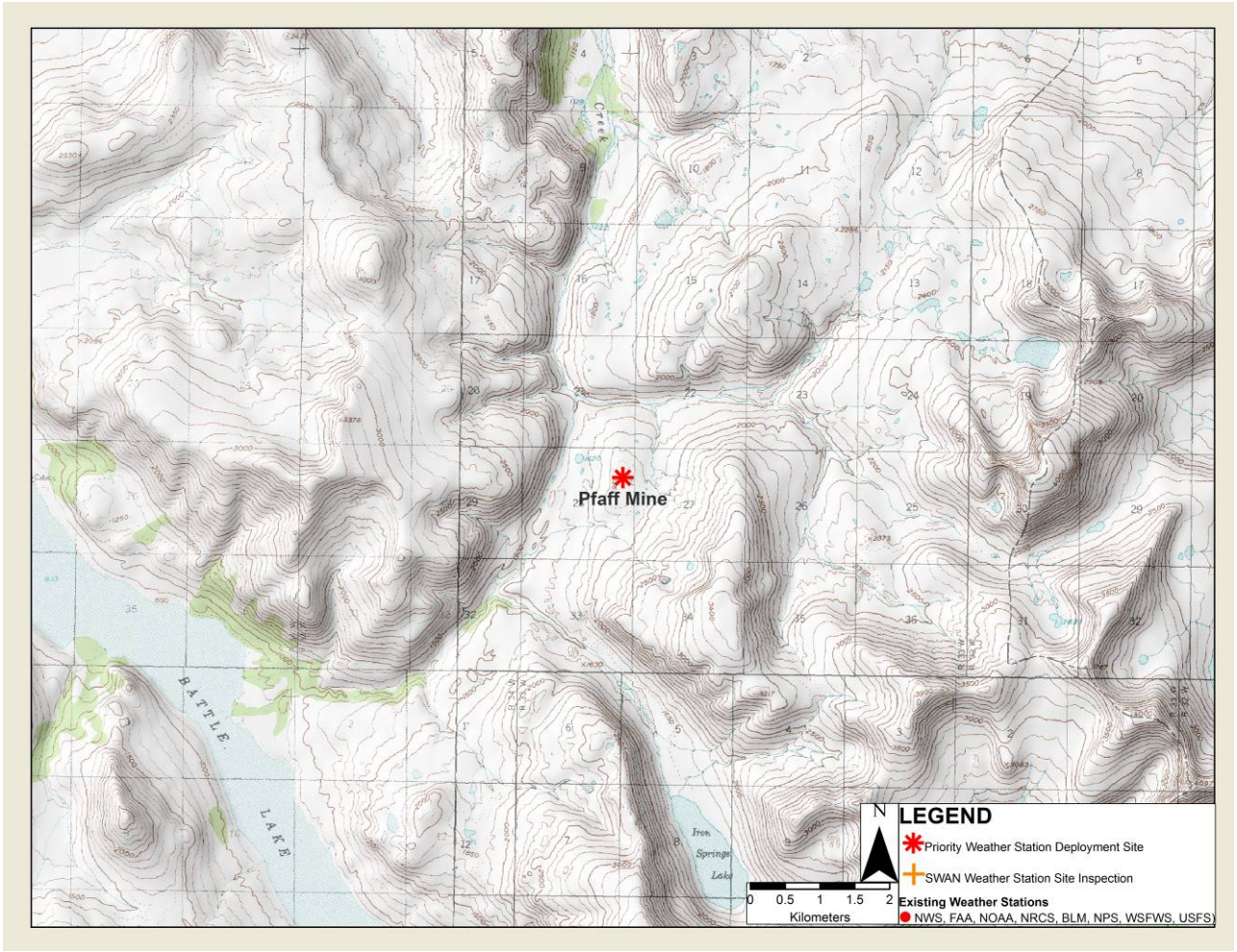

Figure 15. Detailed location of the Pfaff Mine site, Katmai National Park and Preserve.

Figure 16. Aerial view of the Pfaff Mine site looking northeast, Katmai National Park and Preserve.

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KATMAI NATIONAL PARK AND PRESERVE

SITE NAME: Kulik

LOCATION: 58.96794585N; 155.09317221W

Elevation: 700 ft
Slope: flat
Aspect: --

Description:
Site is located on a vegetated glacial moraine that separates Kulik Lake (to the east) and Nonvianuk Lake (to the west), both large lakes (6,800 and 32,700 acres, respectively). This moraine spans the width of the valley (approx 2.5 miles wide here) and is of subdued, undulating topography.

The site is within the confines of the large valley, which narrows east of the site and broadens west of the site. The valley floor is 2.5 miles wide at the site with valley walls topping out on ridge lines and mountain tops well in excess of 2,500 feet. Extensive mountain range (elevations up to 4,600 ft elevation) located to the east. Broad undulating ground and rounded hills occur to the west.

Vegetation/Cover Conditions:
Low tundra ground cover. Crowberry, blueberry, willow (<1 meter) and dwarf birch (<.5 meter), lichen, grass, Mountain Aven (in blossom), tundra, scattered spruce to 10 to 15 feet in height.

Surface Water:
Dry at the site.

Obstructions:
Spruce trees to 20 feet in height 300 feet away, typically isolated individuals and dispersed clusters of a few trees.

Satellite antenna transmission:
Horizon: SE < 13 to 14 degrees.

Access:
Fixed-wing on wheels. Single and multi-engine of all sizes.

Excellent gravel airstrip, well maintained. Western portion of the airstrip maybe located on private property owned by KatmaiLand Inc.

Land Status
Katmai National Park - not wilderness

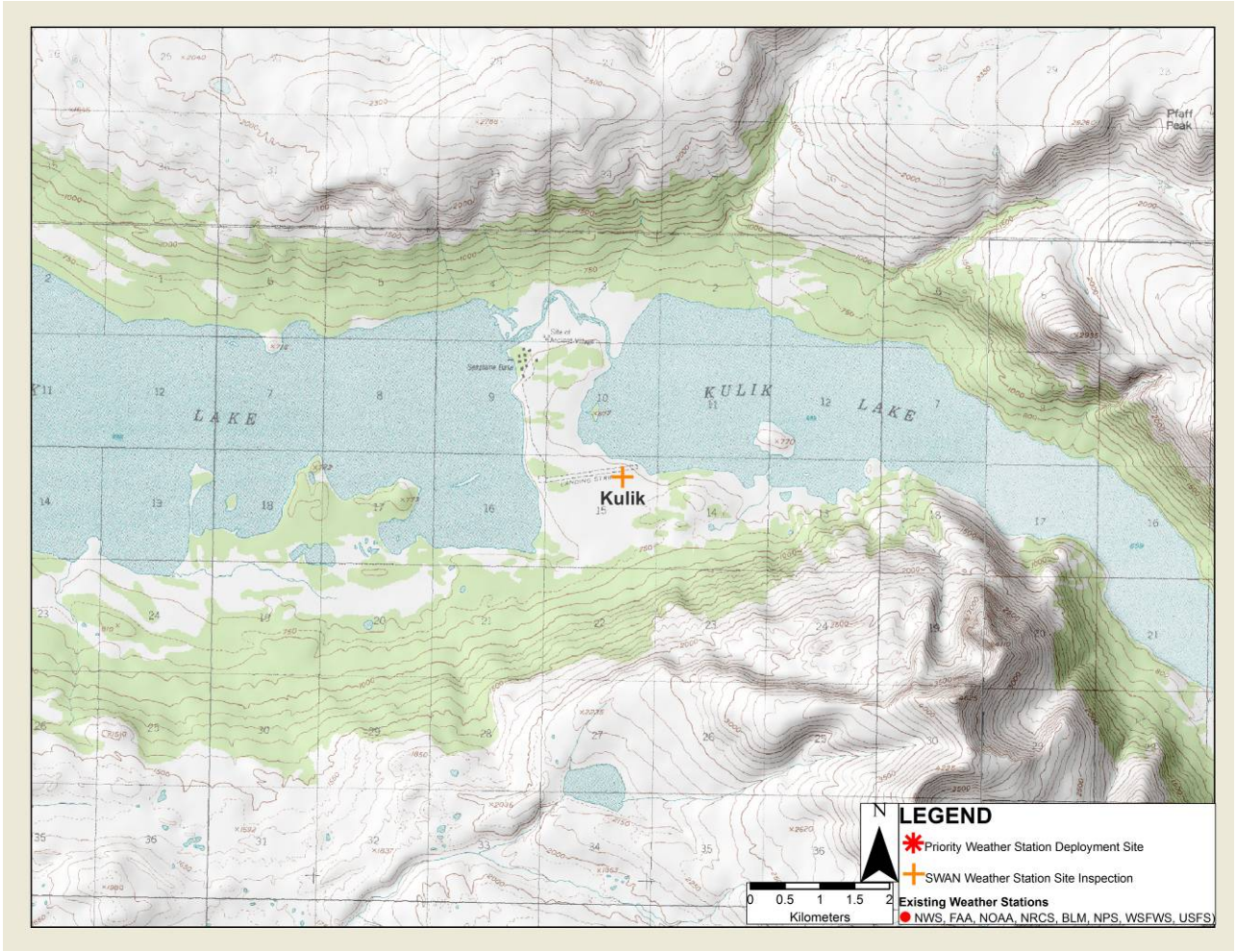


Figure 17. Detailed location of the Kulik site, Katmai National Park and Preserve.

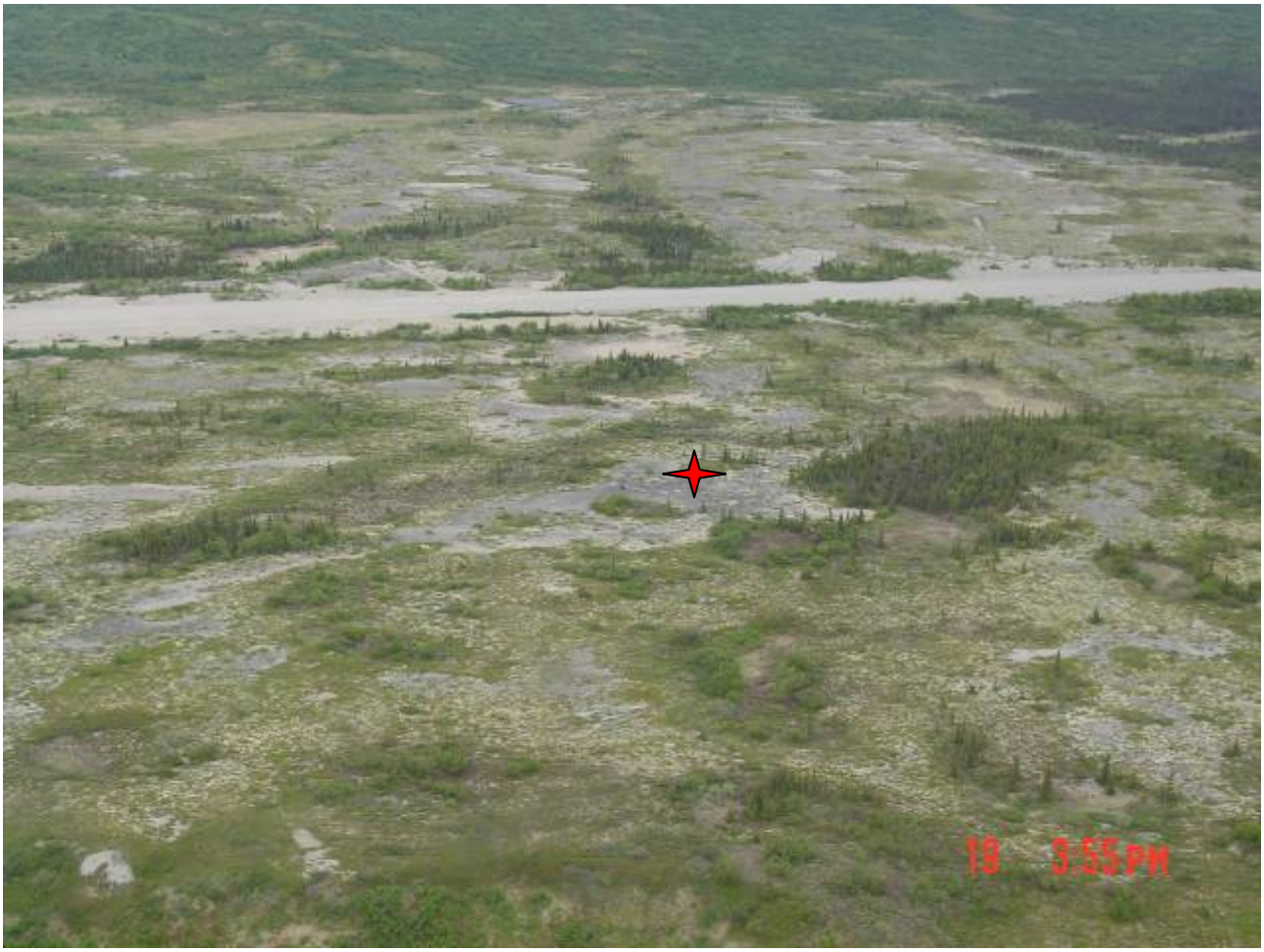


Figure 18. Aerial view of the Kulik site looking south, Katmai National Park and Preserve.

KATMAI NATIONAL PARK AND PRESERVE

SITE NAME: Coville

LOCATION: 58.802572N; 155.562799W

Elevation: 1,500
Slope: flat
Aspect: --

Description:
The site is located 3 miles northeast of Coville Lake in rolling foot hills. Mountains rise to the east. Broad gently rolling terrain lies to the west.

Site has very good regional exposure.

Vegetation/Cover Conditions:
Low tundra ground cover. Crow berry, blueberry, bear berry, willow and dwarf birch, lichen, grass. Alder occurs off on the sides of the hills. Occasional stunted spruce.

Surface Water:
Dry. Coville Lake is 3 miles to the south west.

Obstructions:
None

Satellite antenna transmission:
Clear.

Access:
Fixed-wing on floats. A one mile hike to the site.
Cessna 206 or Single Otter or Beaver

Land Status
Katmai National Park - wilderness

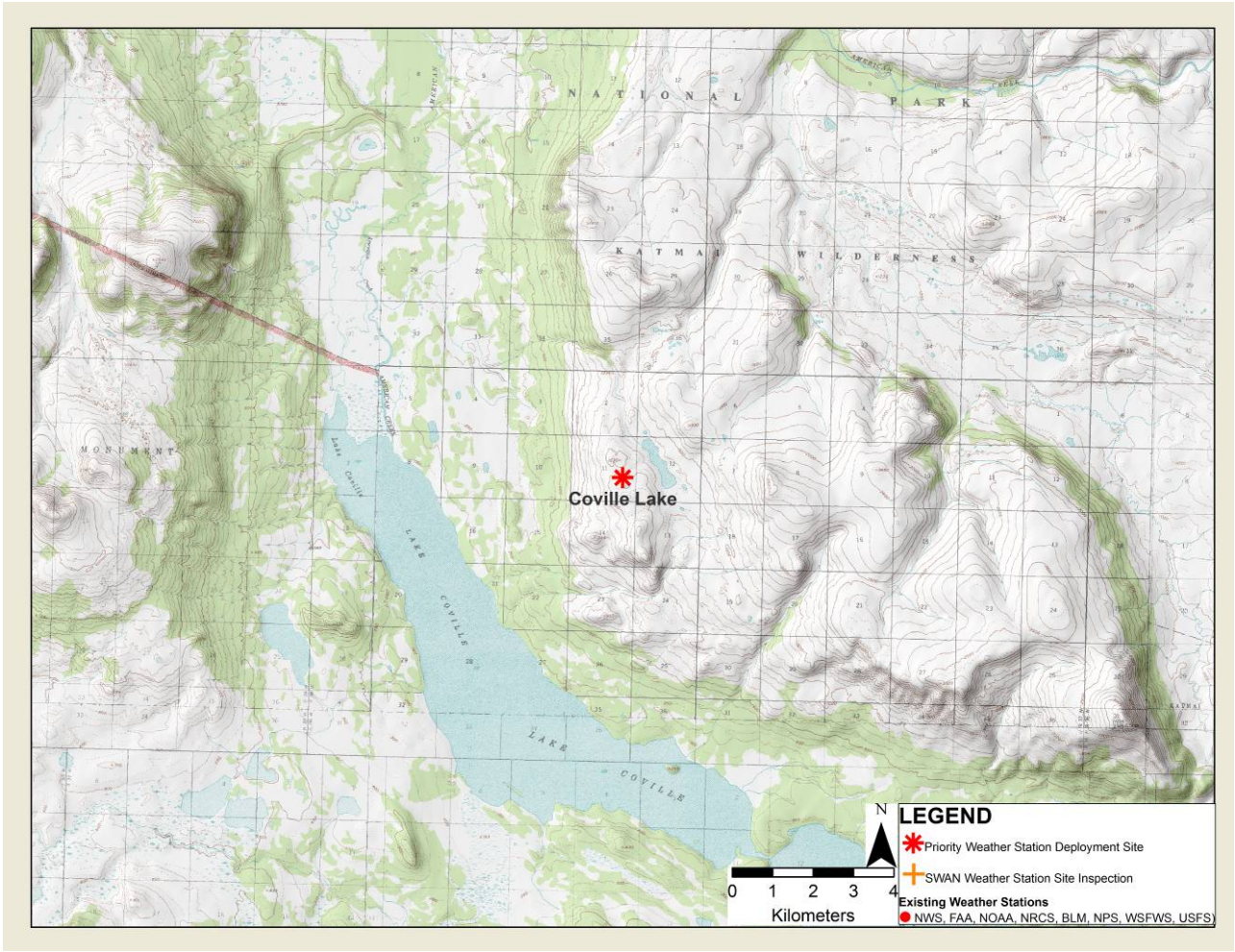


Figure 19. Detailed location of the Coville site, Katmai National Park and Preserve.

Figure 20. Aerial view of the Coville site looking southwest Katmai National Park and Preserve.

KATMAI NATIONAL PARK AND PRESERVE

SITE NAME: Dumpling

LOCATION: 58.581663N: 155.859888W

Elevation: 2,400 ft
Slope: Flat
Aspect: --

Description:
Site is located on the broad rounded top of Dumpling Mountain. Dumpling Mountain is an isolated mountain rising over 2000 feet above the surrounding terrain and is located at least 20 miles from the large mountain east of the site. This site has excellent exposure to all directions.

Vegetation/Cover Conditions:
Low tundra ground cover. Crowberry, blue berry, lichen, grass, occasional willow.

Surface Water:
Dry.

Obstructions:
None

Satellite antenna transmission:
Clear

Access:
Fixed-wing to Brooks Camp and then a several mile hike to the top of Dumpling Mountain or helicopter.

There is a potential partnership opportunity with NPS radio shop to conduct annual maintenance.

Land Status
Katmai National Park - wilderness

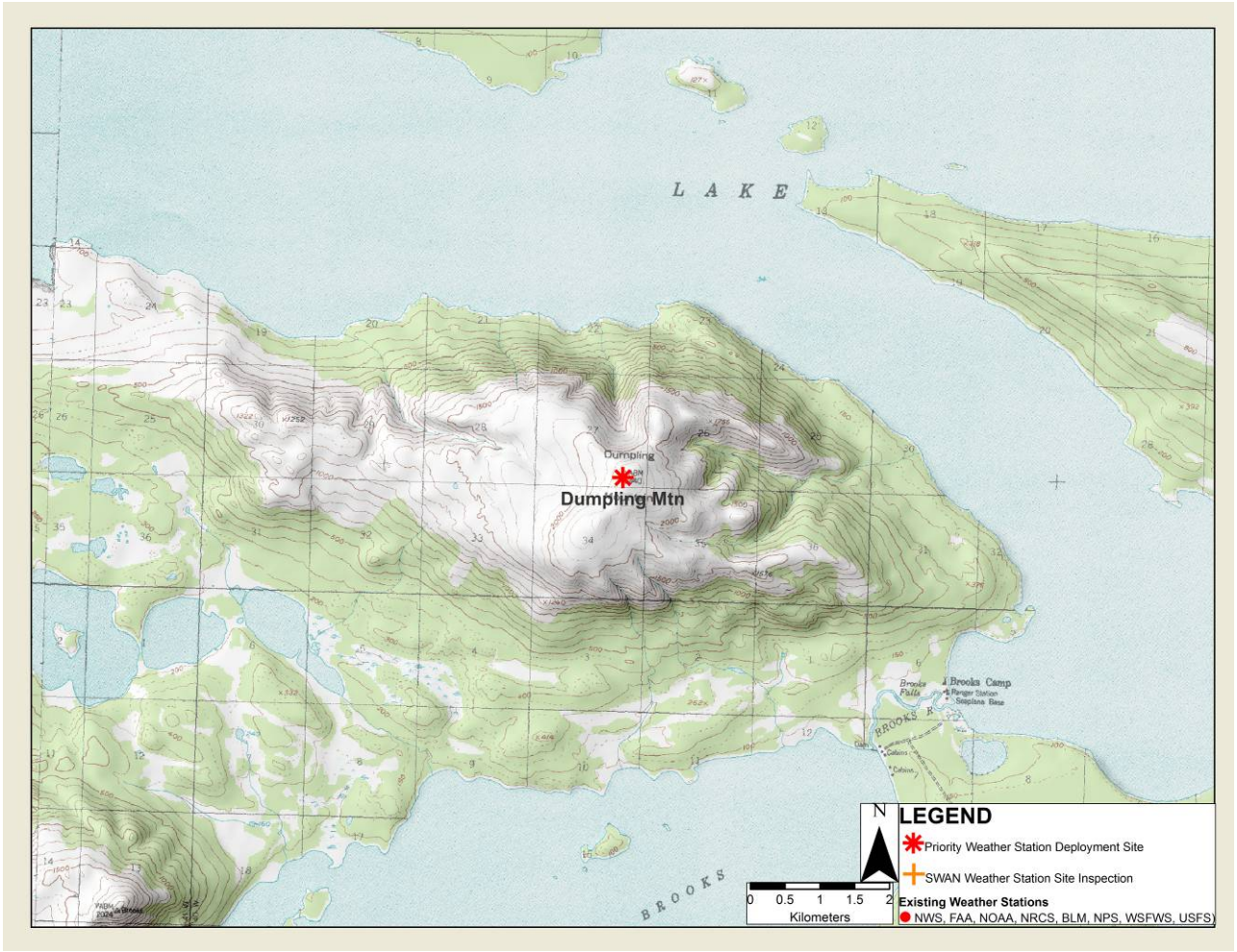


Figure 21. Detailed location of the Dumpling Mtn site, Katmai National Park and Preserve.

Figure 22. Aerial view of the Dumpling site looking north, Katmai National Park and Preserve.

KATMAI NATIONAL PARK AND PRESERVE

SITE NAME: Three Forks

LOCATION: 58.370499N 155.397862W

Elevation: 1,300 ft
Slope: None, gently rounded hilltop
Aspect: --

Description:
Site is located on a rounded and elongate hill within the broad Valley of Ten Thousand Smokes. Being in a valley, the site is surrounded by high mountains.

Vegetation/Cover Conditions:

Low tundra ground cover and low brush. Crowberry, blue berry, Lupine, Labrador tea, willow up to 4 feet in height, lichen, grass, occasional spruce.

Surface Water:
Dry.

Obstructions:
None

Satellite antenna transmission:
Clear

Access:
Fixed-wing access to Brooks Camp. Vehicle travel to the site from Brooks Camp. Easy .6 mile walk to the site. Vegetation is generally light with some brush.

Land Status
Katmai National Park - wilderness

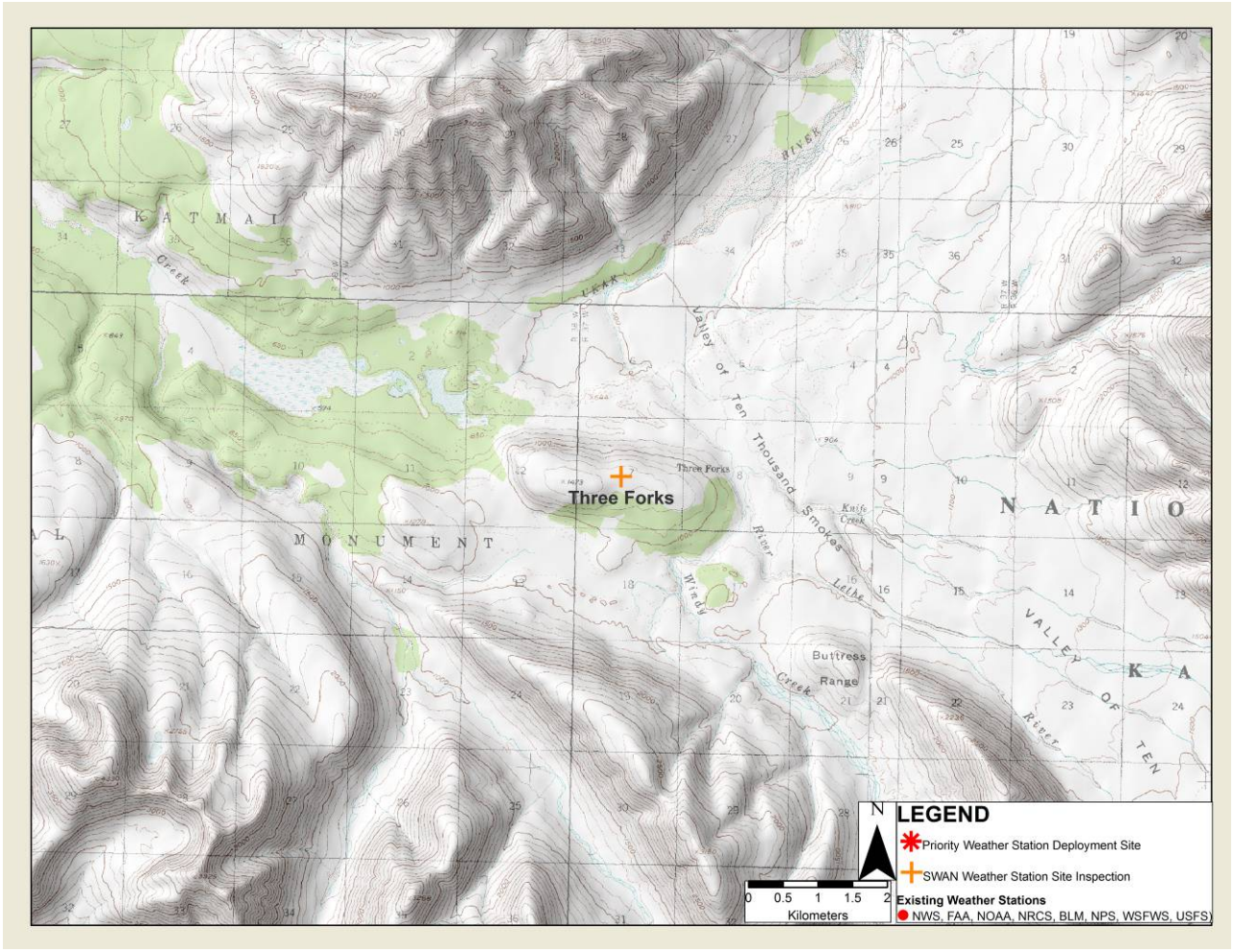


Figure 23. Detailed location of the Three Forks site, Katmai National Park and Preserve.

Figure 24. Aerial view of the Three Forks site looking northwest, Katmai National Park and Preserve.

KATMAI NATIONAL PARK AND PRESERVE

SITE NAME: Contact Creek

LOCATION: 58.20937288N; 155.92106419W

Elevation: 670 ft
Slope: 1%
Aspect: SW

Description:
A broad plain which gently slopes to the SW at approx 1%. The horizon is unobscured from the NE through to the S and through to the NW.

Site has very good regional exposure for 270 degrees from the NE through to the NW. Mountains rising to 2,600 ft occur one to two miles north of the site.

Vegetation/Cover Conditions:
Low tundra ground cover. Crow berry, blueberry, willow and dwarf birch, lichen, grass.

Surface Water:
Dry.

Obstructions:
None

Satellite antenna transmission:
Clear. SE to SW horizon is < 5 degrees.

Access:
Fixed-wing or helicopter. Cessna 185 or Single Otter or Beaver
Unimproved landing strip.

Land Status
Katmai National Park - wilderness

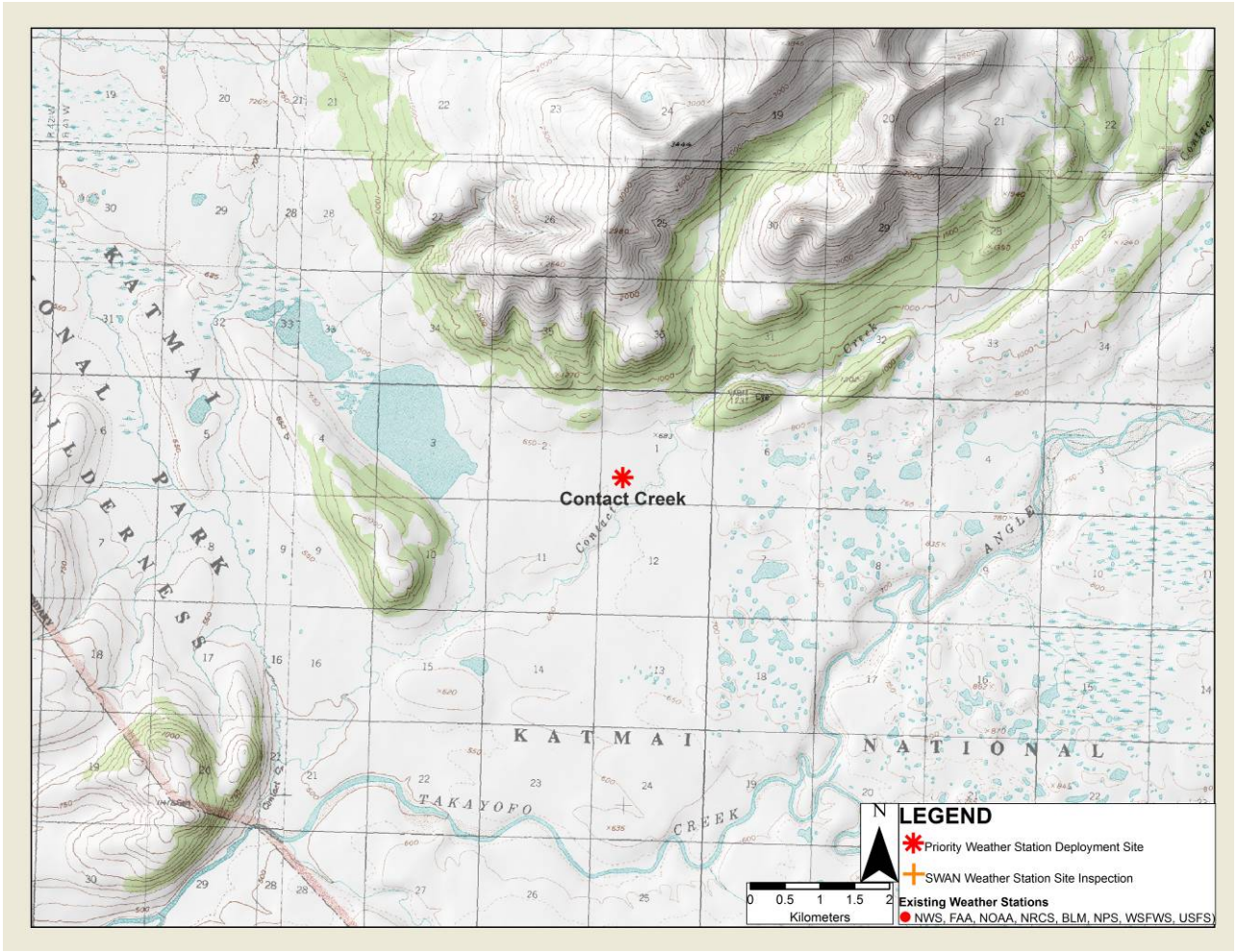


Figure 25. Detailed location of the Contact Creek site, Katmai National Park and Preserve.

Figure 26. Aerial view of the Contact Creek site looking south, Katmai National Park and Preserve.

KATMAI NATIONAL PARK AND PRESERVE

SITE NAME: Fourpeaked Glacier Area

LOCATION: 58.773410N; 153.399960W
Elevation: 100 ft
Slope: rounded hills
Aspect: east

Description:
The site is located along around proglacial lake area of Fourpeaked Glacier. The terrain surrounding the lake is gently sloping and rounded. That which isn't heavily vegetated with alder is barren bedrock.

High mountains to the west greater than 4000 feet high and within a few miles of the site. Site is located at the base of the Fourpeaked Glacier. Weather observations would certainly be effected by the proximity of the glacier and topographically directed valley winds. Site has excellent exposure to the east and south.

Vegetation/Cover Conditions:
Heavily vegetated in thick alder interspersed barren rounded bedrock hill tops. Though a ground inspection wasn't conducted, alder is likely to be 6 to ten feet high.

Surface Water:
Dry. However the ocean is within 1 mile of the potential site and the proglacial lake would not be more than ¼ mile away.

Distance to Ocean:
1,040 meters (.646 miles) east to the ocean.

Obstructions:
Obstructions would be of the alder type. Alder could be 6 to ten feet high within 100 feet of any potential station.

High mountains to the west rising to more than 4000 feet a few miles from the site.

Satellite antenna transmission:
Clear

Access:
Fixed-wing floats (Cessna 185, 206 Dehavilland Beaver and/or Otter) on the proglacial lake. This may be unrealistic because of floating ice in the proglacial lake.

Beach or ocean landing would not be reasonable due to the thick alder vegetation that would need to be traversed from the landing site to any weather station. Helicopter access is probably the only realistic access method.

Land Status
Katmai National Park - wilderness

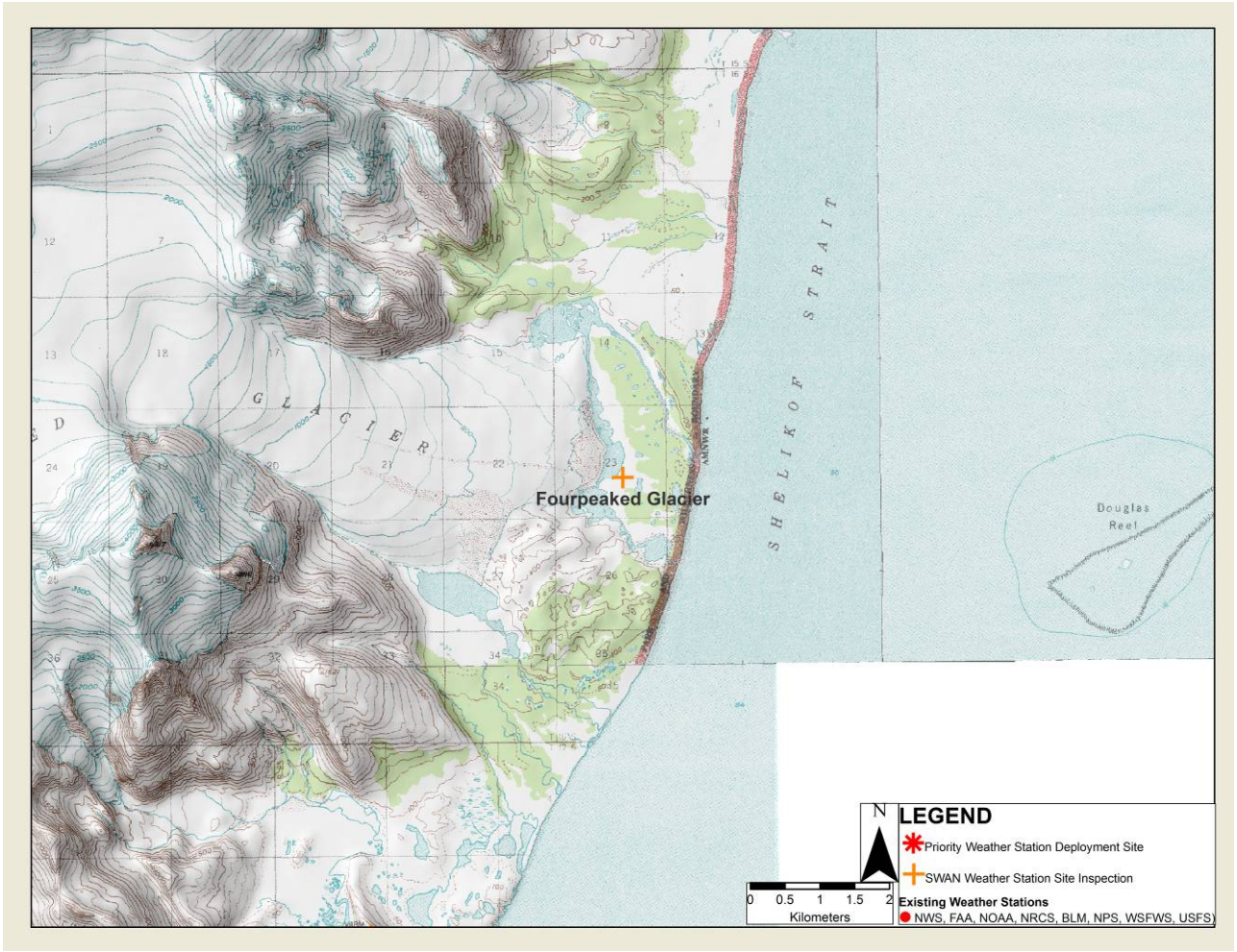


Figure 27. Detailed location of the Fourpeaked Glacier site, Katmai National Park and Preserve.

Figure 28. Aerial view of the Fourpeaked Glacier site looking west, Katmai National Park and Preserve.

KATMAI NATIONAL PARK AND PRESERVE

SITE NAME: Dark

LOCATION: 58.704557N; 153.452527W
Elevation: 500 ft
Slope: Flat, top of hill
Aspect: --

Description:
The site is located on the coast on a prominent topographic feature identified as "Dark" on the USGS quadrangle. From the top of "Dark", the horizon is unobscured to the ocean from the northeast through to the southwest. Mountains up to 4000 thousand feet occur 3 miles to the west and north.

"Dark" is heavily vegetative with thick alder with interspersed grassy glades. There are cliff outcrops and a large stream crossing that would need to be negotiated to gain access to the top of "Dark," which might be quite a challenge.

The site is close to the ocean both laterally (1/4 mile) and vertically (500 feet). Sensors would be exposed to the corrosive effects of the nearby salt air from the ocean.

Vegetation/Cover Conditions:
Heavily vegetated in thick alder interspersed with grassy glades. Though a ground inspection wasn't conducted, it appears that the top of "Dark" is well exposed with no local obstructions.

Surface Water:
Dry. No surface water (lakes or streams) at the site. However the ocean is within ¼ mile of the potential site and lies 500 feet in elevation.

Distance to Ocean:
422 meters (.262 miles) south to the ocean.

Obstructions:
None

Satellite antenna transmission:
Clear

Access:
Fixed-wing on wheels - Beach landing (gravel), (Cessna 185, 206 Dehavilland Beaver and/or Otter). Fixed-wing on floats - Ocean landing (Cessna 185, 206 Dehavilland Beaver and/or Otter) under calm sea conditions.

Helicopter

Land Status
Katmai National Park - wilderness

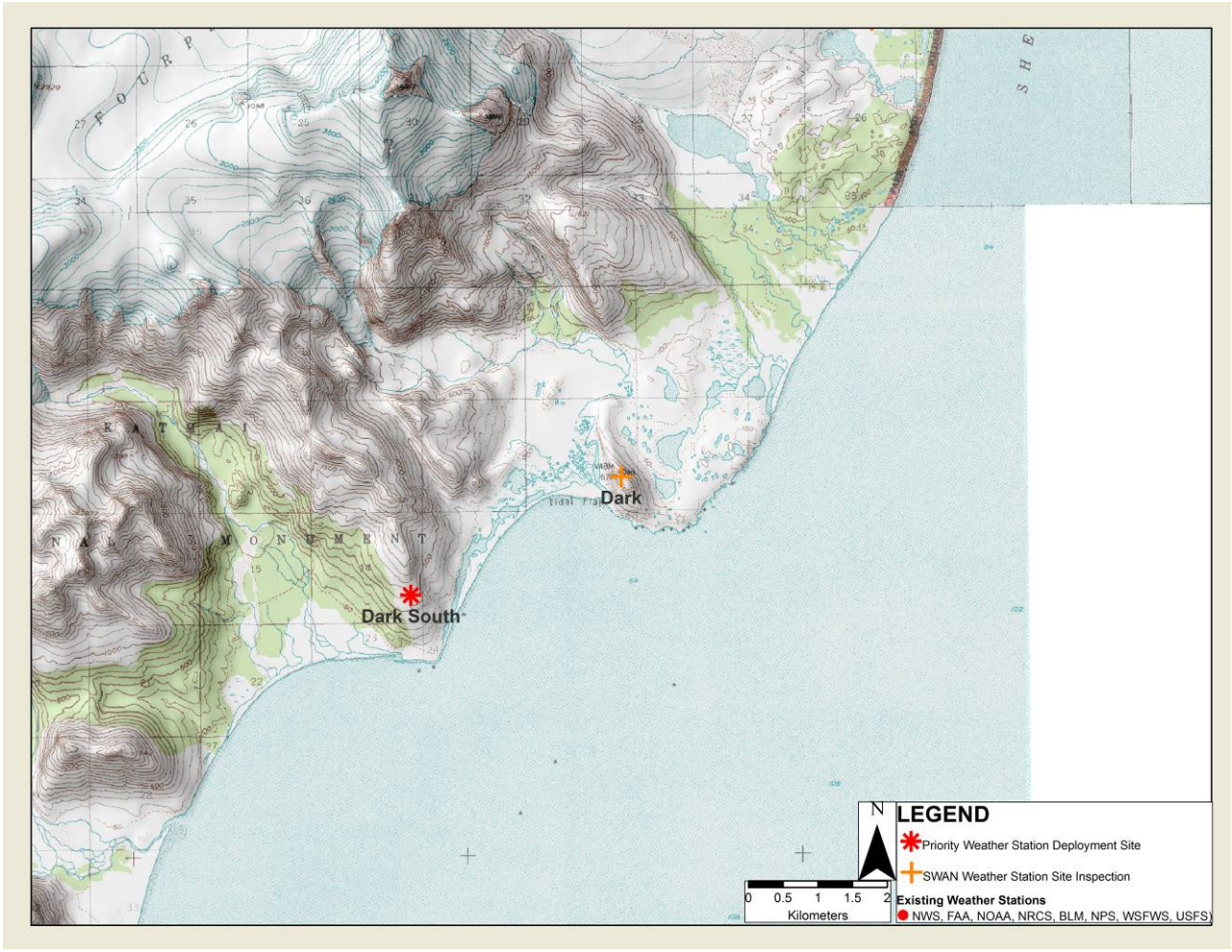


Figure 29. Detailed location of the Dark site, Katmai National Park and Preserve.

Figure 30. Aerial view of the Dark site looking north, Katmai National Park and Preserve.

KATMAI NATIONAL PARK AND PRESERVE

SITE NAME: Dark-South

LOCATION: 58.691444N; 153.504050W

Elevation: 500 ft
Slope: Sloping grassy cape
Aspect: Southeast

Description:
The site is located on the coast on a prominent grassy cape gently sloping to the ocean. From this cape, the horizon is unobscured to the ocean from the northeast through to the southwest.

Site has excellent exposure in all directions; however mountains approaching 4000 feet are within 3 miles of the site to the northwest. The site is close to the ocean both laterally (1/2 mile) and vertically (500 feet). Sensors would be exposed to the corrosive effects of the nearby salt air from the ocean.

Vegetation/Cover Conditions:
The cape is vegetated thick grass. Though a ground inspection wasn't conducted, it appears that this cape is well exposed with no local obstructions.

Surface Water:
Dry.

Distance to Ocean:
730 meters (.453 miles) southeast the ocean.

Obstructions:
None. However the ridge continues to climb in elevation northwest of the site.

Satellite antenna transmission:
Clear

Access:
Fixed-wing on wheels - Beach landing (gravel), (Cessna 185, 206 Dehavilland Beaver and/or Otter). Fixed-wing on floats - Ocean landing (Cessna 185, 206 Dehavilland Beaver and/or Otter) under calm sea conditions.

Helicopter

Land Status
Katmai National Park - wilderness

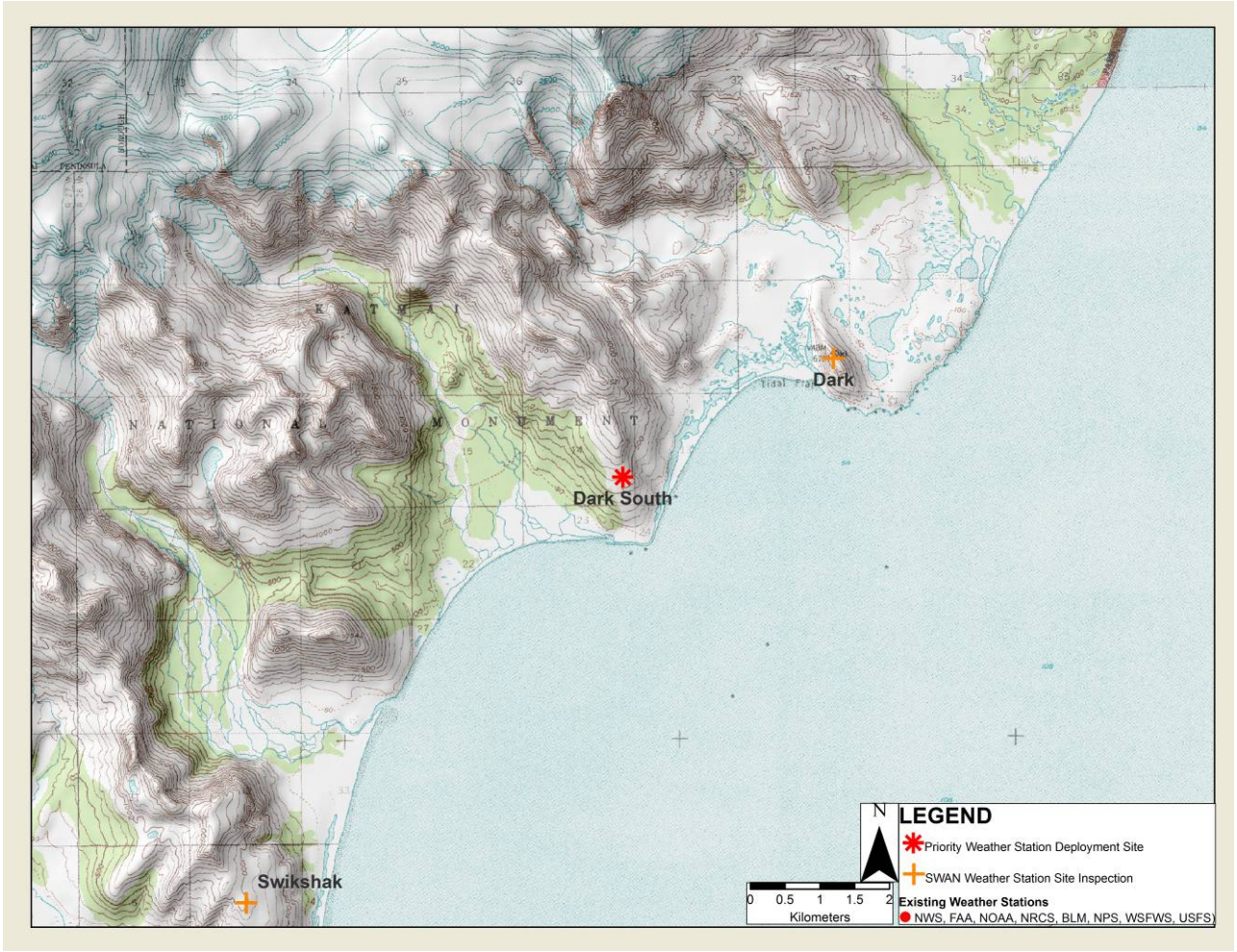


Figure 31. Detailed location of the Dark South site, Katmai National Park and Preserve.

Figure 32. Aerial view of the Dark South site looking north, Katmai National Park and Preserve. Site is on the cape approximately 500 feet elevation.

KATMAI NATIONAL PARK AND PRESERVE

SITE NAME: Swikshak

LOCATION: 58.634508N; 153.587891W

Elevation: 500 ft
Slope: Sloping grassy cape
Aspect: Southeast

Description:
The site is located on the coast on a prominent grassy cape gently sloping to the ocean. From this cape, the horizon is unobscured to the ocean from the northeast through to the southwest.

Site has excellent exposure in all directions; however mountains approaching 4000 feet are within 3 miles of the site to the northwest. The site is close to the ocean both laterally (1/2 mile) and vertically (500 feet). Sensors would be exposed to the corrosive effects of the nearby salt air from the ocean.

Vegetation/Cover Conditions:
The cape is vegetated thick grass. Though a ground inspection wasn't conducted, it appears that this cape is well exposed with no local obstructions.

Surface Water:
Dry.

Distance to Ocean:
1,170 meters (.727 miles) south to the ocean.

Obstructions:
None. However the ridge continues to climb in elevation northwest of the site.

Satellite antenna transmission:
Clear

Access:
Fixed-wing on wheels - Beach landing (gravel), (Cessna 185, 206 Dehavilland Beaver and/or Otter). Fixed-wing on floats - Ocean landing (Cessna 185, 206 Dehavilland Beaver and/or Otter) under calm sea conditions.

Helicopter

Land Status
Katmai National Park - wilderness

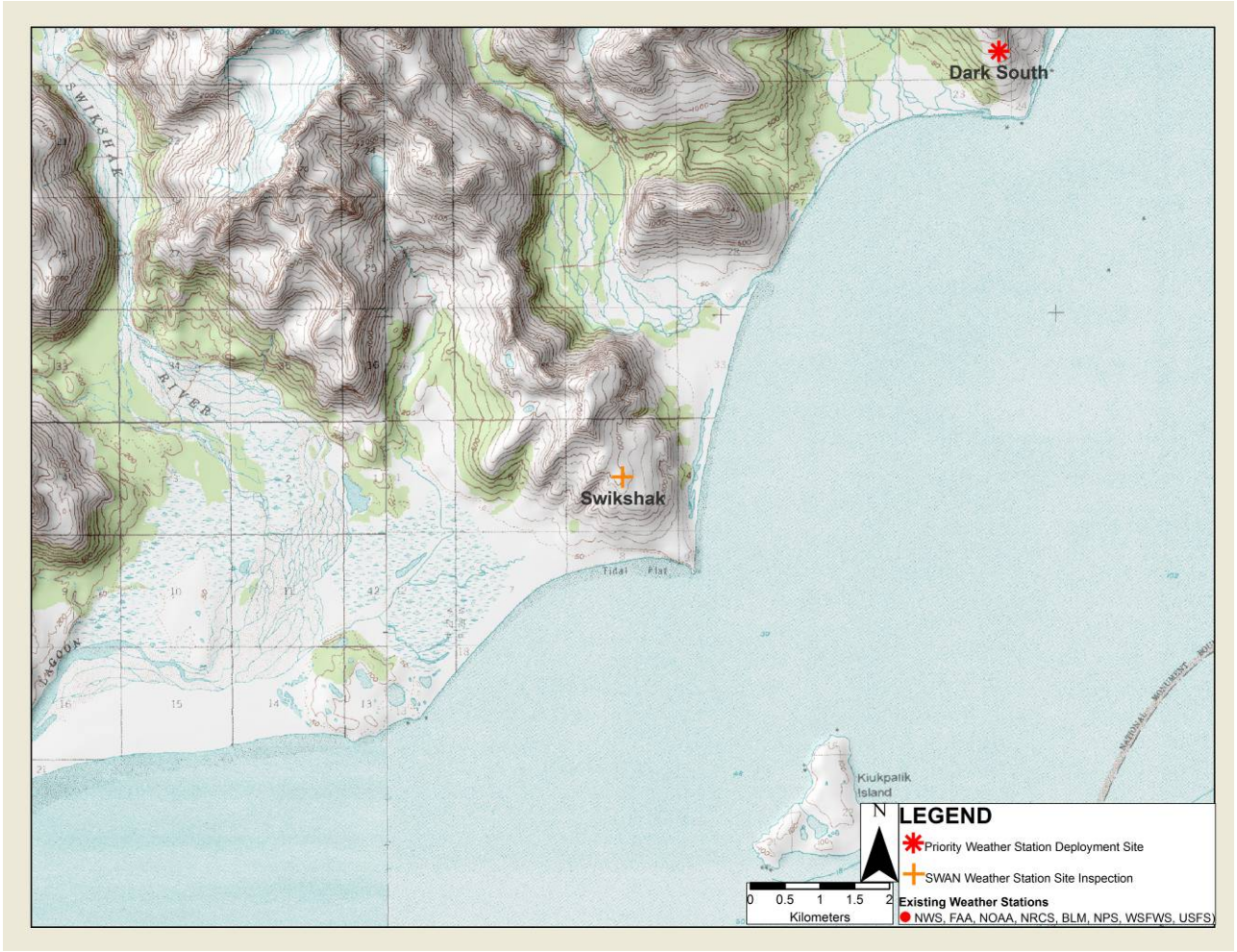


Figure 33. Detailed location of the Swikshak site, Katmai National Park and Preserve.

Figure 34. Aerial view of the Swikshak site looking north, Katmai National Park and Preserve. Site is on the cape approximately 500 feet elevation.

KATMAI NATIONAL PARK AND PRESERVE

SITE NAME: Hallo Bay Lodge Area

LOCATION: 58.587639N; 153.914962W

Elevation: 50 ft
Slope: Slight, on a ridge line
Aspect: southeast

Description:
The site is located in gently rolling topography of the nearby coastal setting. Site is located approximately ¼ mile off the coast thus being open to the ocean from the northeast to the south. Mountains to the southwest through the north in excess of 4,000 feet at a distance of 4 miles or greater.

Vegetation/Cover Conditions:
Heavily vegetated in thick alder interspersed with grassy glades. Though a ground inspection wasn't conducted, alder is likely to be 6 to ten feet high with thick grass likely to be 2 to 3 feet high.

Surface Water:
Dry. No surface water (lakes or streams) at the site. However the ocean is within ¼ mile of the potential site.

Distance to Ocean:
563 meters (.349 miles) east to the ocean.

Obstructions:
Obstructions would be of the alder type. Alder could be 6 to ten feet high and within 60 feet of any potential station. Mountains to the southwest through the north in excess of 4,000 feet at a distance of 4 miles or greater.

Satellite antenna transmission:
Clear

Access:
Fixed-wing on wheels - Beach landing (gravel), (Cessna 185, 206 Dehavilland Beaver and/or Otter). Fixed-wing on floats - Ocean landing (Cessna 185, 206 Dehavilland Beaver and/or Otter) under calm sea conditions.

Helicopter

Land Status
Katmai National Park - wilderness

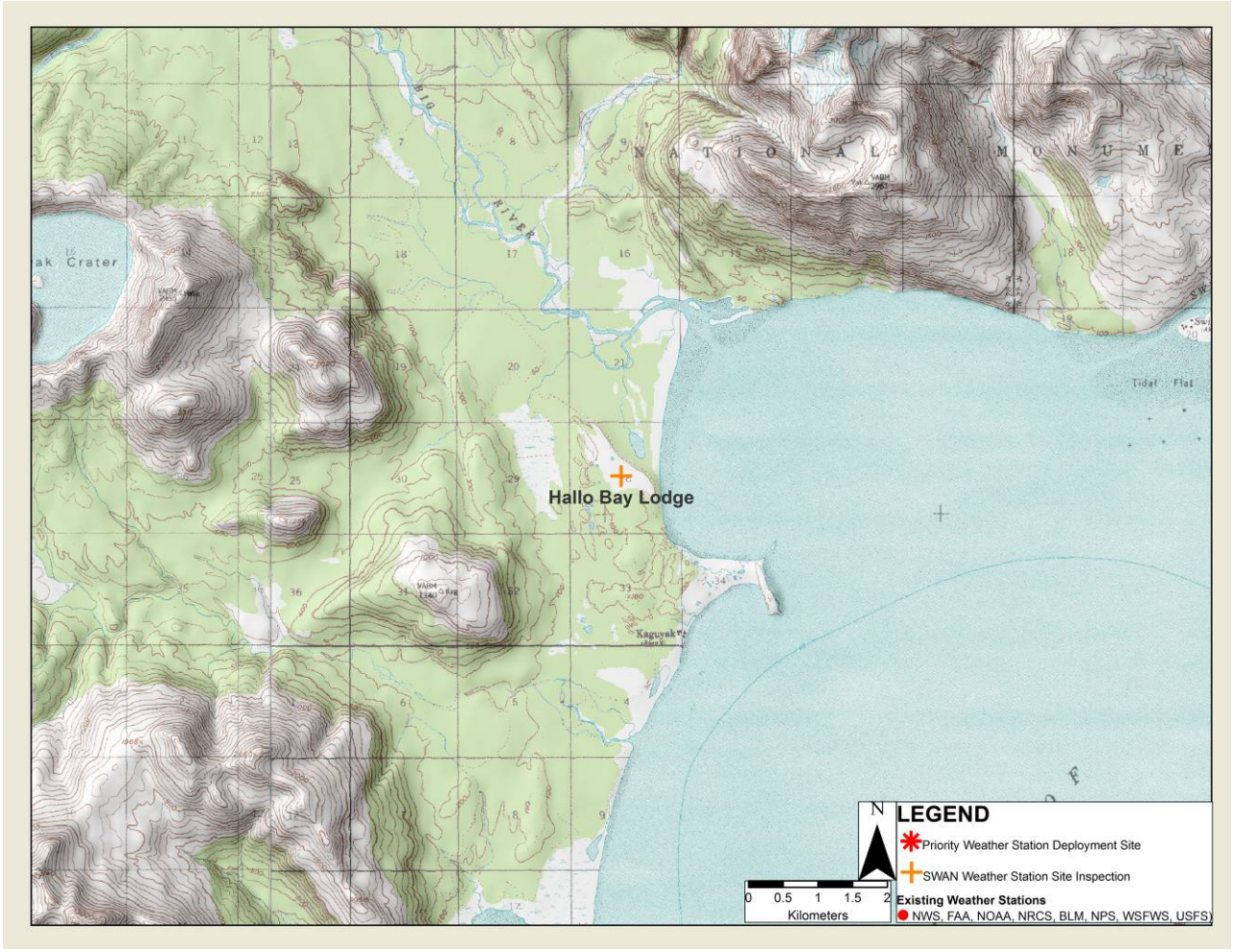


Figure 35. Detailed location of the Hallo Bay Lodge site, Katmai National Park and Preserve.

Figure 36. Aerial view of the Hallo Bay site looking northwest, Katmai National Park and Preserve. Site is in the glades on low lying ridges behind the Hallo Bay Lodge (foreground).

KATMAI NATIONAL PARK AND PRESERVE

SITE NAME: Hallo Glacier Area
LOCATION: 58.40N; 154.14W

Elevation: 50 ft
Slope: Rolling hill on glacial moraine.
Aspect: Southeast

Description:
The site is located in gently rolling topography of the Hallo Glacier moraine. The moraine has a melting ice core and thus the surface is unstable.

Site has excellent exposure to the north and east. High mountains to the west (4,000 ft +) and a prominent ridge directly to the south (1,500 ft +).

Site is located approximately 3 miles off the coast thus being open to the ocean from the northeast to the east. A prominent mountain ridge 2 miles to the south (1,500 feet elevation) may cause some topographically induced weather observations.

Vegetation/Cover Conditions:
Heavily vegetated with thick alder. Though a ground inspection wasn't conducted, alder is likely to be 6 to ten feet high.

Surface Water:
Dry. No surface water (lakes or streams) at the site. However the ocean is within 3.5 miles of the potential site and the pro-glacial lake would be within ¼ mile.

Distance to Ocean:
4,500 meters (2.796 miles) east to the ocean.

Obstructions:
Obstructions would be of the alder type. Alder could be 6 to ten feet high within 6 to ten feet high of any potential station.

Mountains occur to the west in excess of 4,000 feet at a distance of 4 miles or greater.

Satellite antenna transmission:
Clear

Access:
Fixed-wing wheels on the beach, though the traverse through heavy alder makes this option not practical. Fixed-wing floats (Cessna 185, 206 Dehavilland Beaver and/or Otter) on the pro-glacial lake – not recommended though due to floating ice.

Helicopter

Land Status
Katmai National Park - wilderness

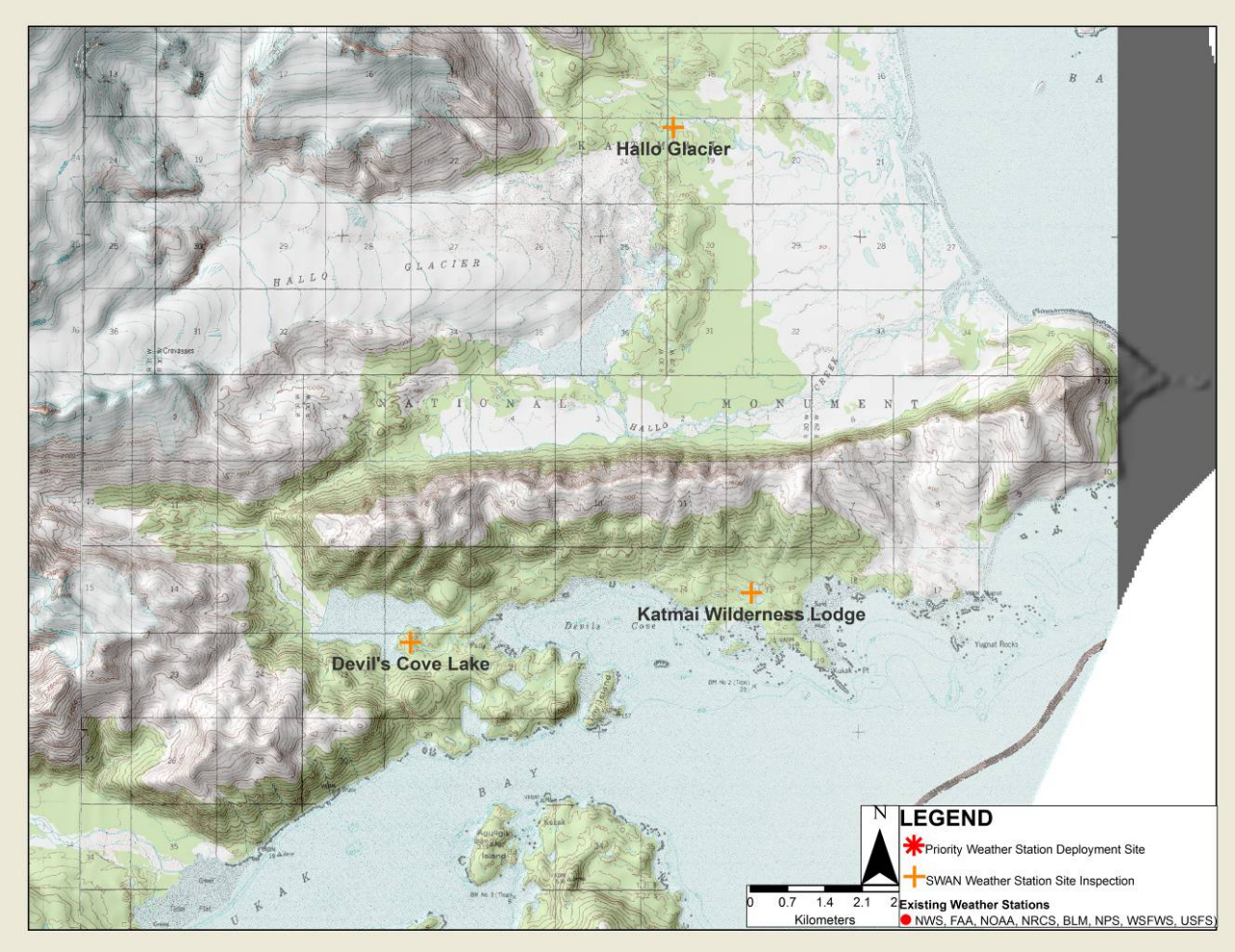


Figure 37. Detailed location of the Hallo Glacier site, Katmai National Park and Preserve.

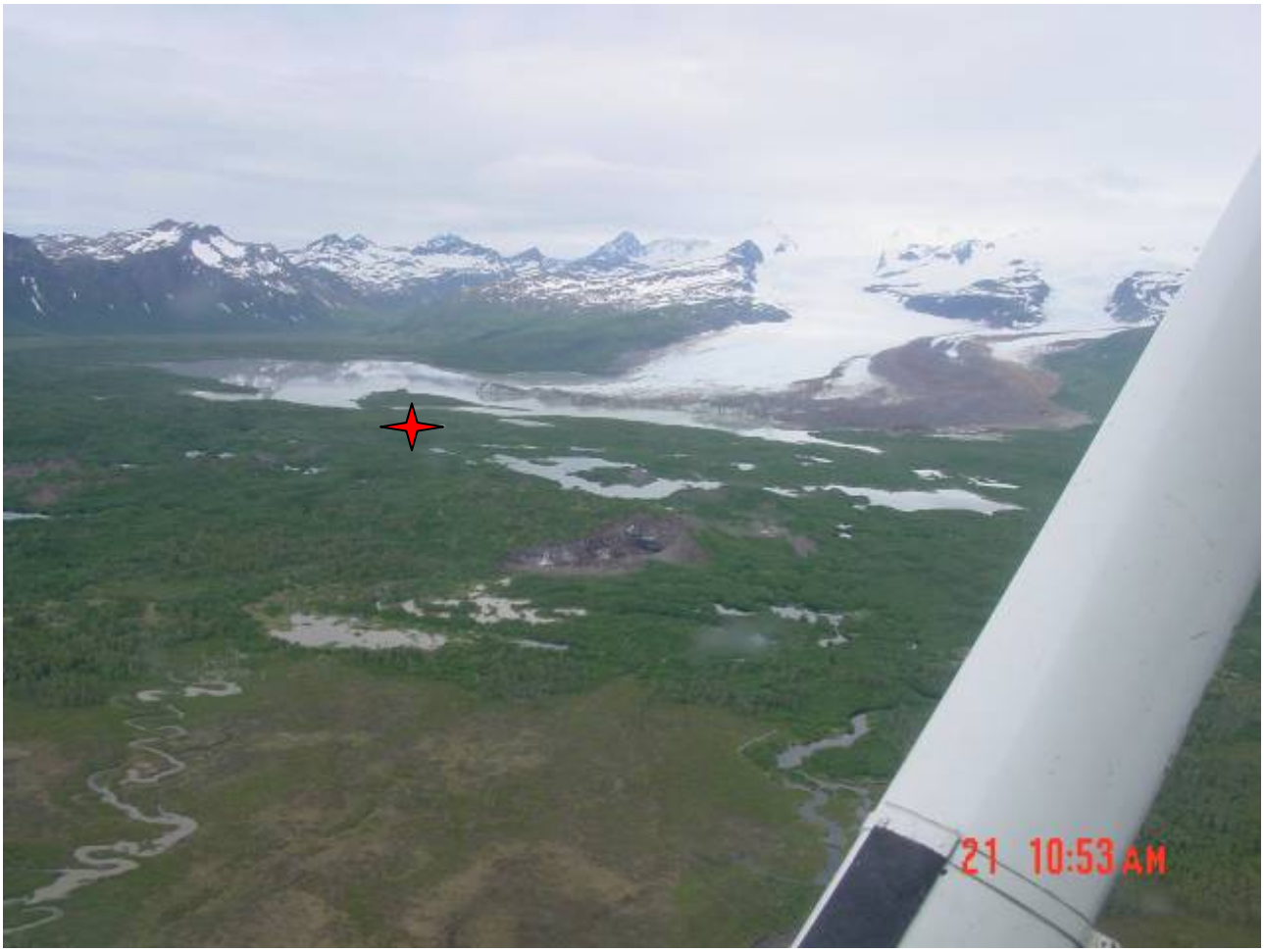


Figure 38. Aerial view of the Hallo Glacier site, Katmai National Park and Preserve. Site would be on moraine material in front of the lake.

KATMAI NATIONAL PARK AND PRESERVE

SITE NAME: Katmai Wilderness Lodge

LOCATION: 58.343733N; 154.114736W

Elevation: 50 ft
Slope: Rolling coast terrain
Aspect: --

Description:
Site located on the coast near Katmai Wilderness Lodge.

Site is open to the ocean to the east and south. Mountains occur in excess of 4,000 feet to the west and a prominent ridge directly north of the site rises to 1,500 feet.

Vegetation/Cover Conditions:
Thick alder.

Surface Water:
Dry. The ocean would be within ¼ mile from any station.

Distance to Ocean:
525 meters (.326 miles) south to the ocean.

Obstructions:
Site has excellent exposure to the east and south. High mountains to the west (4,000 ft +) and a prominent ridge directly to the north (1,500 ft +).

Satellite antenna transmission:
Clear

Access:
Float plane or helicopter

Land Status
Katmai National Park - wilderness

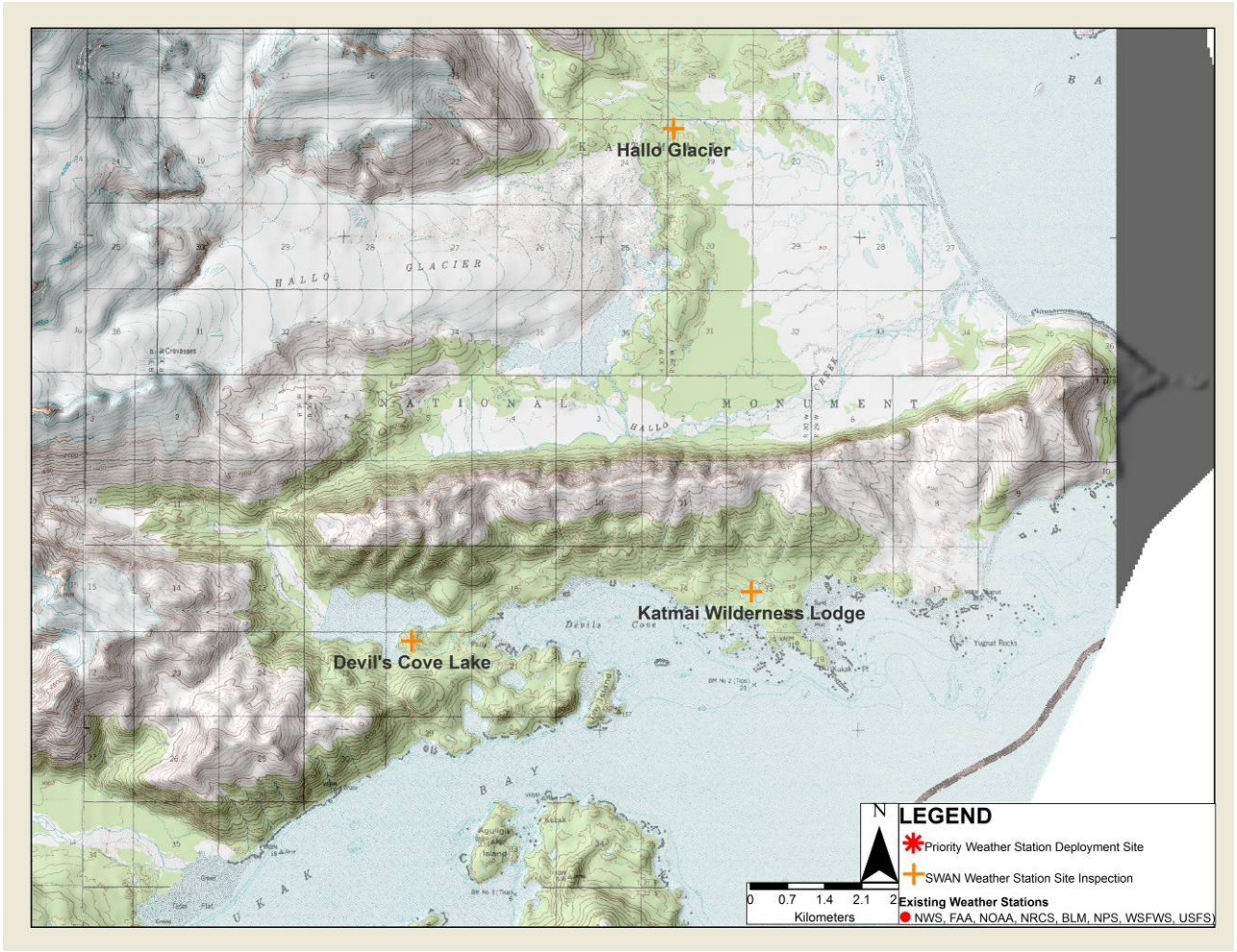


Figure 39. Detailed location of the Katmai Wilderness Lodge site, Katmai National Park and Preserve.

Figure 40. Aerial view of the Katmai Wilderness Lodge site, Katmai National Park and Preserve. Site would be located in the grassy glades between thick alder.

KATMAI NATIONAL PARK AND PRESERVE

SITE NAME: Devil's Cove Lake

LOCATION: 58.350858N; 154.230313W

Elevation: 100 ft
Slope: Valley bottom
Aspect: --

Description:
Site located in the valley bottom with Devil's Lake. Local topographic affects would dominate the weather observation.

Site is just inland from the coast at the mouth of a narrow valley surrounded by high mountains from every direction but the east. Mountains to the west exceed 4,000 feet elevation.

Vegetation/Cover Conditions:
Heavily vegetated with alder.

Surface Water:
Dry. Devil's Cove Lake would be within a ¼ mile of any site.

Distance to Ocean:
1,080 meters (.671 miles) east to the ocean.

Obstructions:
This site is within a steep narrow valley surrounded by mountains. Localized topographic affects would affect weather observations at this site.

Satellite antenna transmission:
Clear

Access:
Float plane or helicopter

Land Status
Katmai National Park - wilderness

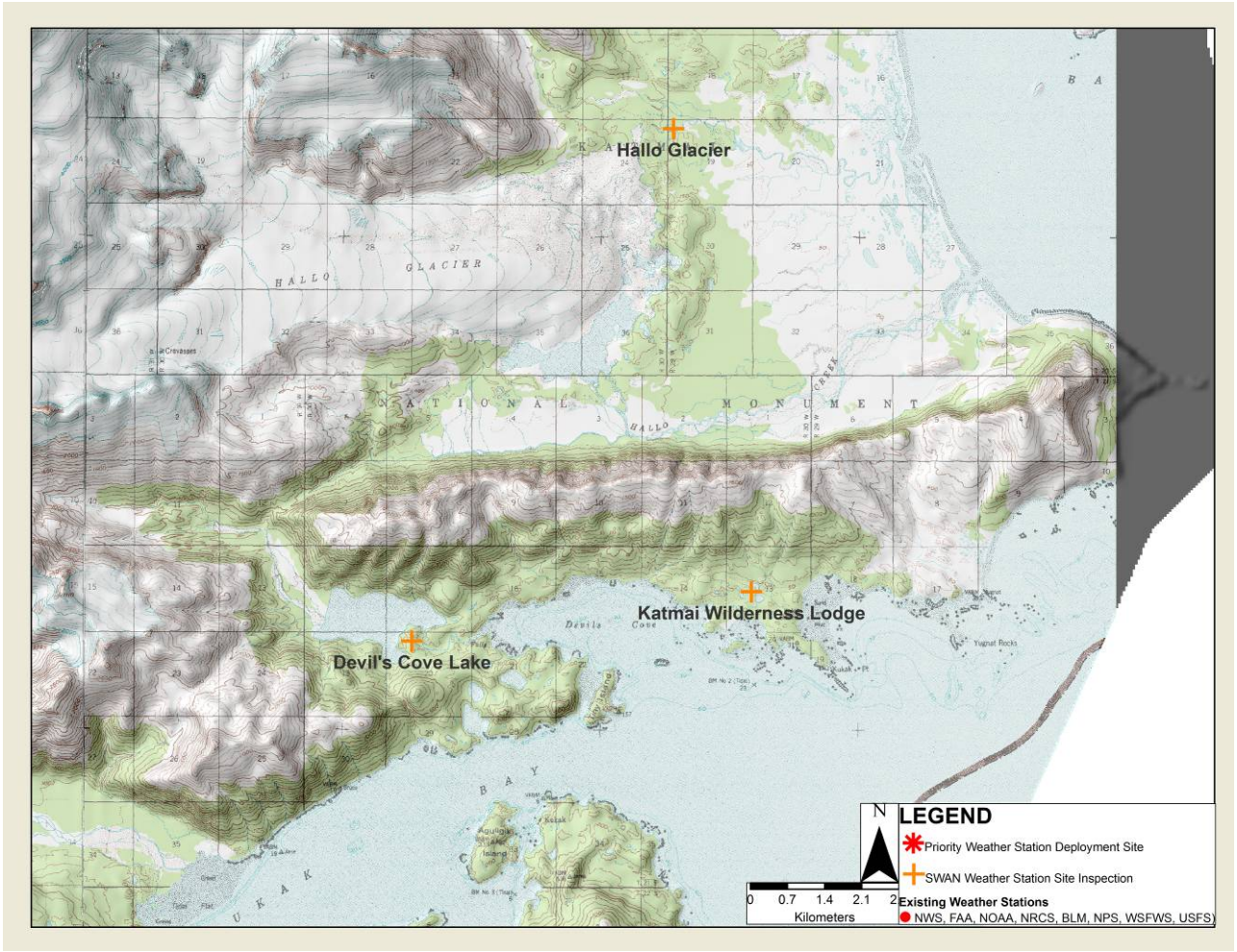


Figure 41. Detailed location of the Devil's Cove site, Katmai National Park and Preserve.

Figure 42. Aerial view of the Devil's Cove Lake site looking west, Katmai National Park and Preserve. Site would be in open area between alder vegetation.

KATMAI NATIONAL PARK AND PRESERVE

SITE NAME: Cape Gull

LOCATION: 58.204392N; 154.200093W
Elevation: 1,300 ft
Slope: Sloping cape
Aspect: Southeast

Description:
The site is located on the coast on a prominent grassy cape gently sloping to the ocean. From this cape, there is unobscured horizon open to the ocean from the northeast through to the south.

Site has excellent exposure in all directions, however a mountain approaching 2000 feet are within 1.5 miles of the site to the northwest. The site is close to the ocean both laterally (1 mile) and vertically (1,300 feet). Sensors would be exposed to the corrosive effects of the nearby salt air from the ocean.

Vegetation/Cover Conditions:
The cape is vegetated grass. Though a ground inspection wasn't conducted, it appears that this cape is well exposed with no local obstructions, other than mountains to the west.

Surface Water:
Dry. No surface water (lakes or streams) at the site. However the site would be approximately 1 mile from the ocean at an elevation of 1,300 feet.

Distance to Ocean:
1,200 meters (.745 miles) southeast to the ocean.

Obstructions:
None. However the ridge continues to climb in elevation northwest of the site to an elevation of 2,000 feet.

Satellite antenna transmission:
Clear

Access: Helicopter only. Possible partnership with the US Coast Guard?

Land Status
Katmai National Park - wilderness

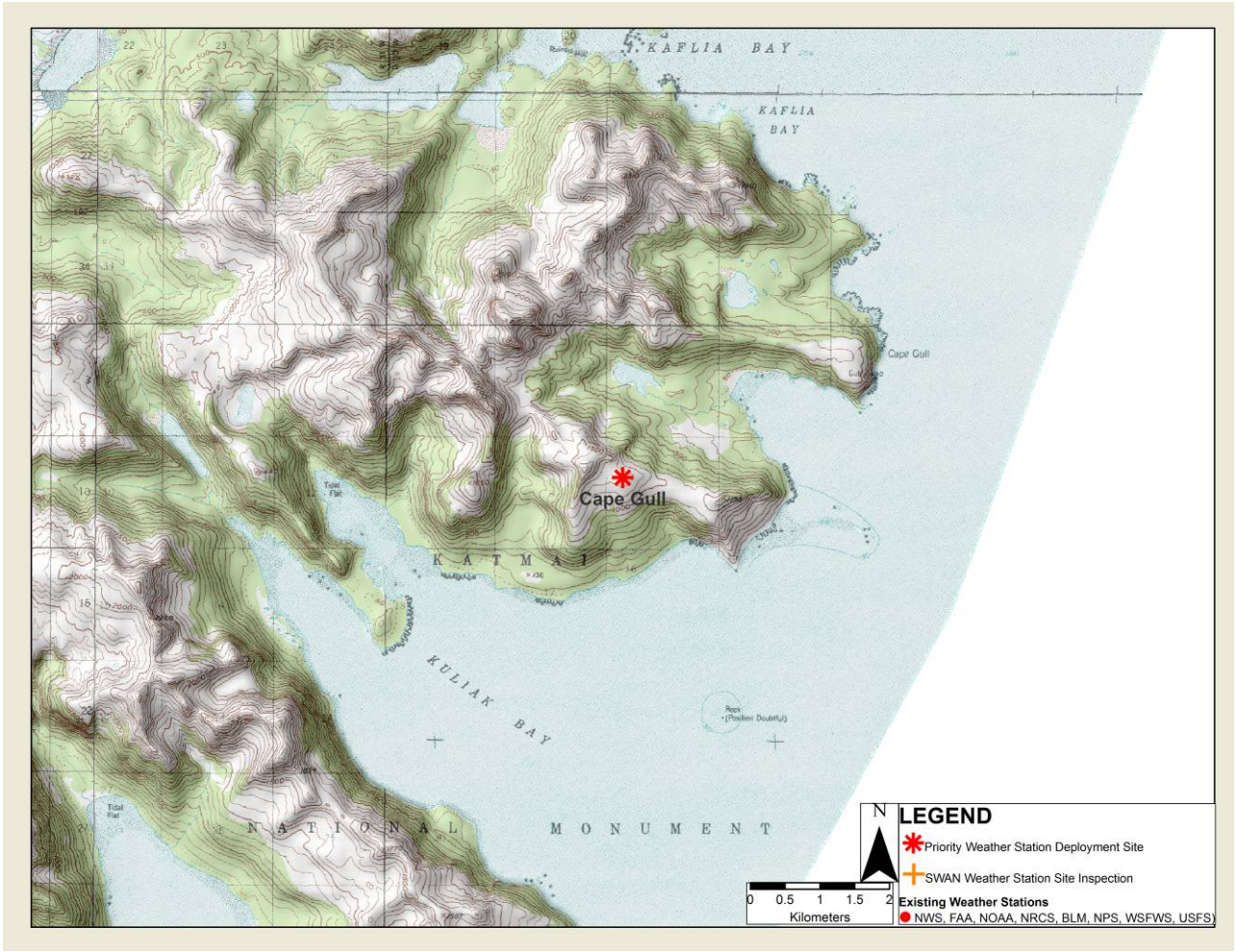


Figure 43. Detailed location of the Cape Gull site, Katmai National Park and Preserve.

Figure 44. Aerial view of the Cape Gull site looking north, Katmai National Park and Preserve. Site would be on the flat area in the foreground.

KATMAI NATIONAL PARK AND PRESERVE

SITE NAME: Dakavak

LOCATION: 58.13N; 154.70W

Elevation: 400 ft
Slope: Valley bottom
Aspect: --

Description:
Site located in the valley bottom with Dakavak Lake. Local topographic affects would dominate the weather observation. Lots of blowing volcanic ash.

Site is confined in a narrow valley surrounded by mountains in excess of 2500 feet. within 1.5 miles of the site.

Vegetation/Cover Conditions:
Heavily vegetated with alder. Occasional "blows" of barren volcanic ash material. Lots of ash observed floating on Dakavak Lake.

Surface Water:
Dry. Dakavak Lake would be within a ¼ mile of any site here.

Distance to Ocean:
7,200 meters (4.47 miles) south to the ocean.

Obstructions:
This site is within a steep narrow valley surrounded by mountains. Localized topographic affects would be extreme at this site.

Satellite antenna transmission:
OK: SE – 12 degrees

Access:
Float plane or helicopter

Land Status
Katmai National Park - wilderness

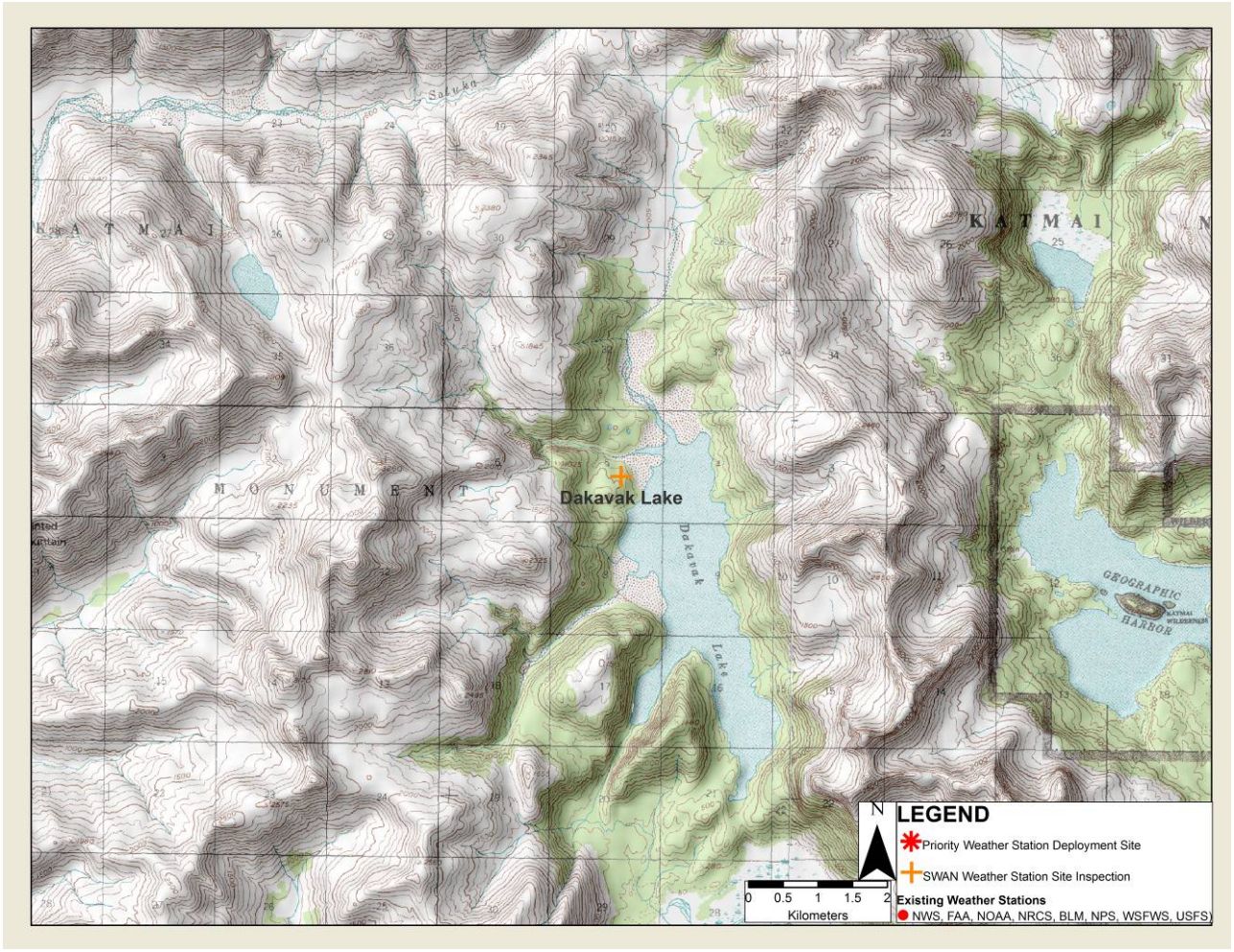
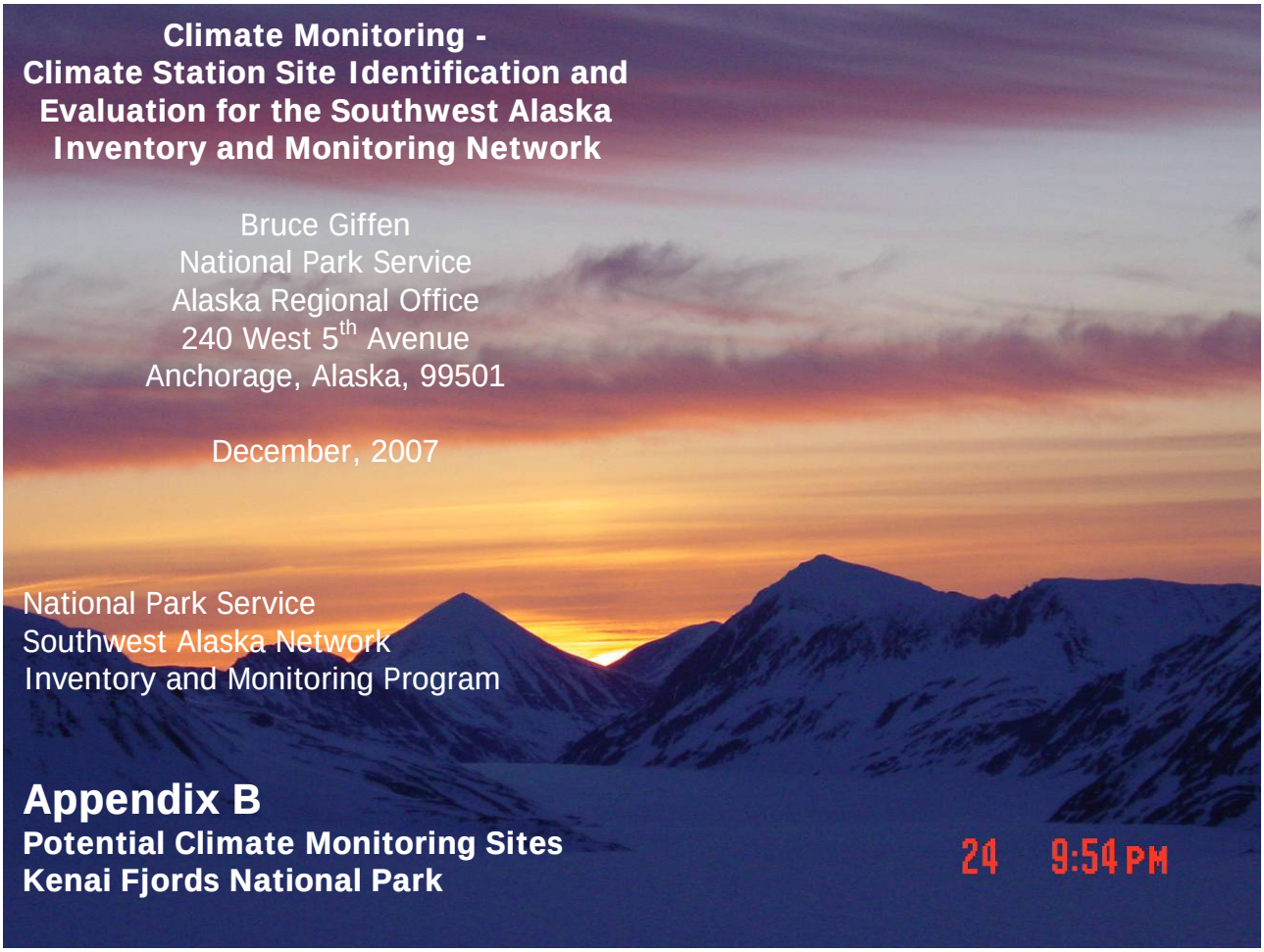


Figure 45. Detailed location of the Dakavak Lake site, Katmai National Park and Preserve.

Figure 46. Aerial view of the Dakavak site looking northeast, Katmai National Park and Preserve. Site would be located in open areas between alder vegetation.



Looking northwest across the north portion of the Harding Icefield at sunset.

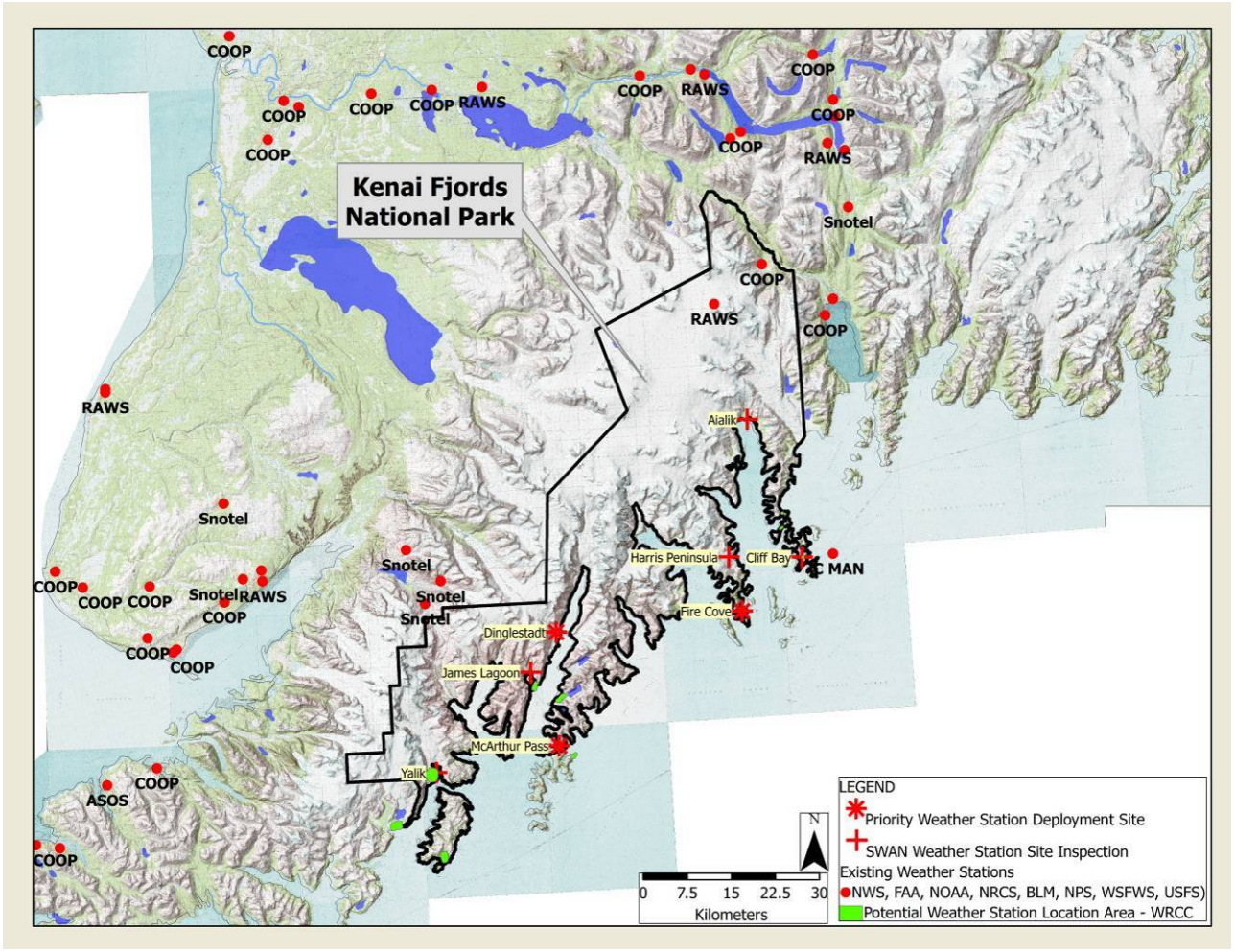


Figure 47. Kenai Fjords National Park with potential and priority weather station sites.

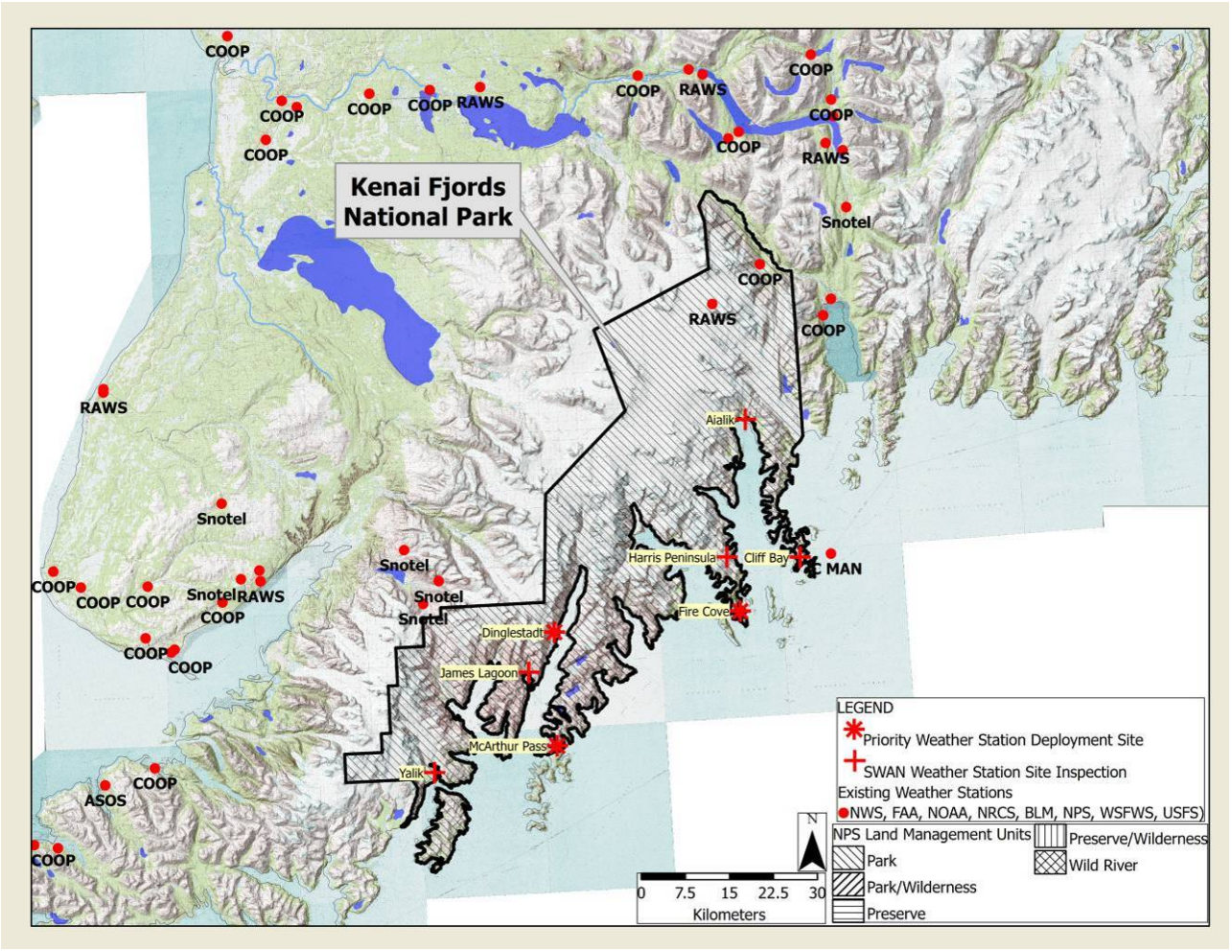


Figure 48. Land Management Units of Kenai Fjords National Park with potential and priority weather station sites.

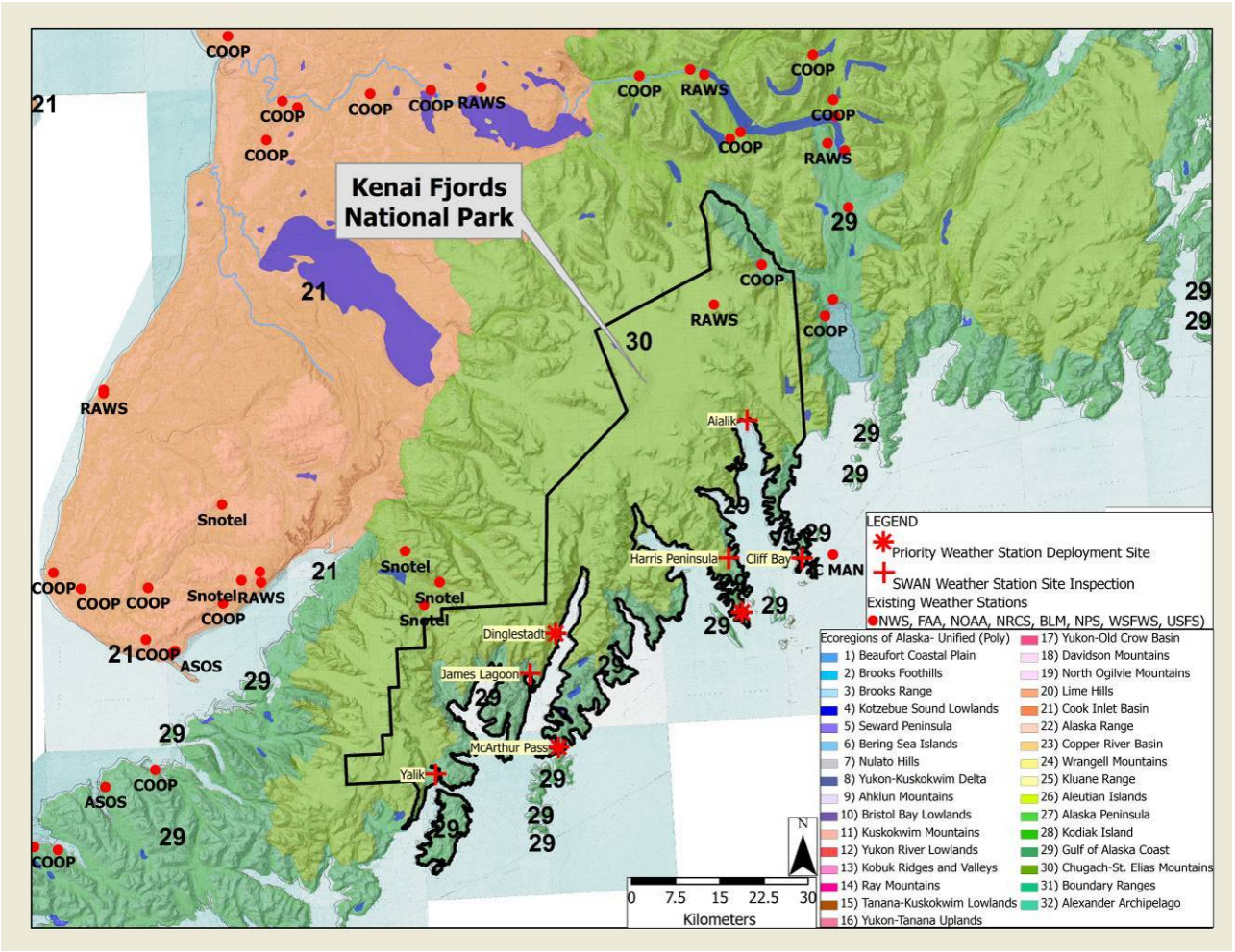


Figure 49. Ecoregions of Kenai Fjords National Park with potential and priority weather station sites.

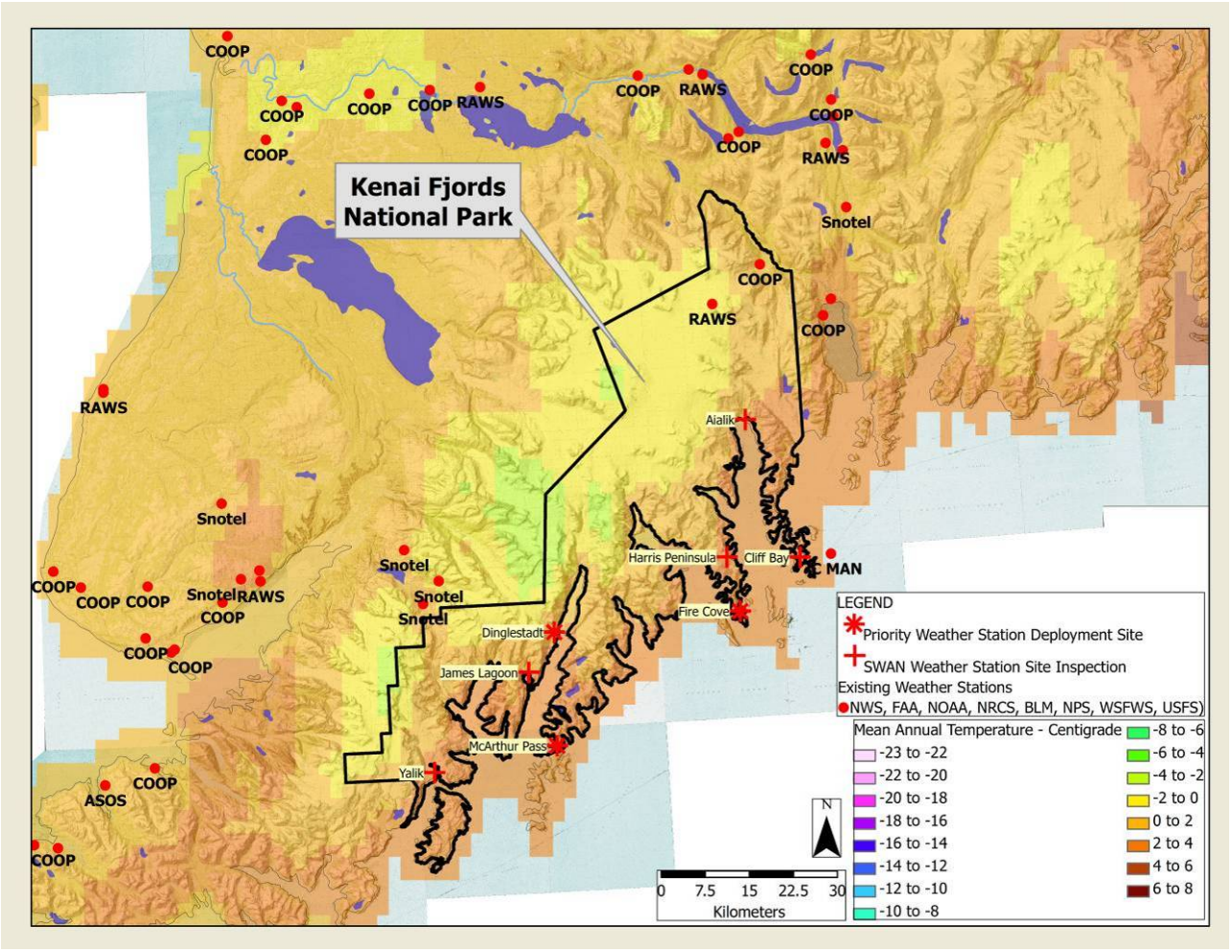


Figure 50. PRISM Temperature Model of Kenai Fjords National Park with potential and priority weather station sites.

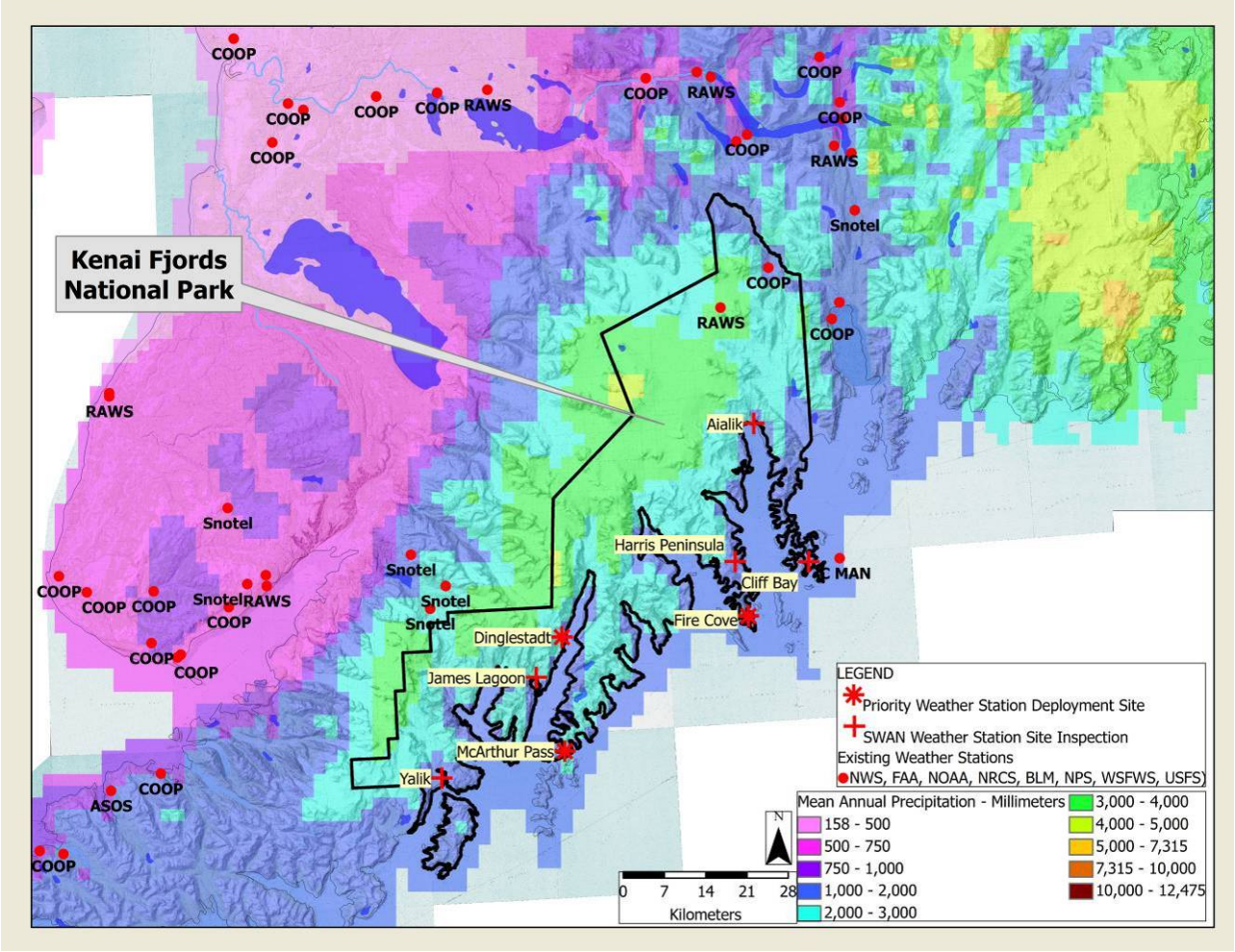


Figure 51. PRISM Precipitation Model of Kenai Fjords National Park with potential and priority weather station sites.

KENAI FJORDS NATIONAL PARK

SITE NAME: Cliff Bay

LOCATION: 59.737429N; 149.564608W

Elevation: 600 ft
Slope: None, Undulating terrain at the southern end of the Aialik Peninsula
Aspect: --

Description:
Site is located on the crest of the Aialik Peninsula near its southern most extent. The terrain at the site is rolling, however the climb to the site is very steep and difficult. The site is well exposed in all directions except for a hill ½ mile to the north that rises 700 feet higher than the site to and elevation of 1,300 feet.

The site is well exposed in all directions except for a hill ½ mile to the north.

Vegetation/Cover Conditions:
Sedge grass, deer cabbage, lichen, dwarf hemlock, moss. Large hemlock on side slopes in the area.

Surface Water:
Dry. There are three small ponds within 1,000 feet of the site.

Distance to Ocean:
585 meters (.363 miles) southwest to the ocean.

Obstructions:
No obstructions within ¼ mile.

One higher topographic feature (hill) ½ mile to the north rising about 700 feet above the site to an elevation of 1,300 feet.

Satellite antenna transmission:
Clear

Access:
Access via park boat or helicopter

Land Status
Kenai Fjords National Park - not wilderness

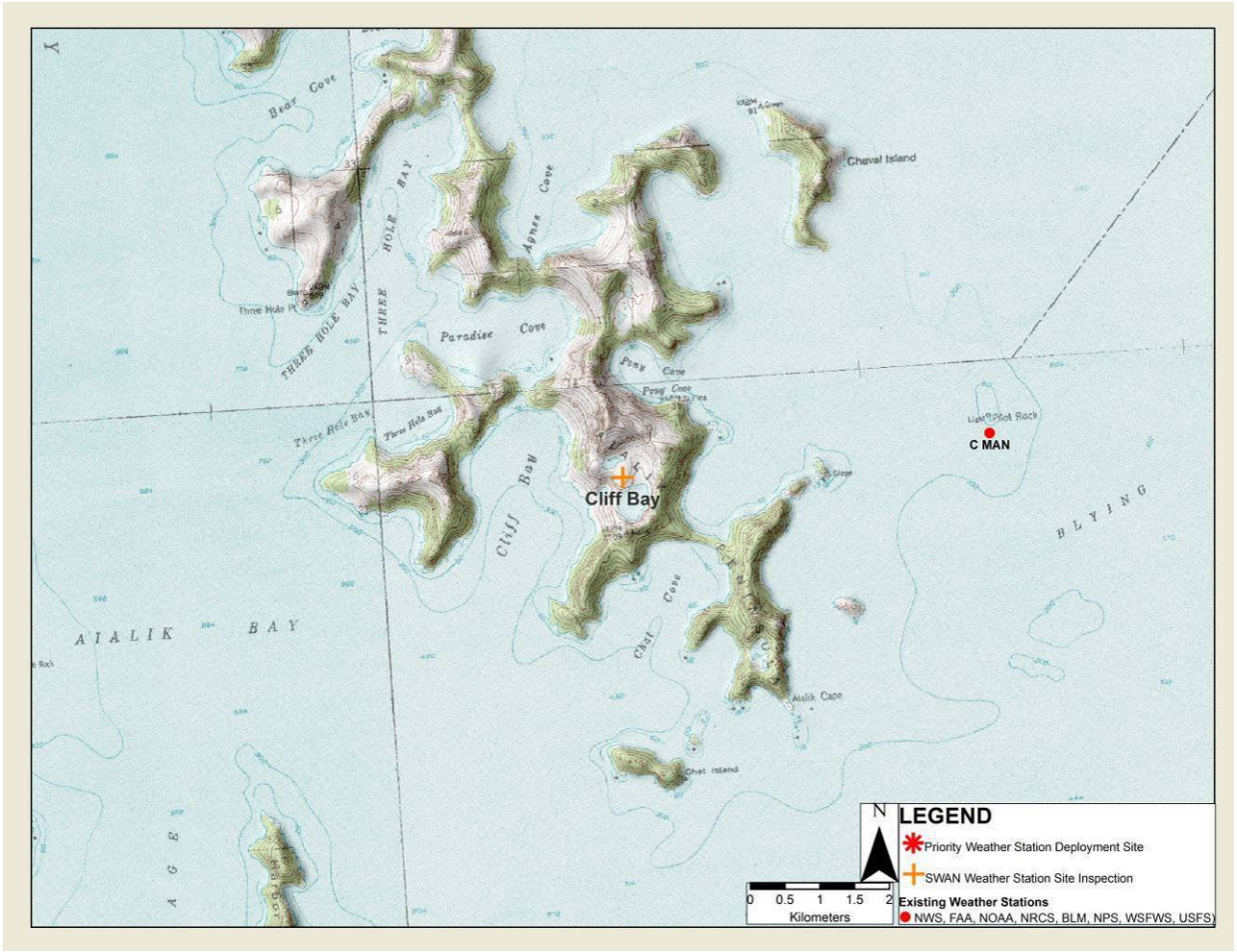


Figure 52. Detailed location of the Cliff Bay site, Kenai Fjords National Park.

Figure 53. Looking north across the Cliff Bay site, Kenai Fjords National Park.

Figure 54. Looking south across the Cliff Bay site, Kenai Fjords National Park.

KENAI FJORDS NATIONAL PARK

SITE NAME: Harris Peninsula

LOCATION: 59.744971N: 149.786446W

Elevation: 1,500 ft
Slope: None, Ridge top of the Harris Peninsula
Aspect: --

Description:
Site is located east of the crest of the Harris Peninsula on a large bedrock bench at approximately 1,500 feet elevation. The crest of the Harris Peninsula is approximately 1 mile to the southwest and rising to an elevation of 3,000 feet above sea level. The site is well above tree-line with lots of bare granite.

Vegetation/Cover Conditions:
Grasses, lichen, crow berry, dwarf hemlock, moss.

Surface Water:
Dry.

Distance to Ocean:
900 meters (.559 miles) east to the ocean.

Obstructions:
The site is well exposed in all directions except to the southwest – a ridge lies 1 mile rises to a 3000 foot elevation.

Satellite antenna transmission:
Clear

Access:
Access via park boat or helicopter

Land Status
Kenai Fjords National Park - not wilderness

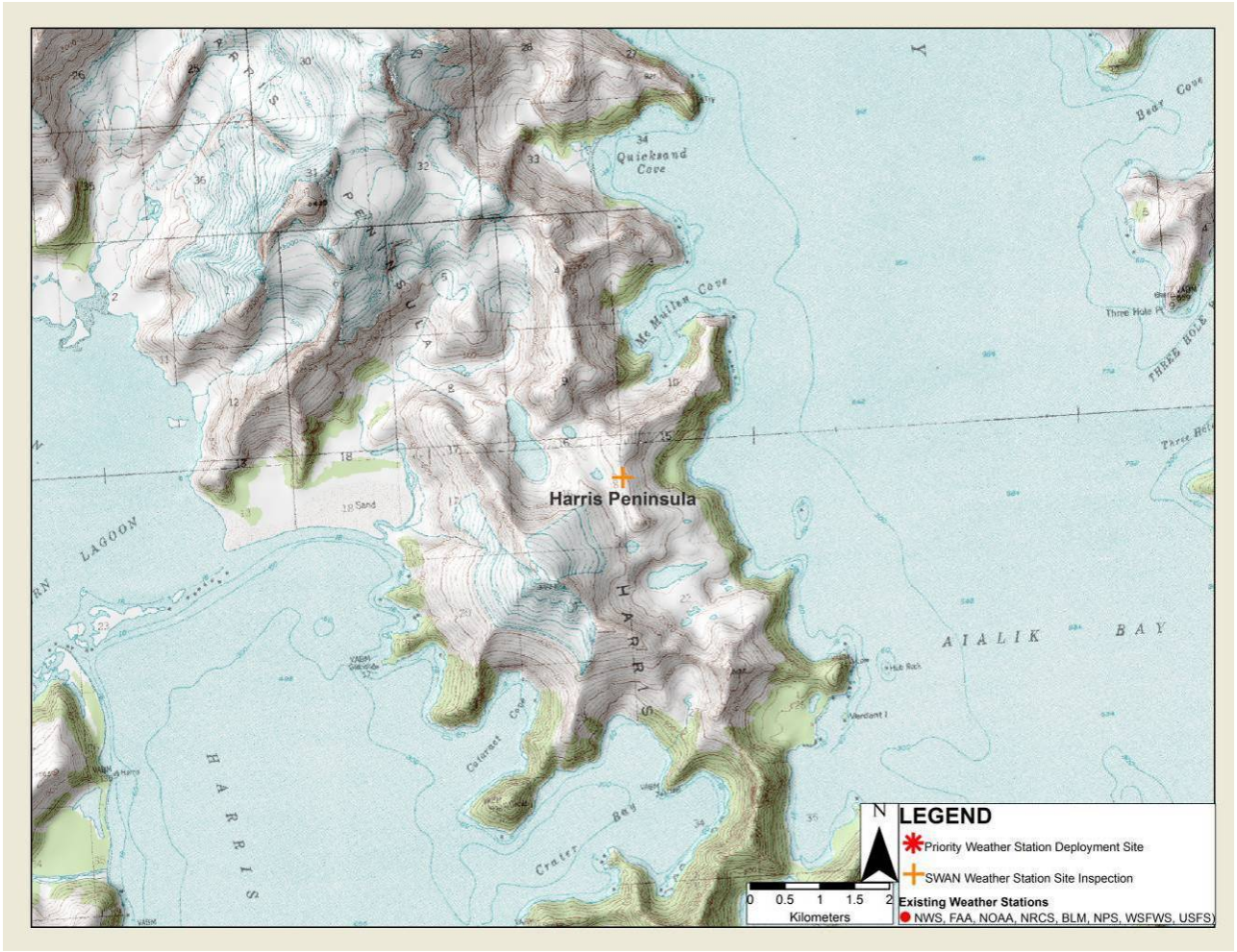


Figure 55. Detailed location of the Harris Peninsula site, Kenai Fjords National Park.

Figure 56. Looking north across the Harris Peninsula site, Kenai Fjords National Park.

Figure 57. Looking south across the Harris Peninsula site, Kenai Fjords National Park.

KENAI FJORDS NATIONAL PARK

SITE NAME: Fire Cove

LOCATION: 59.661548N; 149.756831W

Elevation: 900 ft
Slope: None, Undulating terrain at the southern end of the Harris Peninsula
Aspect: --

Description:
Site is located on the crest of the Harris Peninsula near its southern most extent. The terrain at the site is rolling, however the climb to the site is steep.

The site is well exposed in all directions except for a hill ½ mile away rising about 300 feet above the site to an elevation of 1,200.

Vegetation/Cover Conditions:
Deer Cabbage, grass, lichen, blue berry, dwarf hemlock, moss. Large hemlock on slide slopes in the area.

Surface Water:
Dry. There is a small pond (<2 acres) adjacent to the site.

Distance to Ocean:
350 meters (.217 miles) west to the ocean.

Obstructions:
No obstructions within ¼ mile.

One higher topographic feature (hill) lies ½ mile away rising about 300 feet above the site to an elevation of 1,200.

Satellite antenna transmission:
Clear

Access:
Access via park boat or helicopter

Land Status
Kenai Fjords National Park - not wilderness

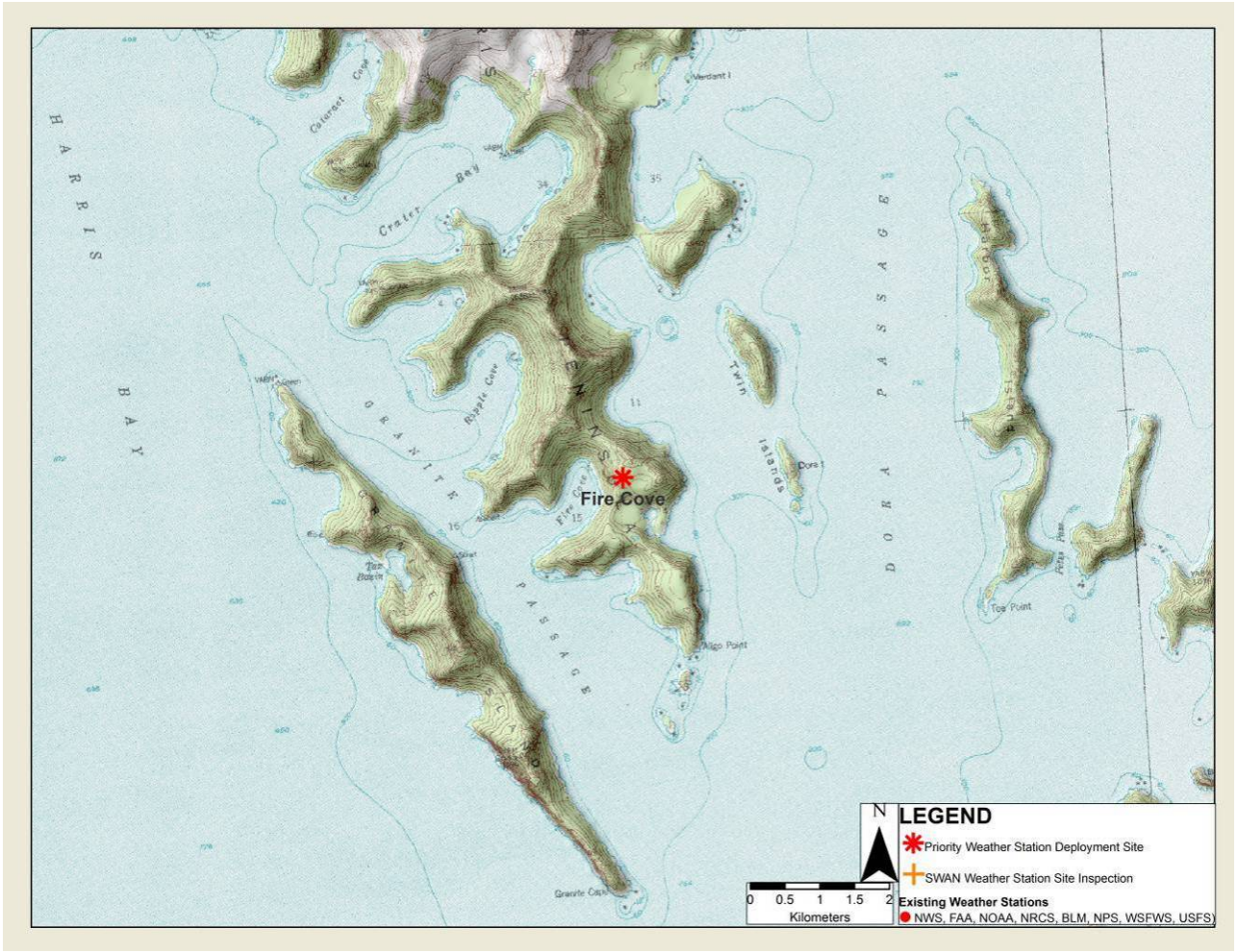


Figure 58. Detailed location of the Fire Cove site, Kenai Fjords National Park.

Figure 59. Looking south across the Fire Cove site, Kenai Fjords National Park.

Figure 60. Looking north across the Fire Cove site, Kenai Fjords National Park.

KENAI FJORDS NATIONAL PARK

SITE NAME: McArthur Pass

LOCATION: 59.472653N; 150.333587W

Elevation: 1,300 ft
Slope: None, Located on a ridge line
Aspect: --

Description:
Site is located on the top of a ridge within several hundred feet of the NPS radio repeater.

This site excellent exposure in all directions.

Vegetation/Cover Conditions:
Low tundra ground cover. Crowberry, blue berry, grass, lichen, occasional spruce.

Surface Water:
Dry. No surface water (lakes or streams) nearby.

Distance to Ocean:
770 meters (.478 miles) west-northwest to the ocean.

Obstructions:
No obstructions within ¼ mile.

Satellite antenna transmission:
Clear

Access:
Access via park boat or helicopter

Land Status
Kenai Fjords National Park - not wilderness

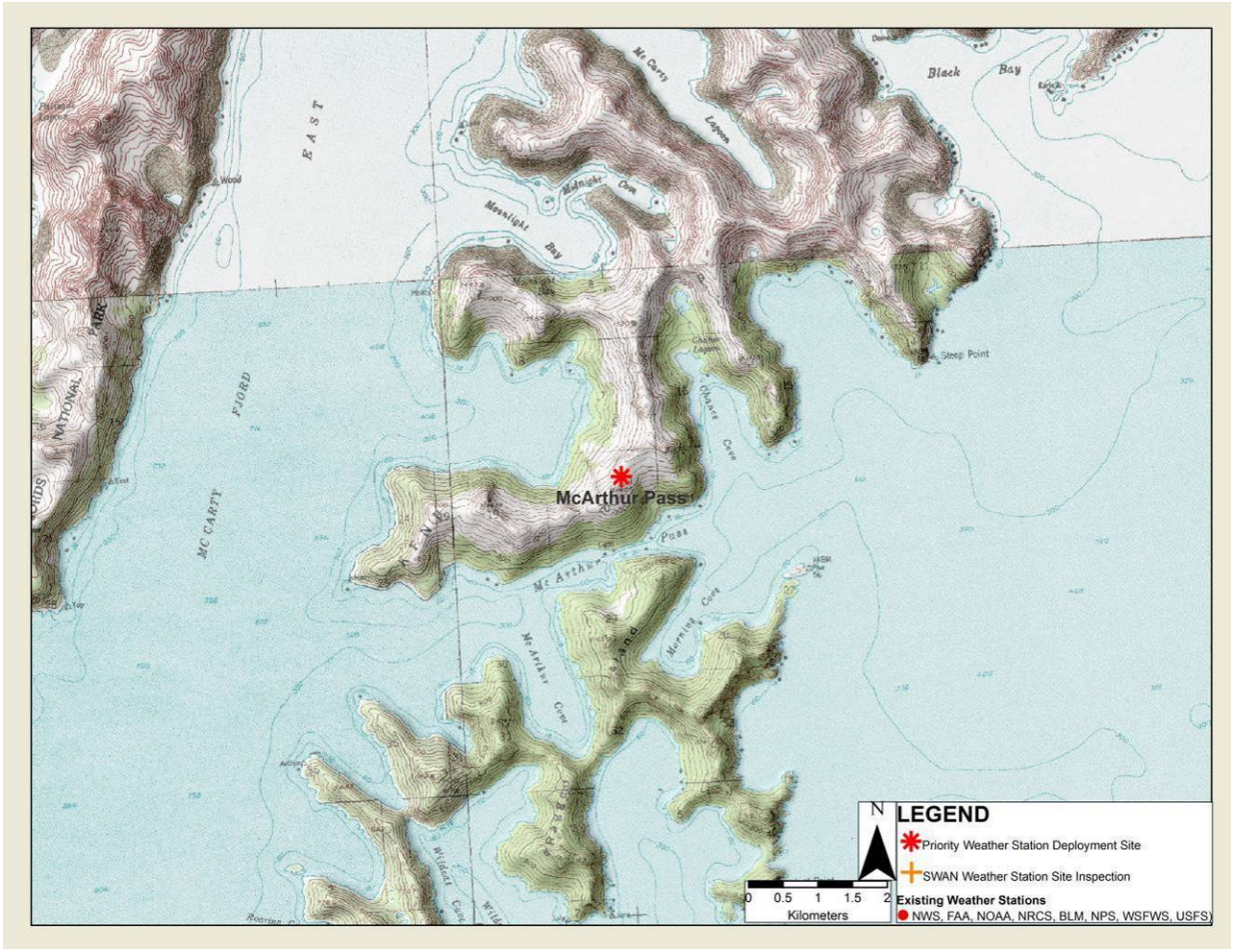


Figure 61. Detailed location of the MacArthur Pass site, Kenai Fjords National Park.

Figure 62. Looking south across the MacArthur Pass site, Kenai Fjords National Park.

Figure 63. Looking north across the MacArthur Pass site, Kenai Fjords National Park.

KENAI FJORDS NATIONAL PARK

SITE NAME: James Lagoon

LOCATION: 59.586956N; 150.407669W

Elevation: <25 ft
Slope: None, valley bottom
Aspect: --

Description:
Site is located in a narrow valley bottom hosting James Lagoon.

Weather observations at this site would be effected by the local topography.

Vegetation/Cover Conditions:
Beach grass and occasional dead spruce.

Surface Water:
Very wet and soft under foot.

Distance to Ocean:
170 meters (.105 miles) south to the ocean.

Obstructions:
No obstructions within ¼ mile.

However, the site is located within James Lagoon valley and is surrounded by mountains, which would certainly affect local weather observations. Mountains directly to the west rise to 2,500+ feet within 1.5 miles of the site. Mountains directly to the east rise to 1,500+ feet within 1.0 miles of the site.

Satellite antenna transmission:
Marginal SE – 18

Access:
Access via park boat.

Land Status
Kenai Fjords National Park - not wilderness

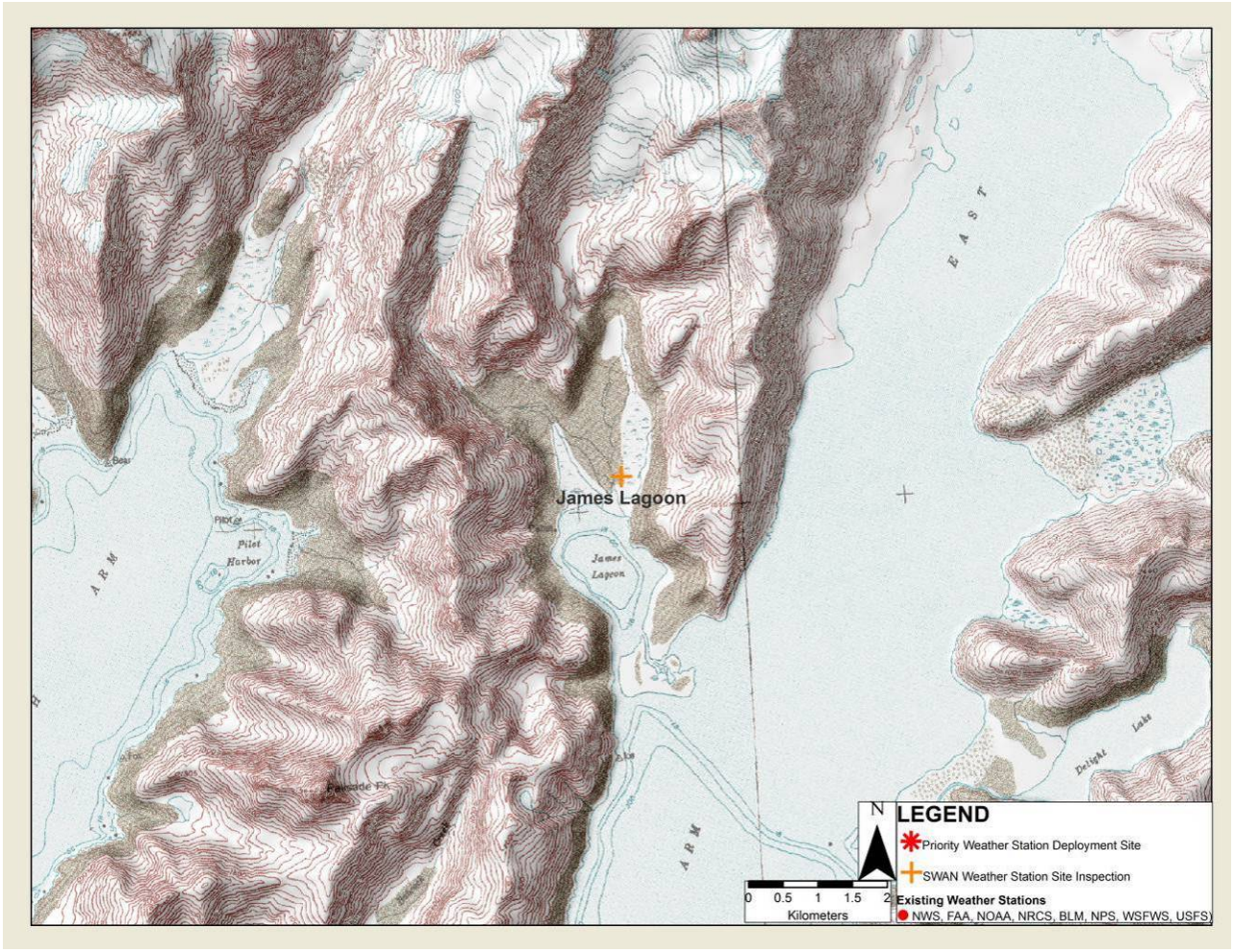


Figure 64. Detailed location of the James Lagoon site, Kenai Fjords National Park.

Figure 65. Looking south across the James Lagoon site, Kenai Fjords National Park.

KENAI FJORDS NATIONAL PARK

SITE NAME: Dinglstadt

LOCATION: 59.646352N; 150.323406W

Elevation: 400 ft
Slope: None, on top of a rounded bedrock knob.
Aspect: --

Description:
Site is located on a bedrock bench just beyond the Dingstadt Glacier.
The site is well exposed in all direction except the west and north. Weather observations would be affected by the proximity to the Dinglstadt Glacier and the extreme topography directly to the west.

Vegetation/Cover Conditions:
Alder, moss, grass.

Surface Water:
Dry. No surface water (lakes or streams) nearby. Ocean is within .4 miles. Dinglstadt Glacier is within .2 miles.

Distance to Ocean:
570 meters (.354 miles) east to the ocean.

Obstructions:
No obstructions within ¼ mile.

However, the site is located deep within McCarty Fjord and adjacent to the Dingstadt Glacier, which would certainly affect local weather observations. The site is surrounded by mountains with the nearest mountains directly to the west rising to 3,500+ feet within a mile of the site.

Satellite antenna transmission:
Clear

Access:
Access via park boat

There is a potential partnership opportunity with NPS radio shop to conduct annual maintenance.

Land Status
Kenai Fjords National Park - not wilderness

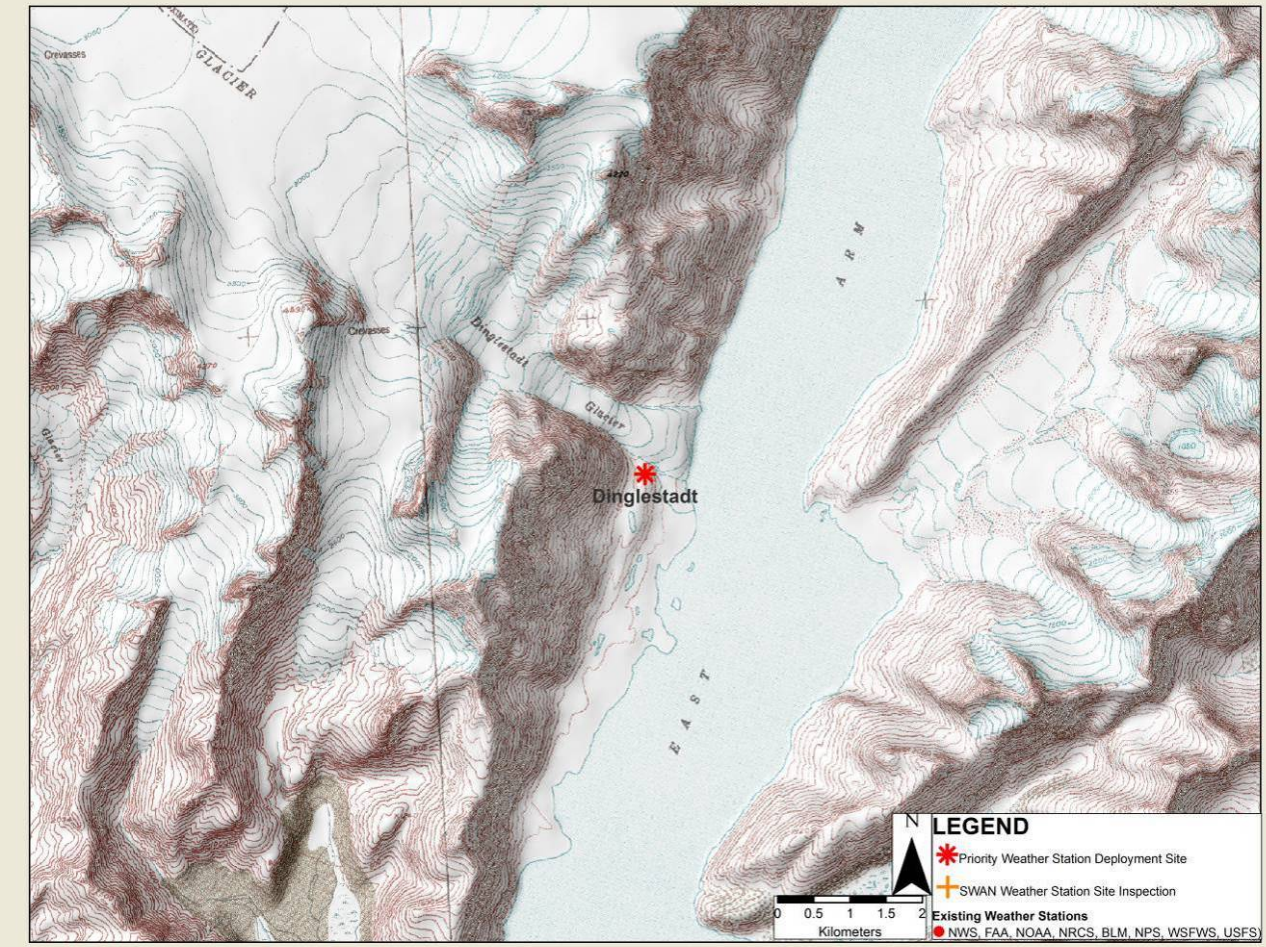


Figure 66. Detailed location of the Dinglestadt site, Kenai Fjords National Park.

Figure 67. Dinglestadt site is located on the low bedrock bench in the foreground (looking west from the beach), Kenai Fjords National Park.

KENAI FJORDS NATIONAL PARK

SITE NAME: Yalik

LOCATION: 59.441285N; 150.707861W

Elevation: 100 ft
Slope: None, glacial outwash plain
Aspect: --

Description:
Site is located on the outwash plain of the Yalik Glacier.

Vegetation/Cover Conditions:
Moss. Lichen, willow, spruce, alder

Surface Water:
Dry. No surface water (lakes or streams) nearby. The Yalik Glacier is located approximately 1 mile to the north.

Distance to Ocean:
1,300 meters (.807 miles) south to the ocean.

Obstructions:
No obstructions within ¼ mile.

However, weather observations would be affected by proximity to the Yalik Glacier and being in the floor of a valley.

Satellite antenna transmission:
Clear

Access:
Access via park boat or helicopter

Land Status
Kenai Fjords National Park - not wilderness

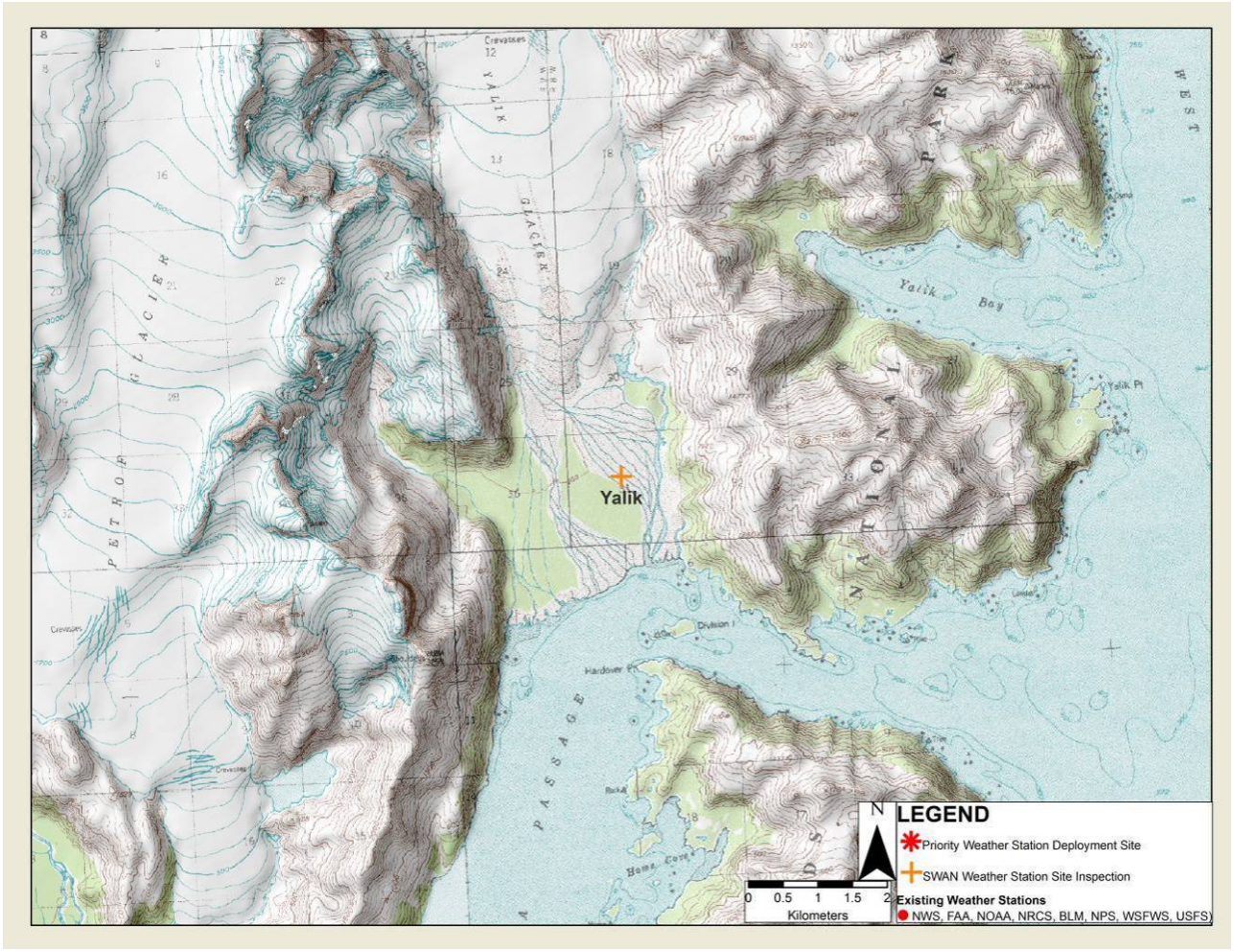
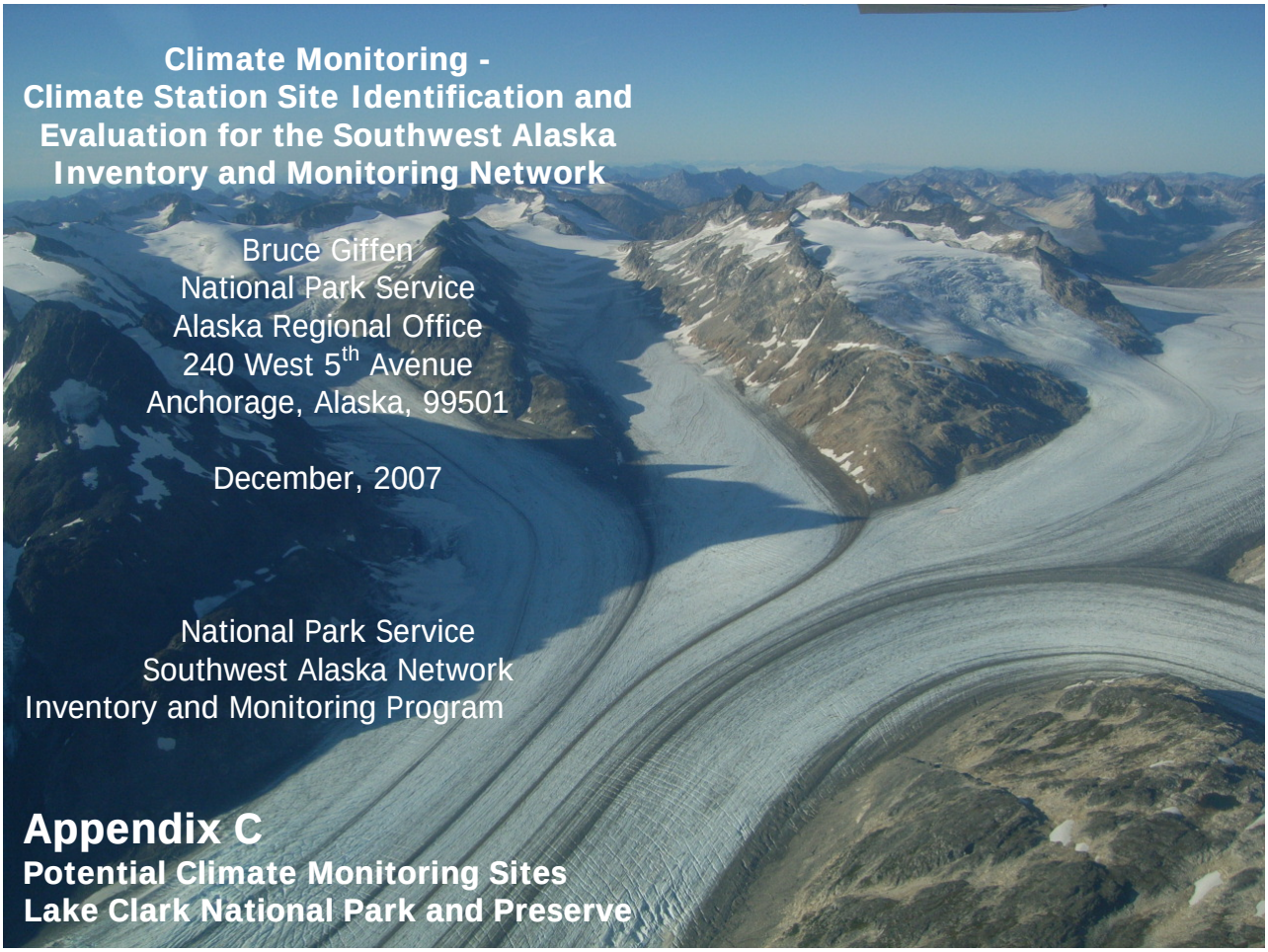


Figure 68. Detailed location of the Yalik site, Kenai Fjords National Park.

Figure 69. Looking south across the Yalik site, Kenai Fjords National Park.



Looking southwest across the Chigmit Mountains, Lake Clark National Park and Preserve.

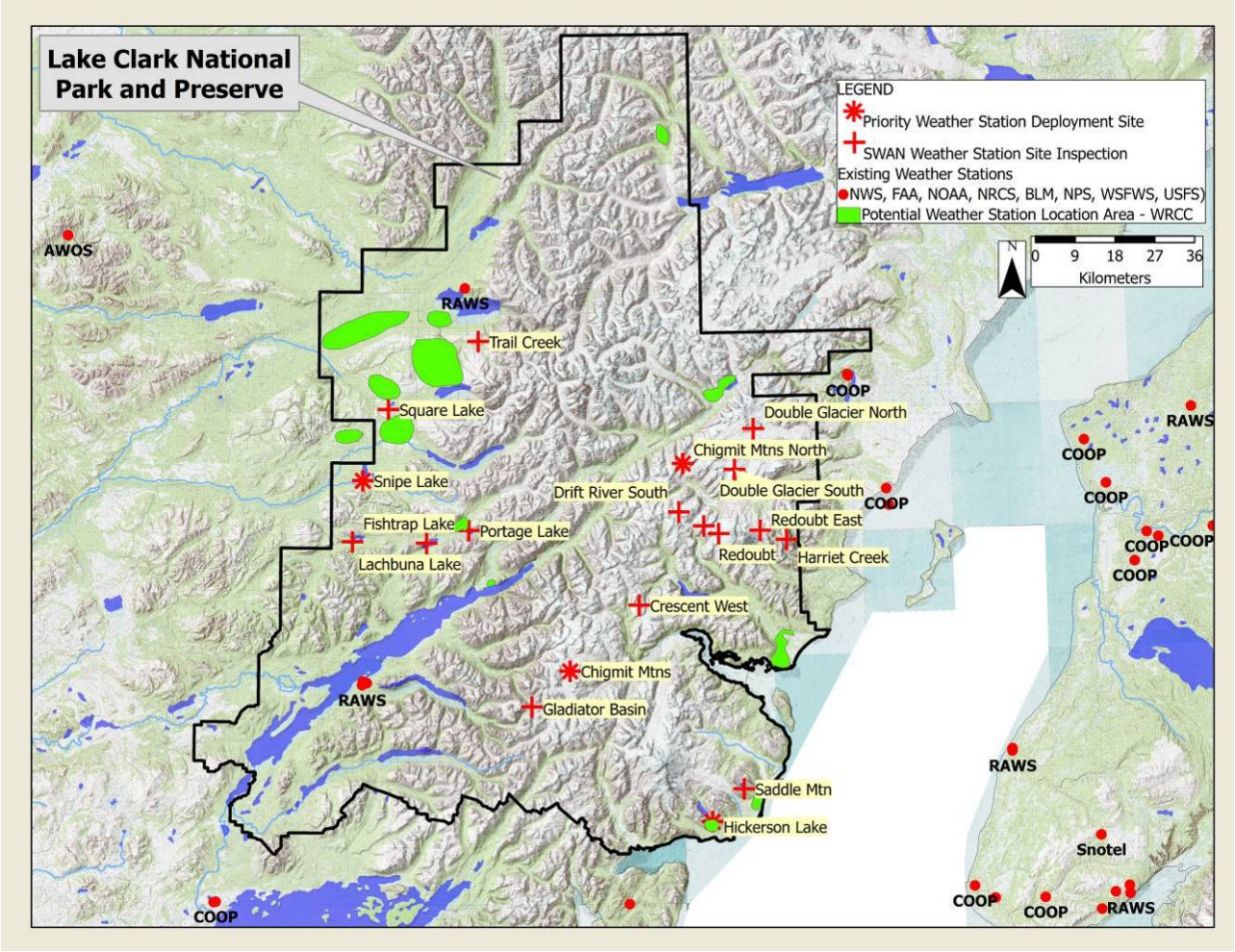


Figure 70. Lake Clark National Park and Preserve with potential and priority weather station sites.

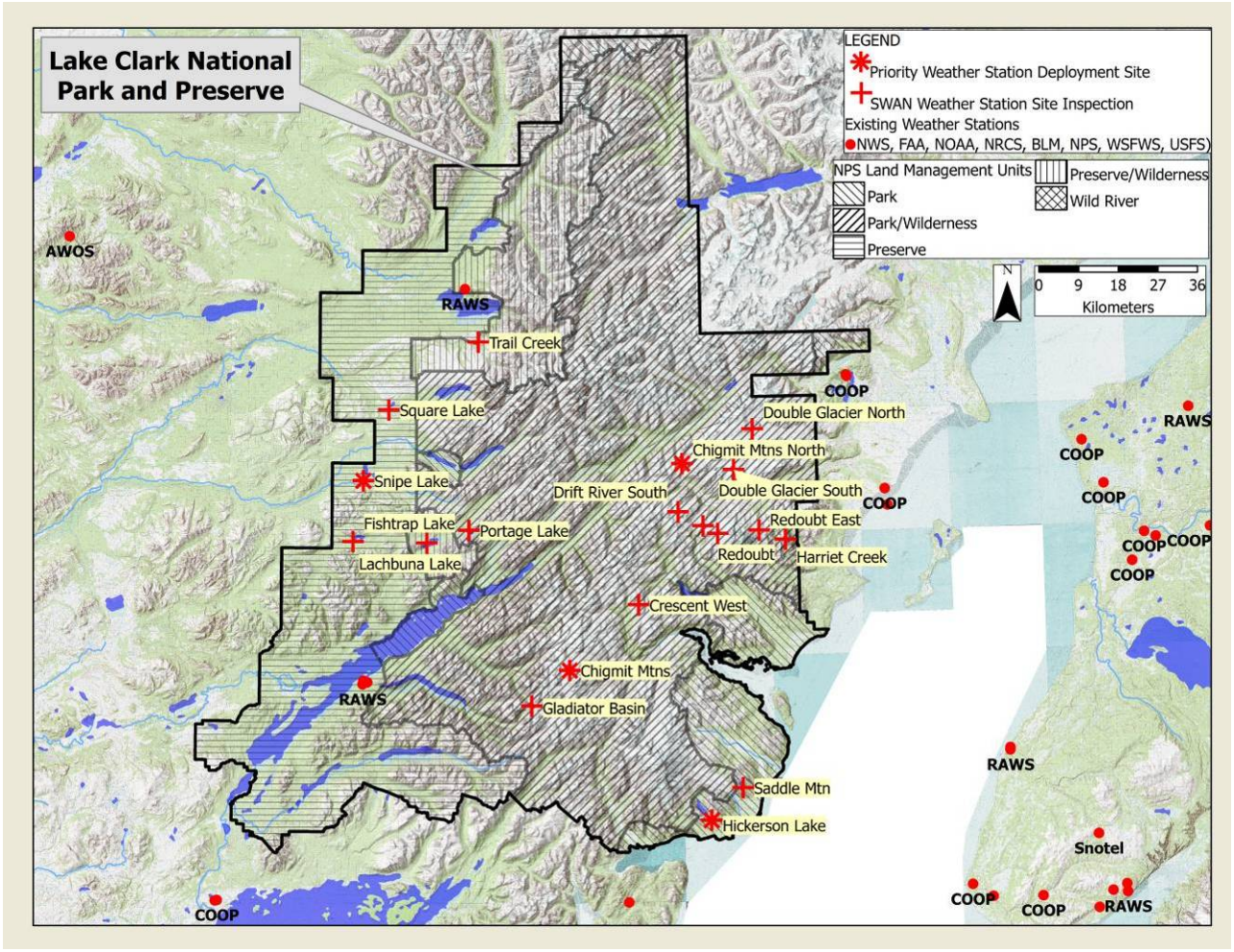


Figure 71. Land Management Units of Lake Clark National Park and Preserve with potential and priority weather station sites.

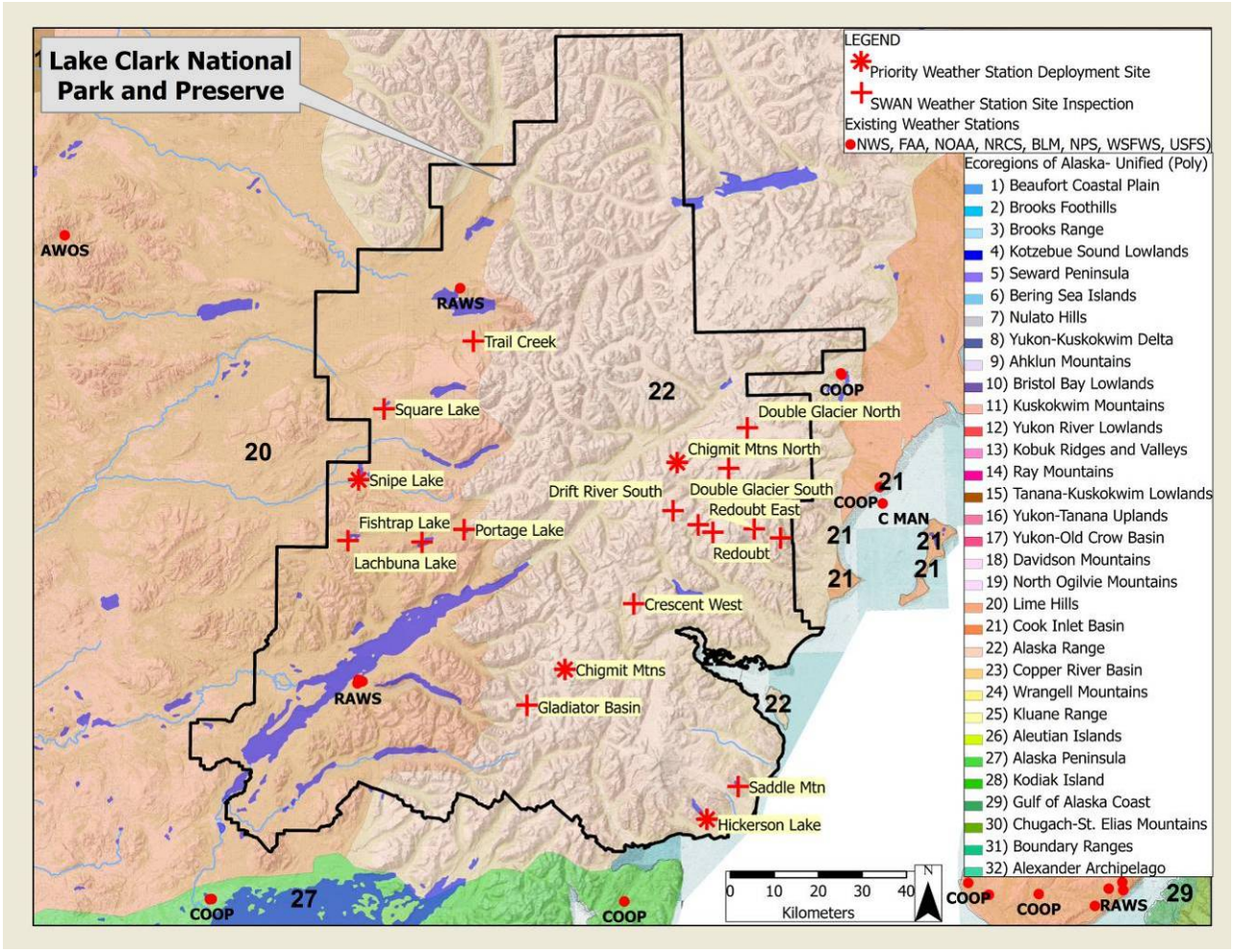


Figure 72. Ecoregions of Lake Clark National Park and Preserve with potential and priority weather station sites.

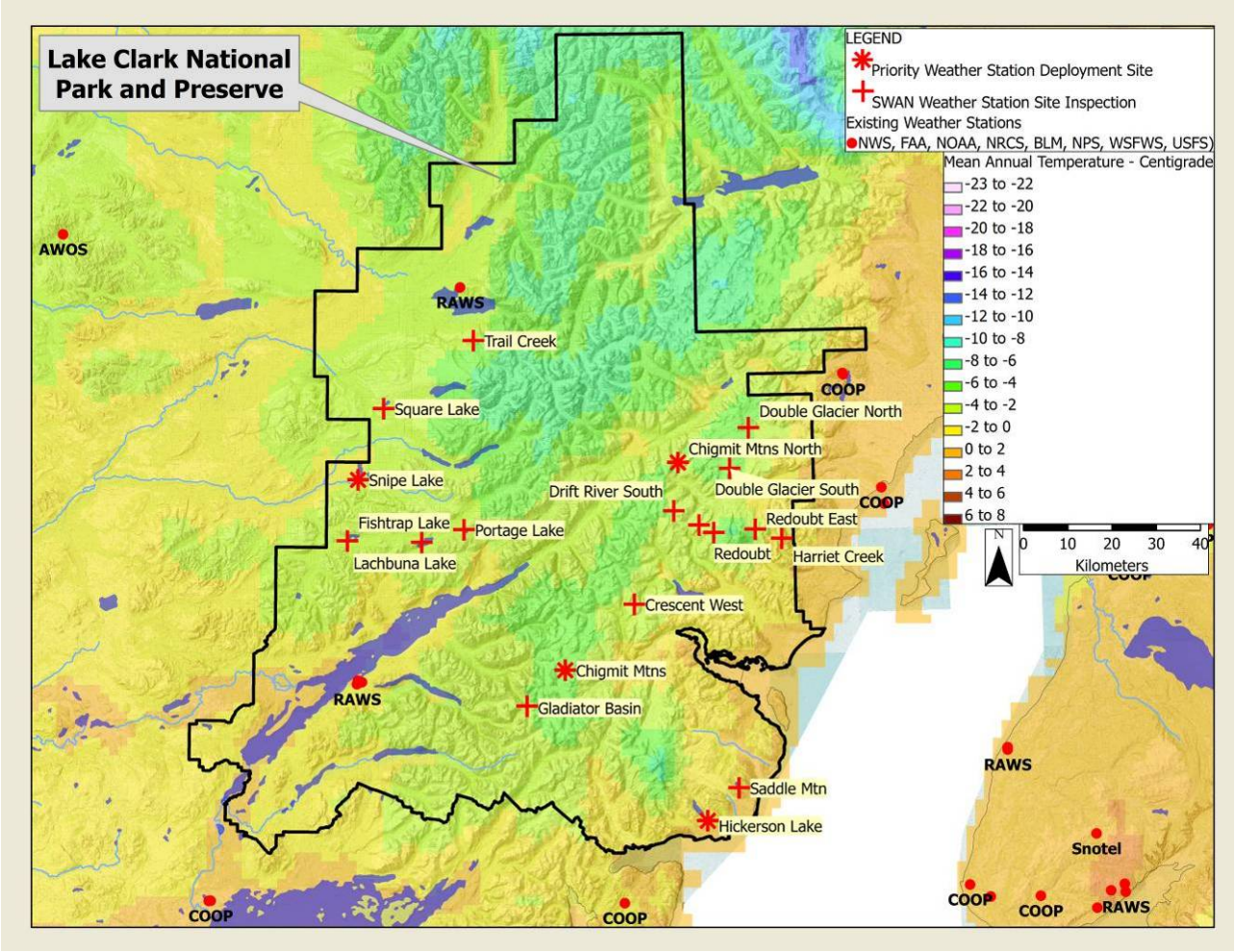


Figure 73. PRISM Temperature Model of Lake Clark National Park and Preserve with potential and priority weather station sites.

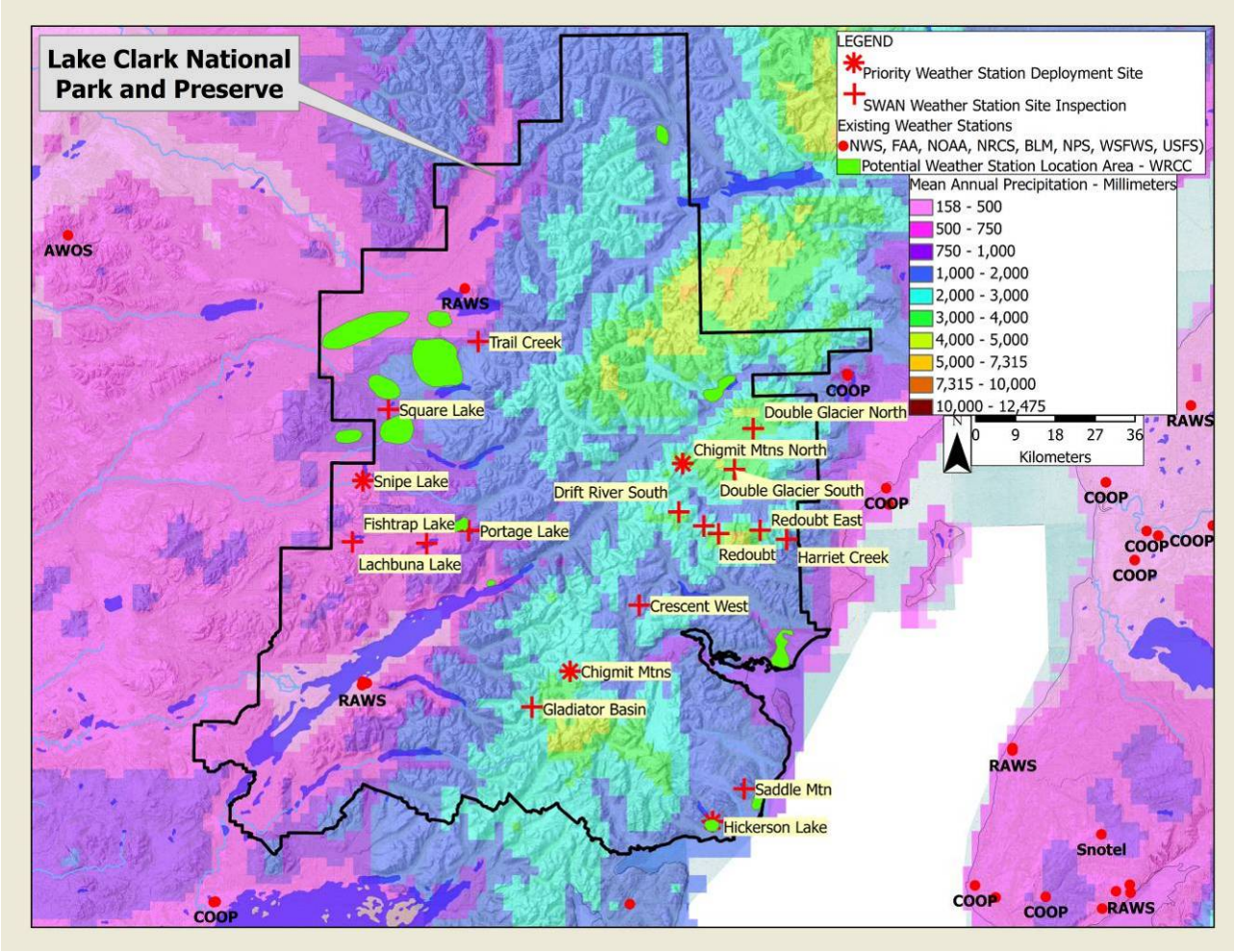


Figure 74. PRISM Precipitation Model of Lake Clark National Park and Preserve with potential and priority weather station sites.

LAKE CLARK NATIONAL PARK AND PRESERVE

SITE NAME: Gladiator Basin

LOCATION: 60.15091N, 153.623701W

Elevation: 3000 ft
Slope: top of rounded knob
Aspect: N/A
Type: Mountain

Description:
This site inspection was completed from the air.

This site is located near a small lake in a mountain pass in the Chigmit Mountains. The site is located just west of the pass in the Lake Clark basin. There are several bald rounded knobs near this small lake where a weather station could be deployed. This site is above the brush and tree line with typical alpine conditions.

Site is located within the confines of this broad mountain pass with the valley floor being approximately ½ mile wide and surrounding peaks rising to 5,500 feet or 1,500 feet above this site. The site being located in a mountain pass will be affected as topography influences weather systems as they move through the area.

Vegetation/Cover Conditions:
Though we didn't land at this site, the rounded knobs area appear to be exposed bedrock, likely fractured at the surface with mosses and lichens. No brush or trees in the area.

Surface Water:
Any potential weather station would be placed on the top of a rounded knob, thus the site is dry. A small lake (<100 acres) lies within ¼ of the deployment site.

Obstructions:
No manmade obstructions. This site will be topographically influenced being located in a mountain pass.

Satellite antenna transmission:
Clear horizon for satellite transmission (horizon approximately 8 degree to the SE)

Access:
Fixed-wing on skis or helicopter. Typical access to this site would be via ski-plane in a mid-March through April time-frame.

Land Status
Lake Clark National Park – Wilderness

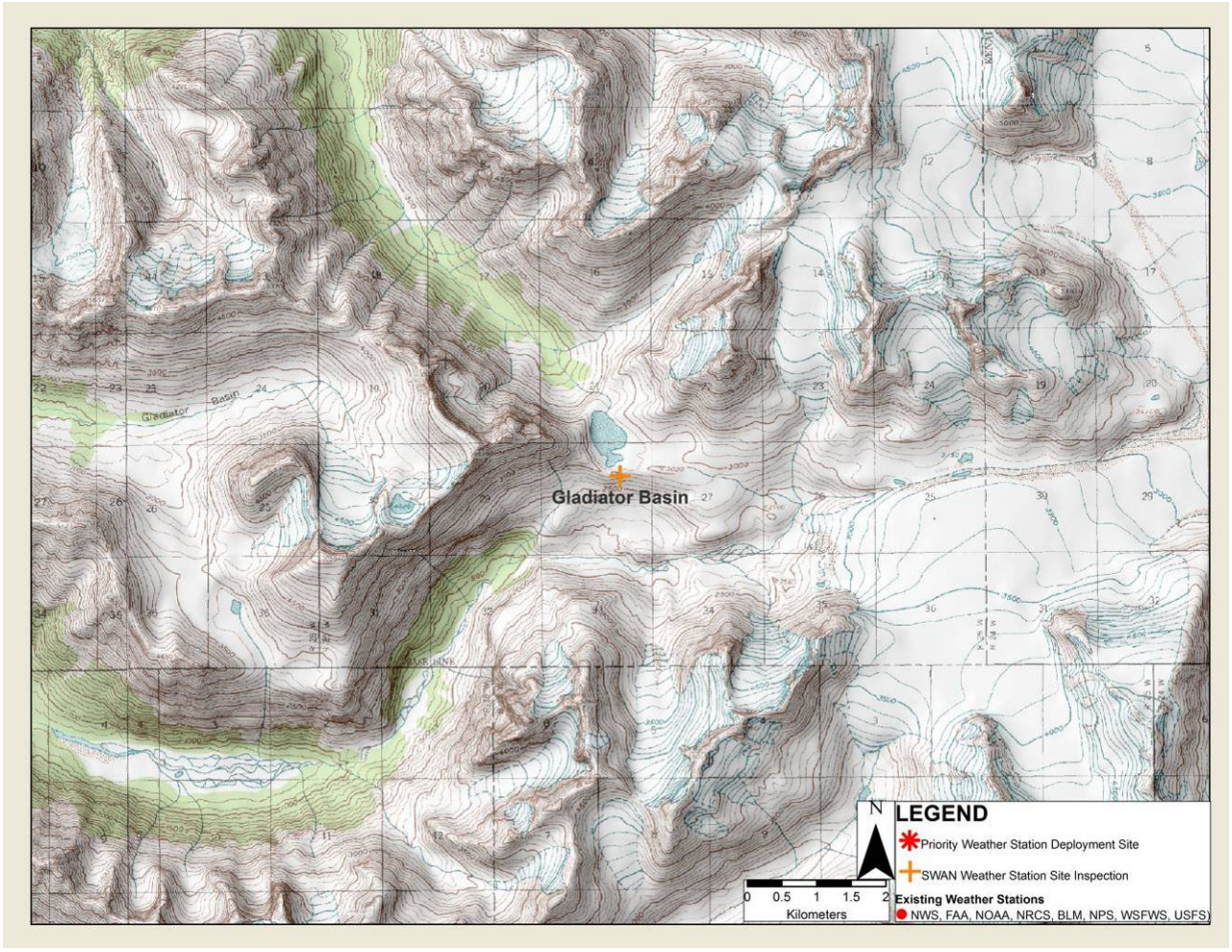


Figure 75. Detailed location of the Gladiator Basin site, Lake Clark National Park and Preserve.

Figure 76. Looking northwest across the Gladiator Basin site, Lake Clark National Park and Preserve.

LAKE CLARK NATIONAL PARK AND PRESERVE

SITE NAME: Chigmit Mtns

LOCATION: 60.223321N, 153.466436W

Elevation: 4,500 ft
Slope: Nunatak, nearly level
Aspect: --
Type: Mountain

Description:
This site inspection was completed from the air.

This site is located on a nunatak in the heart of the Chigmit Mountains. The orientation of the nunatak is northeast-southwest and it is approximately 1-mile long. The north end of this nunatak is very ragged and inhospitable for a weather station. The southern extent of the nunatak is rounded and would be suitable for weather station deployment. The high point of the nunatak is 4,700 feet approximately ¼ mile north and 300 feet above the deployment site.

Site is located at a high elevation in the heart of the Chigmit Mountains. Excellent regional exposure. Unobstructed views in all directions. Huge drifts around this nunatak speak to the consistent winds at this elevation.

Vegetation/Cover Conditions:
Though we didn't land at this site, it is expected that this site is exposed bedrock with lichens, likely fractured at the surface.

Surface Water:
This site is dry.

Obstructions:
No manmade obstructions. Though located in the mountains, this site located on a nunatak, a topographic high, so no topographic funneling of weather would be expected at this site.

Satellite antenna transmission:
Clear horizon for satellite transmission

Access:
Fixed-wing on skis or helicopter. Typical access to this site would be via ski-plane in a mid-March through April time-frame.

Land Status
Lake Clark National Park – Wilderness

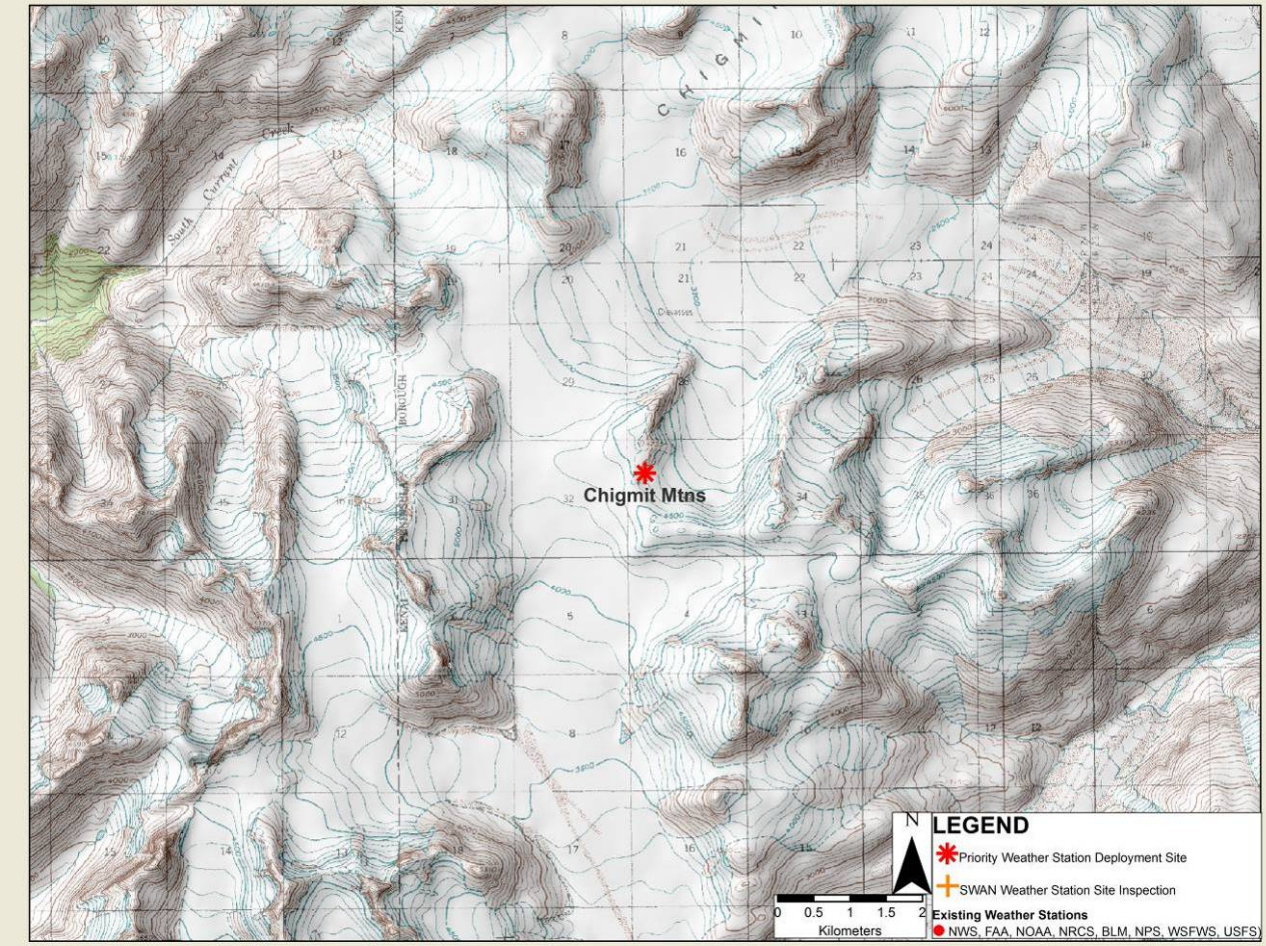


Figure 77. Detailed location of the Chigmit Mountain site, Lake Clark National Park and Preserve.

Figure 78. Looking northeast across the Chigmit Mountain site, Lake Clark National Park and Preserve.

Figure 79. Looking southwest across the Chigmit Mountain site, Lake Clark National Park and Preserve.

LAKE CLARK NATIONAL PARK AND PRESERVE

SITE NAME: Crescent West

LOCATION: 60.355593N, 153.180136W

Elevation: 3,500 ft
Slope: rounded north-facing ridgeline/alpine area
Aspect: north
Type: Mountain

Description:
This site inspection was completed from the air.

This site is located on a ridgeline/alpine area in the heart of the Chigmit Mountains six miles west-southwest of Crescent Lake. The orientation of the ridge is northwest-southeast. The ridge is swept clean of snow. There would be several sites along the ridge acceptable for weather station deployment.

Site is located at a high elevation in the heart of the Chigmit Mountains. Good regional exposure. Mostly unobstructed views, though the terrain rises above this site along the ridgeline to the southeast.

Vegetation/Cover Conditions:
Though we didn't land at this site, it is expected that this site is exposed bedrock with lichens, likely fractured at the surface.

Surface Water:
This site is dry.

Obstructions:
No manmade obstructions. This site is located in the mountains on a ridgeline/alpine area, thus no topographic funneling of weather would be expected at this site.

Satellite antenna transmission:
Clear horizon for satellite transmission

Access:
Fixed-wing on skis or helicopter. Typical access to this site would be via ski-plane in a mid-March through April time-frame. This site would require a landing and then up to a mile hike on skis or foot to access the site.

Land Status
Lake Clark National Park – Wilderness

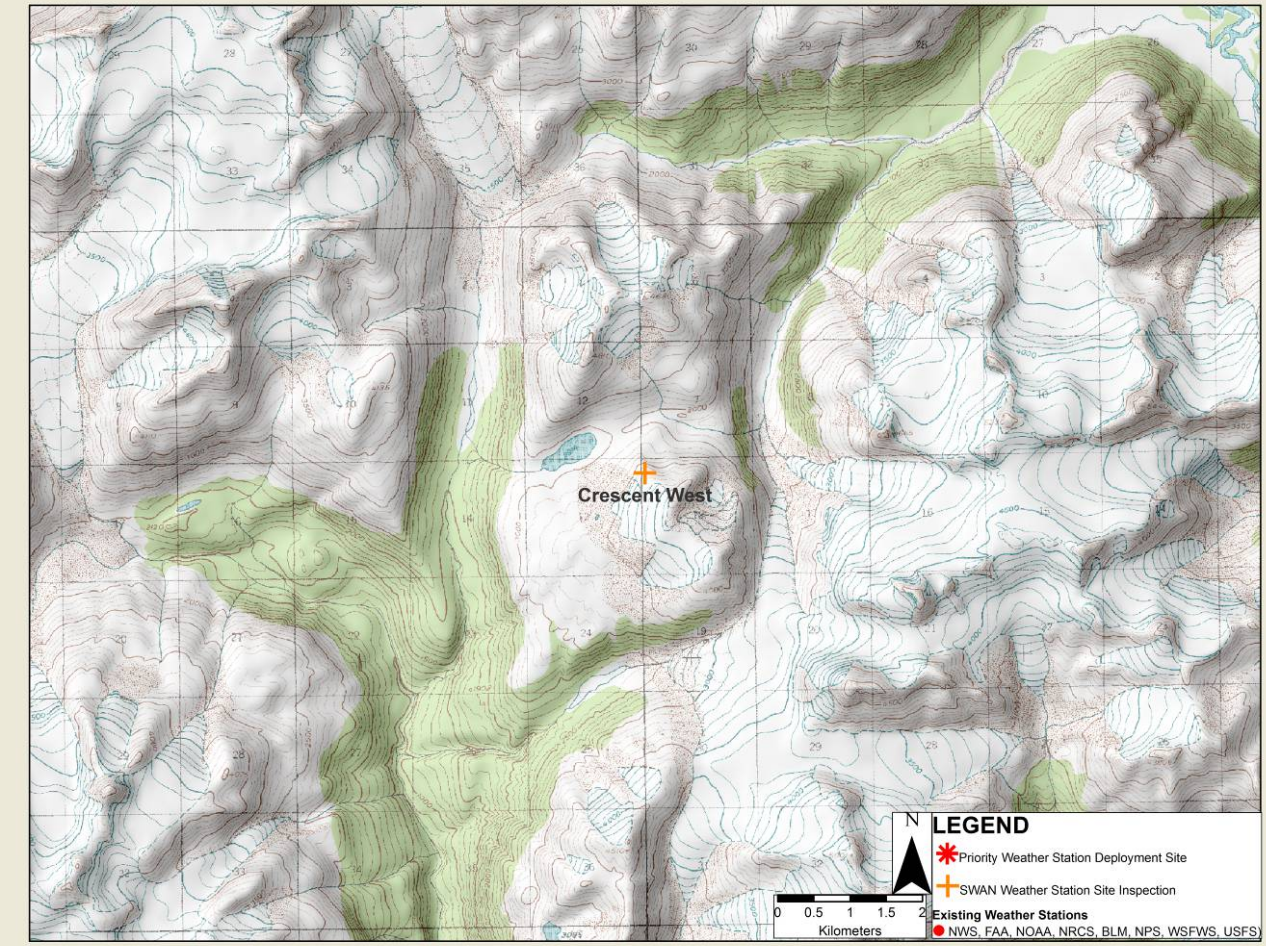


Figure 80. Detailed location of the Crescent West site, Lake Clark National Park and Preserve.

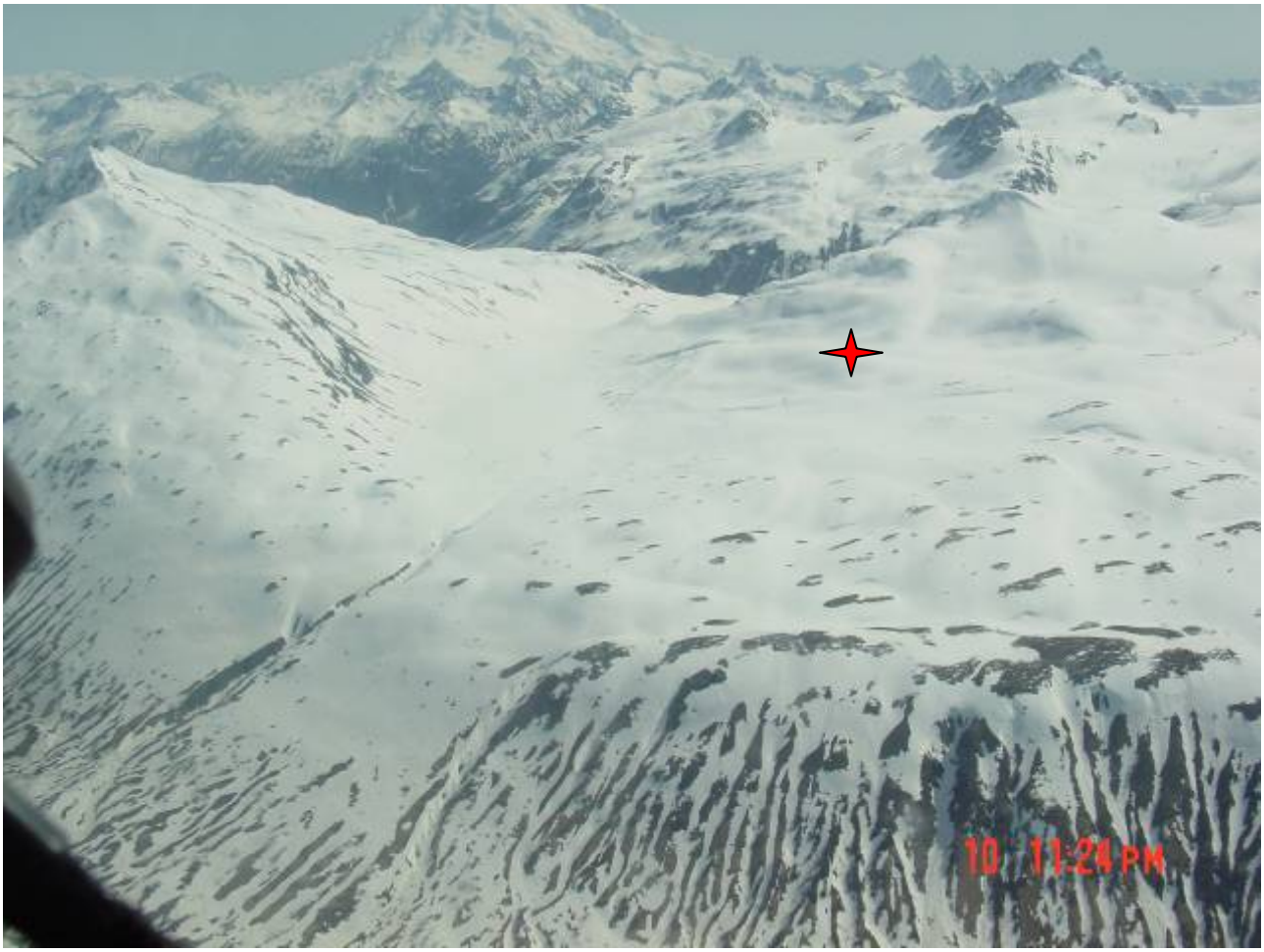


Figure 81. Looking northeast across the Crescent West site. Redoubt is the volcano in the background, Lake Clark National Park and Preserve.

LAKE CLARK NATIONAL PARK AND PRESERVE

SITE NAME: Redoubt

LOCATION: 60.49843N, 152.847952 W

Elevation: 4,600 ft
Slope: West facing slope of Redoubt Volcano
Aspect: West
Type: Mountain

Description:
This site inspection was completed from the air.

This site is located on the west slope of Redoubt Volcano at approximately 4,500 feet elevation. A bench/shoulder at this point on Redoubt may afford fixed-wing landing with skis. Though technically not sitting on a nunatak, the site is largely surrounded by glaciers. Exposed bedrock in the area is swept clean of snow and would be suitable for weather station deployment.

This site affords excellent regional exposure to the south-west-north direction. However, the very large Redoubt Volcano rises to an elevation of over 10,000 feet just three miles to the east and dominates the topography in the area. Being a very dominate topographic feature here, Redoubt Volcano certainly impart strong localized weather conditions on this site.

Vegetation/Cover Conditions:
Though we didn't land at this site, it is expected that this site is exposed bedrock with lichens, likely fractured at the surface.

Surface Water:
This site is dry.

Obstructions:
No manmade obstructions. Redoubt Volcano rises to over 10,000 feet, three miles to the east of this site.

Satellite antenna transmission:
Clear horizon for satellite transmission

Access:
Fixed-wing on skis or helicopter. Typical access to this site would be via ski-plane in a mid-March through April time-frame. This site would require a landing and then a hike on skis or foot to access the site.

Land Status
Lake Clark National Park - Wilderness

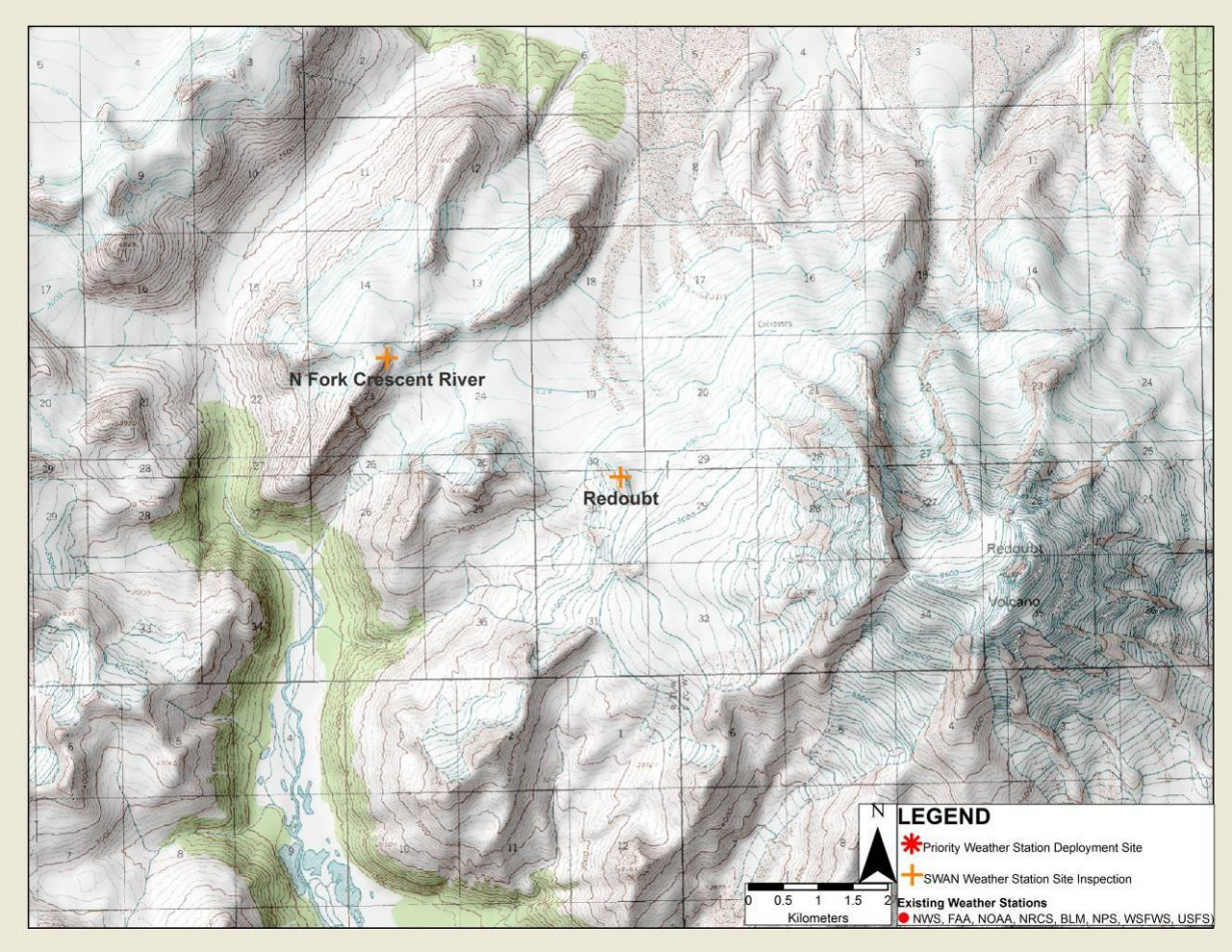


Figure 82. Detailed location of the Redoubt site, Lake Clark National Park and Preserve.

Figure 83. Looking southeast across the Redoubt site. Nunatak in foreground is the potential site, Lake Clark National Park and Preserve.

LAKE CLARK NATIONAL PARK AND PRESERVE

SITE NAME: North Fork Crescent River

LOCATION: 60.514223N, 152.908669 W

Elevation: 4,000 ft
Slope: West facing slope of Redoubt Volcano
Aspect: West
Type: Mountain

Description:
This site inspection was completed from the air.

This site is located on the west slope of Redoubt Volcano at approximately 3,500 feet elevation and at the headwaters of the North Fork Crescent River. A bench/shoulder at this point on Redoubt may afford fixed-wing landing with skis. Though technically not sitting on a nunatak, the site is largely surrounded by glaciers. Rounded exposed bedrock in the area is swept clean of snow and would be suitable for weather station deployment.

This site affords excellent regional exposure to the south-west-north direction. However, the very large Redoubt Volcano rises to an elevation of over 10,000 feet just six miles to the east and dominates the topography in the area. Being a very dominate topographic feature here, Redoubt Volcano certainly impart strong localized weather conditions on this site. Winds here may be topographically affected by funneling effect here between Redoubt Volcano and the Chigmit Mountains.

Vegetation/Cover Conditions:
Though we didn't land at this site, it is expected that this site is exposed bedrock with lichens, likely fractured at the surface.

Surface Water:
This site is dry.

Obstructions:
No manmade obstructions. Reboubt Volcano rises to over 10,000 feet, six miles to the east of this site.

Satellite antenna transmission:
Clear horizon for satellite transmission

Access:
Fixed-wing on skis or helicopter. Typical access to this site would be via ski-plane in a mid-March through April time-frame. This site would require a landing and then a hike on skis or foot to access the site.

Land Status
Lake Clark National Park - Wilderness

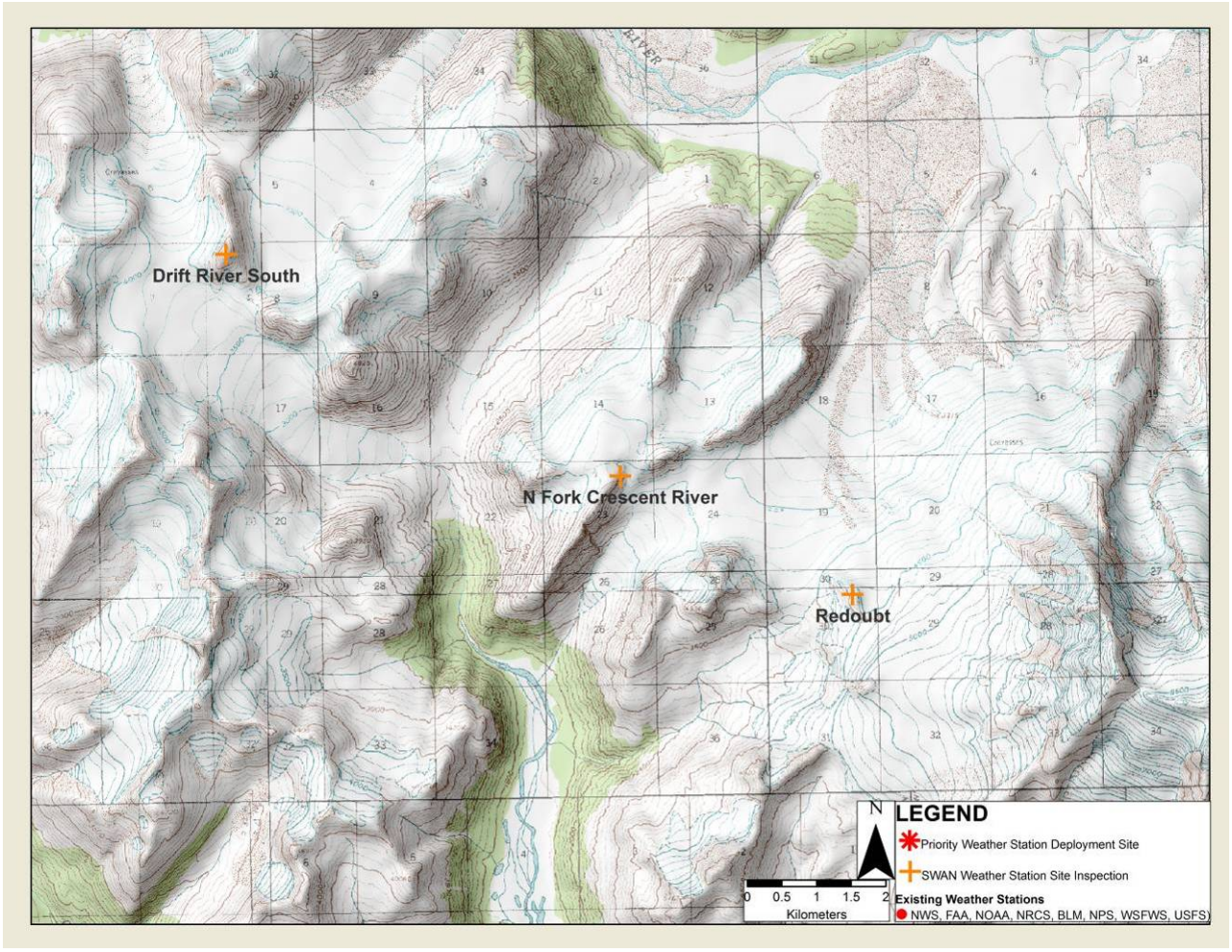


Figure 84. Detailed location of the North Fork Crescent River site, Lake Clark National Park and Preserve.

Figure 85. Looking east across the North Fork Crescent River site, Lake Clark National Park and Preserve.

LAKE CLARK NATIONAL PARK AND PRESERVE

SITE NAME: Drift River - South

LOCATION: 60.543643N, 153.011637 W

Elevation: 4,900 ft
Slope: north-south oriented ridgeline
Aspect: --
Type: Mountain

Description:
This site inspection was completed from the air.

This site is located on a north-south oriented ridge, three to four miles south of the upper reaches of the Drift River. Though technically not sitting on a nunatak, the site is largely surrounded by glaciers. The site is located in high mountain terrain separating the Drift and Crescent River drainages. Rounded exposed bedrock of the ridge in the area is swept clean of snow and would be suitable for weather station deployment.

Broad flat-lying glacier ice may afford fixed-wing landing with skis, however, access to the ridge by foot from the landing site would be across very steep rocky terrain.

This site affords excellent regional exposure to the south-west-north direction. Redoubt Volcano rises to an elevation of over 10,000 feet just eleven miles to the east and dominates the topography in the area. Being a very dominate topographic feature here, Redoubt Volcano certainly impart strong localized weather conditions on this site. Winds here may be topographically affected by funneling effect here between Redoubt Volcano and the Chigmit Mountains.

Vegetation/Cover Conditions:
Though we didn't land at this site, it is expected that this site is exposed bedrock with lichens, likely fractured at the surface.

Surface Water:
This site is dry.

Obstructions:
No manmade obstructions. Redoubt Volcano rises to over 10,000 feet, eleven miles to the southeast of this site.

Satellite antenna transmission:
Clear horizon for satellite transmission

Access:
Fixed-wing on skis or helicopter. Typical access to this site would be via ski-plane in a mid-March through April time-frame. This site would require a landing and then a very arduous hike on skis or foot to access the site.

Land Status
Lake Clark National Park - Wilderness

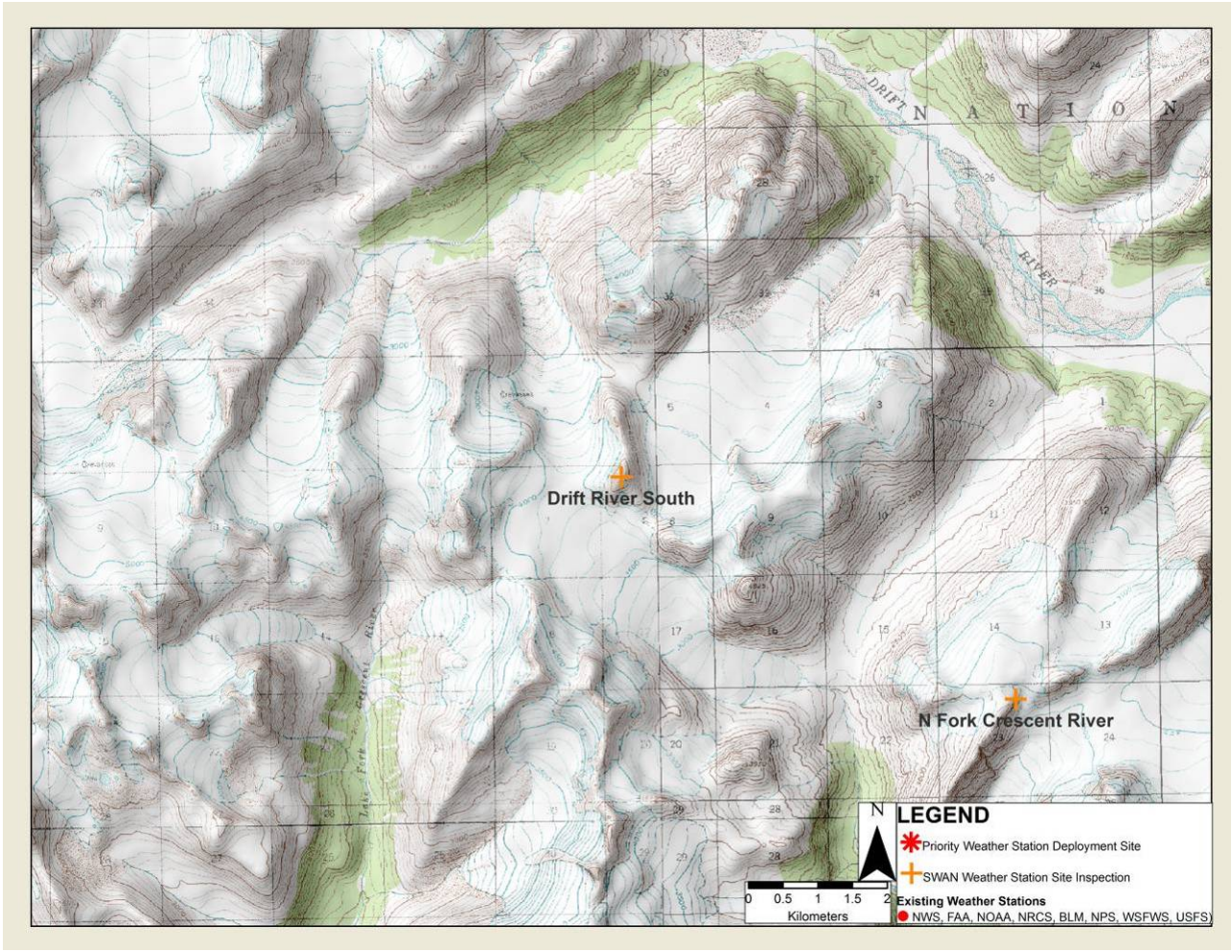


Figure 86. Detailed location of the Drift River South site, Lake Clark National Park and Preserve.

Figure 87. Looking northeast across the Drift River South site, Lake Clark National Park and Preserve.

LAKE CLARK NATIONAL PARK AND PRESERVE

SITE NAME: Chigmit Mtns North

LOCATION: 60.641982N; 152.991716W

Elevation: 4,400 ft
Slope: rounded hilltop
Aspect: --
Type: Mountain

Description:
This site inspection was completed from the air.

This site is located on an exposed hilltop in the north Chigmit Mountains near the head of the Drift River. The site is located in an area of more subdued topography approximately 1,500 above the Drift River valley floor. Surrounding topography rises to 5,000 ft within 1.5 miles to the west, north and east of the site. The topography drops to the south into the Drift River valley from the site. This site is rounded and would be suitable for weather station deployment.

Based on the snow-drift orientation here the, the prevailing wind is from the northeast. Even though higher topography occurs to the west, north and east (within 1.5 miles of the site), the regional exposure is pretty good. The site is not located in a valley.

Vegetation/Cover Conditions:
Though we didn't land at this site, it is expected that this site is exposed bedrock with lichens, likely fractured at the surface.

Surface Water:
This site is dry.

Obstructions:
No manmade obstructions. Ridgelines and mountain tops rise to 5,000 within 1.5 miles of the site to the west, north and east.

Satellite antenna transmission:
Clear horizon for satellite transmission

Access:
Fixed-wing on skis or helicopter. Typical access to this site would be via ski-plane in a mid-March through April time-frame.

Land Status
Lake Clark National Park – Wilderness

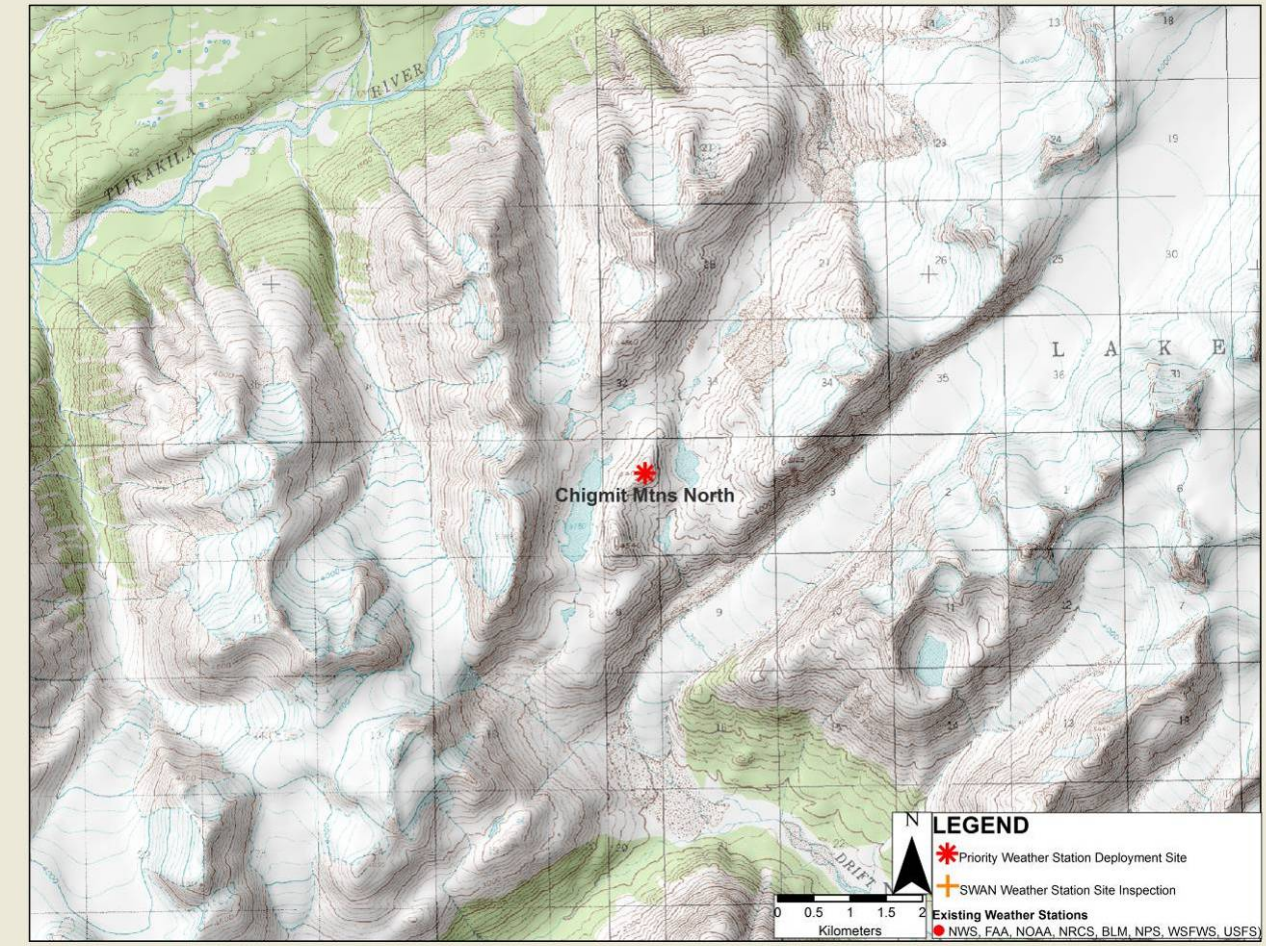


Figure 88. Detailed location of the Chigmit Mountains North site, Lake Clark National Park and Preserve.

Figure 89. Looking north across the Chigmit Mtns North site, Lake Clark National Park and Preserve.

LAKE CLARK NATIONAL PARK AND PRESERVE

SITE NAME: Double Glacier North

LOCATION: 60.710083N, 152.696139 W

Elevation: 3,500 ft
Slope: gentle
Aspect: southeast
Type: Nunatak

Description:
This site inspection was completed from the air.

This site is located on a nunatak at 3,500 on the north side of the middle Double Glacier. Rounded exposed bedrock of the nunatak is swept clean of snow and would be suitable for weather station deployment.

Broad flat-lying glacier ice may afford fixed-wing landing with skis, though there were exposed crevasses in the area. **Fixed-wing operations here would not be safe.**

This site affords excellent regional exposure in all directions. Redoubt Volcano rises to an elevation of over 10,000 feet just 15 miles to the south.

Vegetation/Cover Conditions:
Though we didn't land at this site, it is expected that this site is exposed bedrock with lichens, likely fractured at the surface.

Surface Water:
This site is dry.

Obstructions:
No manmade obstructions. Redoubt Volcano rises to over 10,000 feet, eleven miles to the southeast of this site.

Satellite antenna transmission:
Clear horizon for satellite transmission

Access:
Fixed-wing on skis or helicopter. **Crevasses in the area make fix-wing access unsafe.**

Land Status
Lake Clark National Park - Wilderness

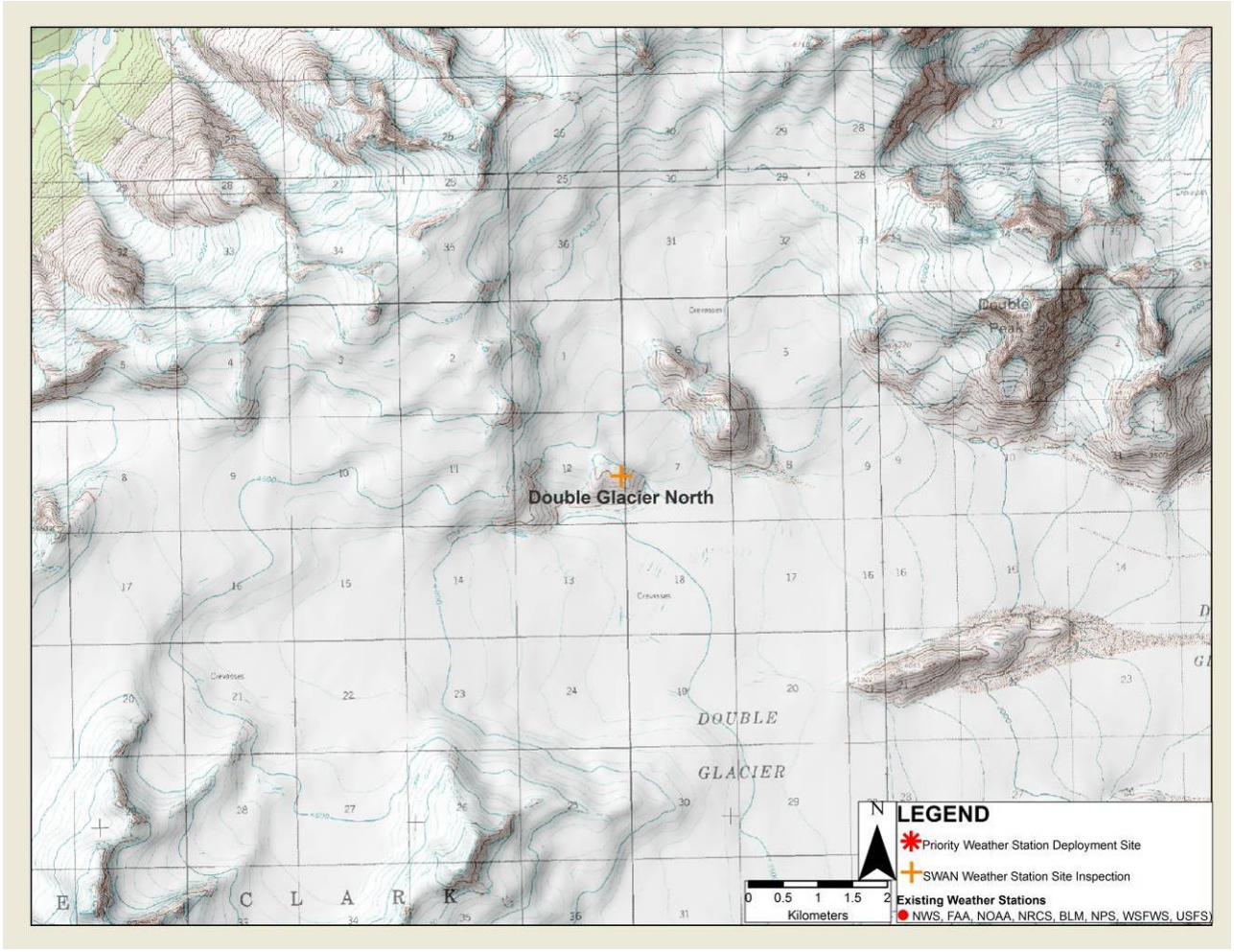


Figure 90. Detailed location of the Double Glacier North site, Lake Clark National Park and Preserve.

Figure 91. Looking north across the Double Glacier North site. Site would be located on the near nunatak, Lake Clark National Park and Preserve.

LAKE CLARK NATIONAL PARK AND PRESERVE

SITE NAME: Double Glacier South

LOCATION: 60.628083N, 152.777232 W

Elevation: 5,000 ft
Slope: rugged rocky ridgeline
Aspect: --
Type: Nunatak

Description:
This site inspection was completed from the air.

This site is located on a nunatak at 5,000 on the south side of the middle Double Glacier. This rugged exposed bedrock nunatak is swept clean of snow. The rugged nature of this nunatak would make deployment of a weather station very difficult to install and access for annual maintenance.

Poor landing options for fixed-wing operations. **Fixed-wing operations here would not be safe.**

This site affords excellent regional exposure in all directions. Redoubt Volcano rises to an elevation of over 10,000 feet just nine miles to the south.

Vegetation/Cover Conditions:
Though we didn't land at this site, it is expected that this site is exposed bedrock with lichens, likely fractured at the surface.

Surface Water:
This site is dry.

Obstructions:
No manmade obstructions. Redoubt Volcano rises to over 10,000 feet, eleven miles to the southeast of this site.

Satellite antenna transmission:
Clear horizon for satellite transmission

Access:
Fixed-wing on skis or helicopter. **Crevasses in the area make fix-wing access unsafe.**

Land Status
Lake Clark National Park - Wilderness

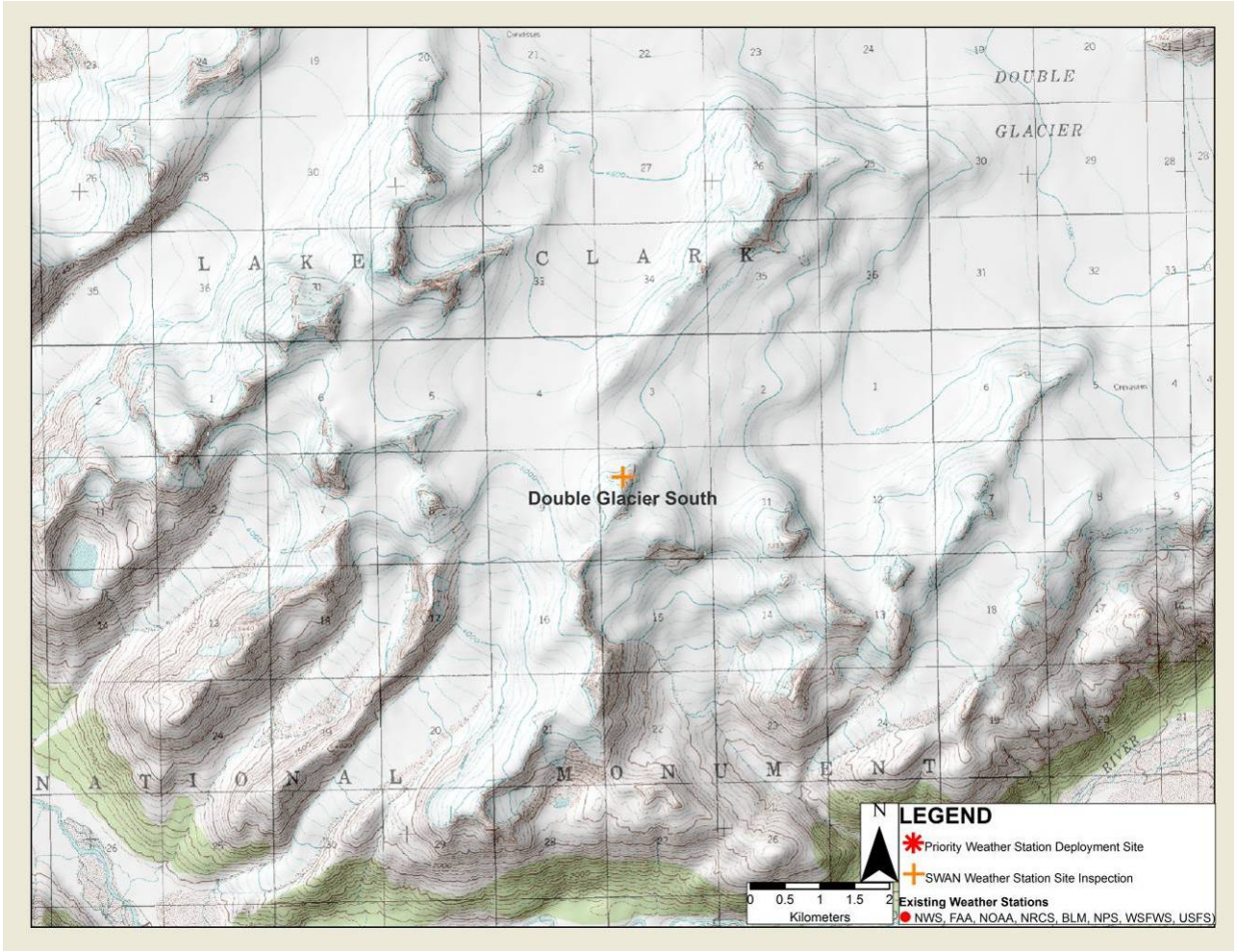


Figure 92. Detailed location of the Double Glacier South site, Lake Clark National Park and Preserve.

Figure 93. Looking northwest across the Double Glacier South site. Site would be located on the near nunatak, Lake Clark National Park and Preserve.

LAKE CLARK NATIONAL PARK AND PRESERVE

SITE NAME: Harriet Creek

LOCATION: 60.484061N, 152.56714 W

Elevation: 4,500 ft
Slope: northwest-southeast trending ridgeline
Aspect: northwest
Type: Mountain

Description:
This site inspection was completed from the air.

This site is located 6 miles east of Redoubt Volcano at approximately 4,500 feet elevation. A broad gently lying glacier just west of Harriet Creek may afford fixed-wing landing with skis. Exposed bedrock in the area is swept clean of snow and would be suitable for weather station deployment.

This site affords excellent regional exposure to the north-east-south direction. However, the very large Redoubt Volcano rises to an elevation of over 10,000 feet just six miles to the west and dominates the topography in the area. Being a very dominate topographic feature here, Redoubt Volcano may impart localized weather conditions on this site.

Vegetation/Cover Conditions:
Though we didn't land at this site, it is expected that this site is exposed bedrock with lichens, likely fractured at the surface.

Surface Water:
This site is dry.

Obstructions:
No manmade obstructions. Redoubt Volcano rises to over 10,000 feet, six miles to the west of this site.

Satellite antenna transmission:
Clear horizon for satellite transmission

Access:
Fixed-wing on skis or helicopter. **Characteristics of potential fixed-wing landing areas here make this are unsafe for fix-wing operations.**

Land Status
Lake Clark National Park - Wilderness

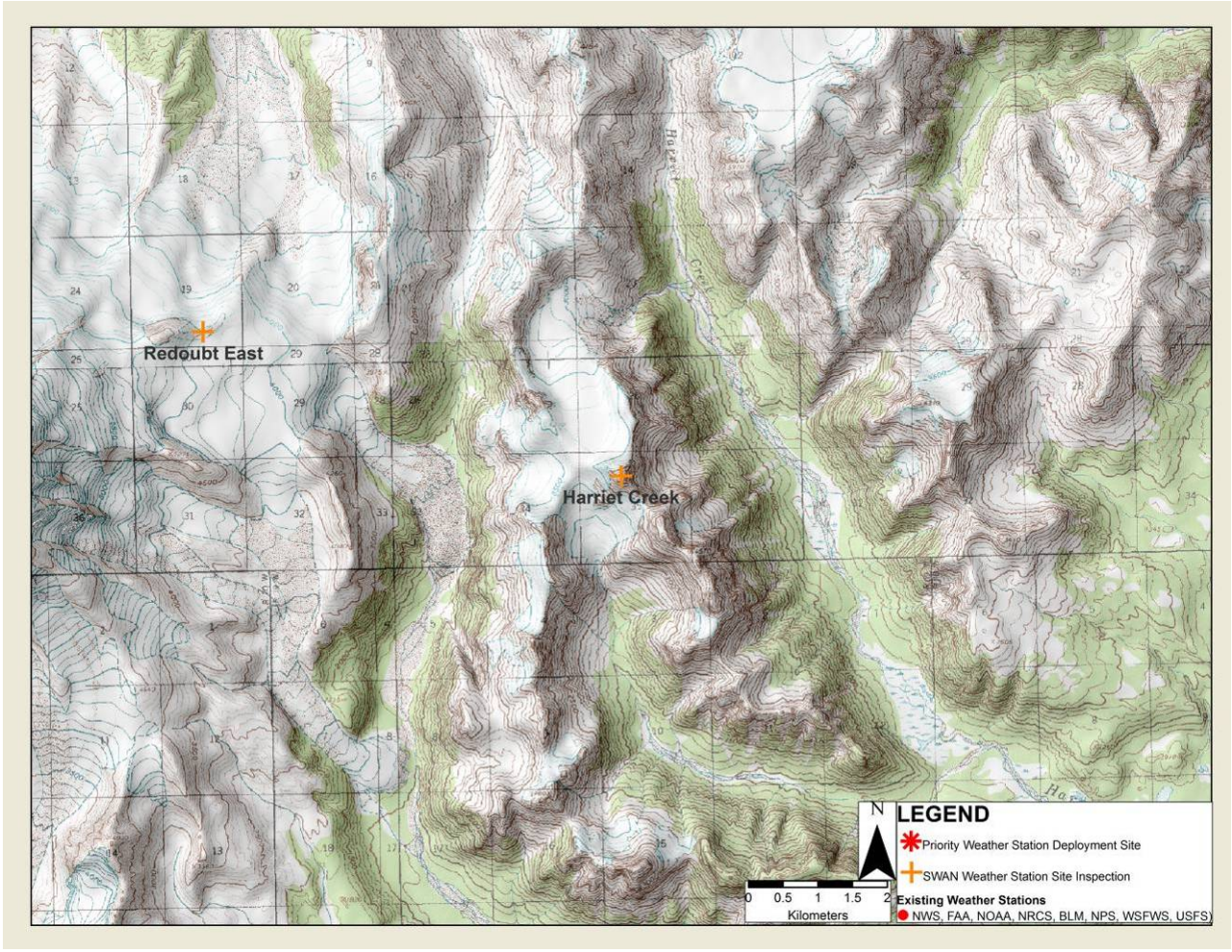


Figure 94. Detailed location of the Harriet Creek site, Lake Clark National Park and Preserve.

Figure 95. Looking southeast across the Harriet Creek site. Site would be located on a ridgeline surrounding the basin. Lake Clark National Park and Preserve.

LAKE CLARK NATIONAL PARK AND PRESERVE

SITE NAME: Redoubt East

LOCATION: 60.50376N, 152.676237 W

Elevation: 4,500 ft
Slope: bedrock outcropping on east slope of Redoubt Volcano
Aspect: east
Type: Mountain

Description:
This site inspection was completed from the air.

This site is located three miles east of Redoubt Volcano at approximately 4,500 feet elevation. The volcano slope here is glaciated. Exposed bedrock in the area is swept clean of snow.

This site affords excellent regional exposure to the north-east-south direction. However, the very large Redoubt Volcano rises to an elevation of over 10,000 feet just three miles to the west and dominates the topography in the area. Being a very dominate topographic feature here, Redoubt Volcano would certainly impart localized weather conditions on this site.

Vegetation/Cover Conditions:
Though we didn't land at this site, it is expected that this site is exposed bedrock with lichens, likely fractured at the surface.

Surface Water:
This site is dry.

Obstructions:
No manmade obstructions. Redoubt Volcano rises to over 10,000 feet, six miles to the west of this site.

Satellite antenna transmission:
Clear horizon for satellite transmission

Access:
Fixed-wing on skis or helicopter. **Characteristics of potential fixed-wing landing areas here make this are unsafe for fix-wing operations.**

Land Status
Lake Clark National Park - Wilderness

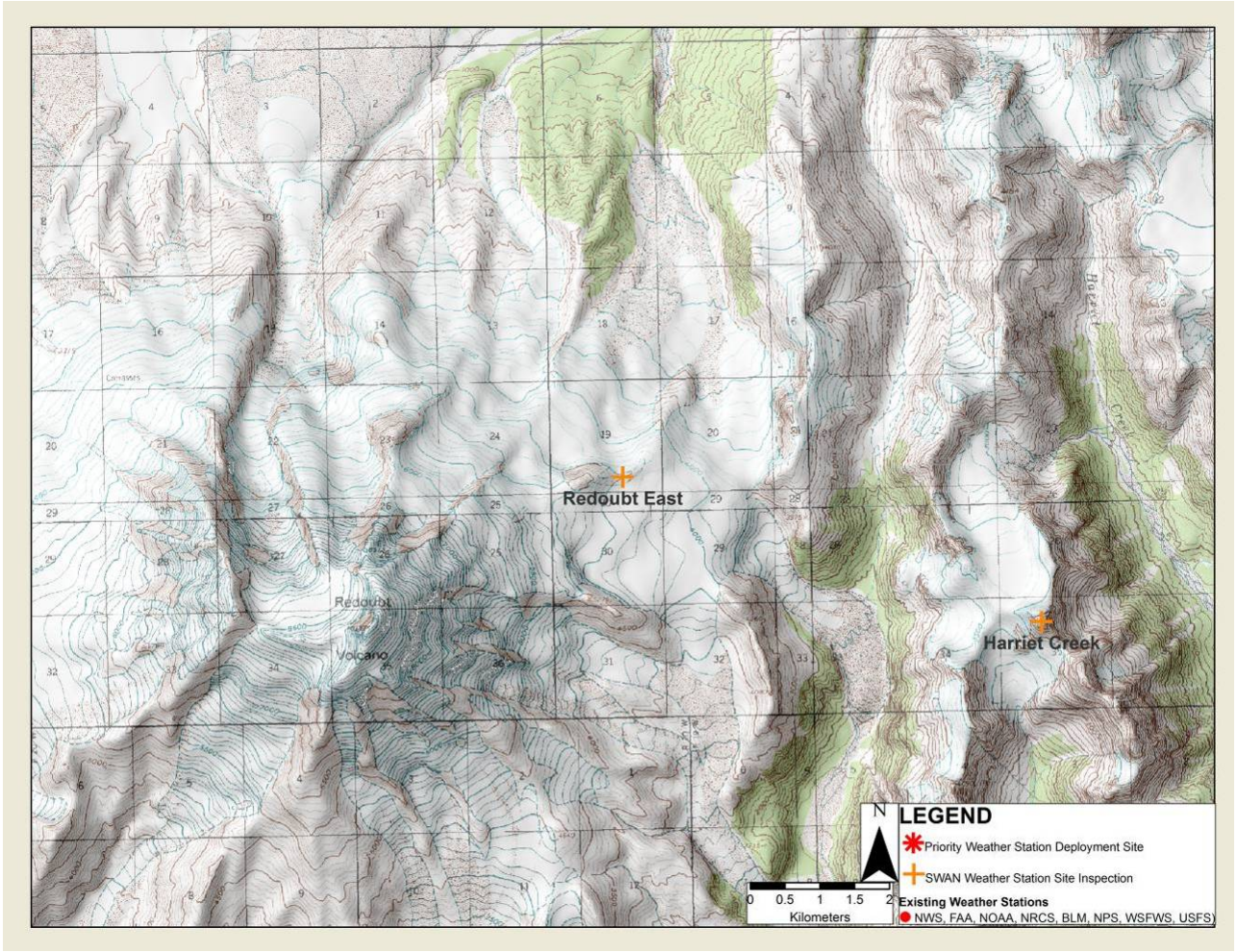


Figure 96. Detailed location of the Redoubt East site, Lake Clark National Park and Preserve.

Figure 97. Looking northwest across the Redoubt East site. Site would be located on a nunatak on the east flank of Redoubt Volcano. Lake Clark National Park and Preserve.

LAKE CLARK NATIONAL PARK AND PRESERVE

SITE NAME: Saddle Mtn

LOCATION: 59.98N: 152.76W

Elevation: 1,300 ft
Slope: Flat
Aspect: --
Type: Coastal

Description:
This site inspection was completed from the air.

This site is located towards the east end of a small lake just south of Saddle Mountain. It was hoped that this lake would afford access via float plane. The lake is too small to allow for safe float plane operations. This site was not further considered.

This site overlooks Cook Inlet from to the northeast, east and south and is approximately 2.5 miles from the coast. The site is located at the mouth of the valley hosting a small lake just south of Saddle Mountain. Iliamna Volcano (10,000 feet) is approximately 10 miles northwest of the site.

Though located at the mouth of a small valley there will be some local influence at this site. However, the regional view from the north through the east and to the south is excellent.

Vegetation/Cover Conditions:
Alder seen from the air.

Surface Water:
This site is dry.

Distance to Ocean:
4,764 meters (2.960 miles) southeast to the ocean.

Obstructions:
No manmade obstructions. Ridgelines and Iliamna Volcano to the west and north.

Satellite antenna transmission:

Horizon for satellite transmission may be questionable, but can only be determined via ground inspection.

Access:
Helicopter only.

Land Status
Lake Clark National Park – Not Wilderness

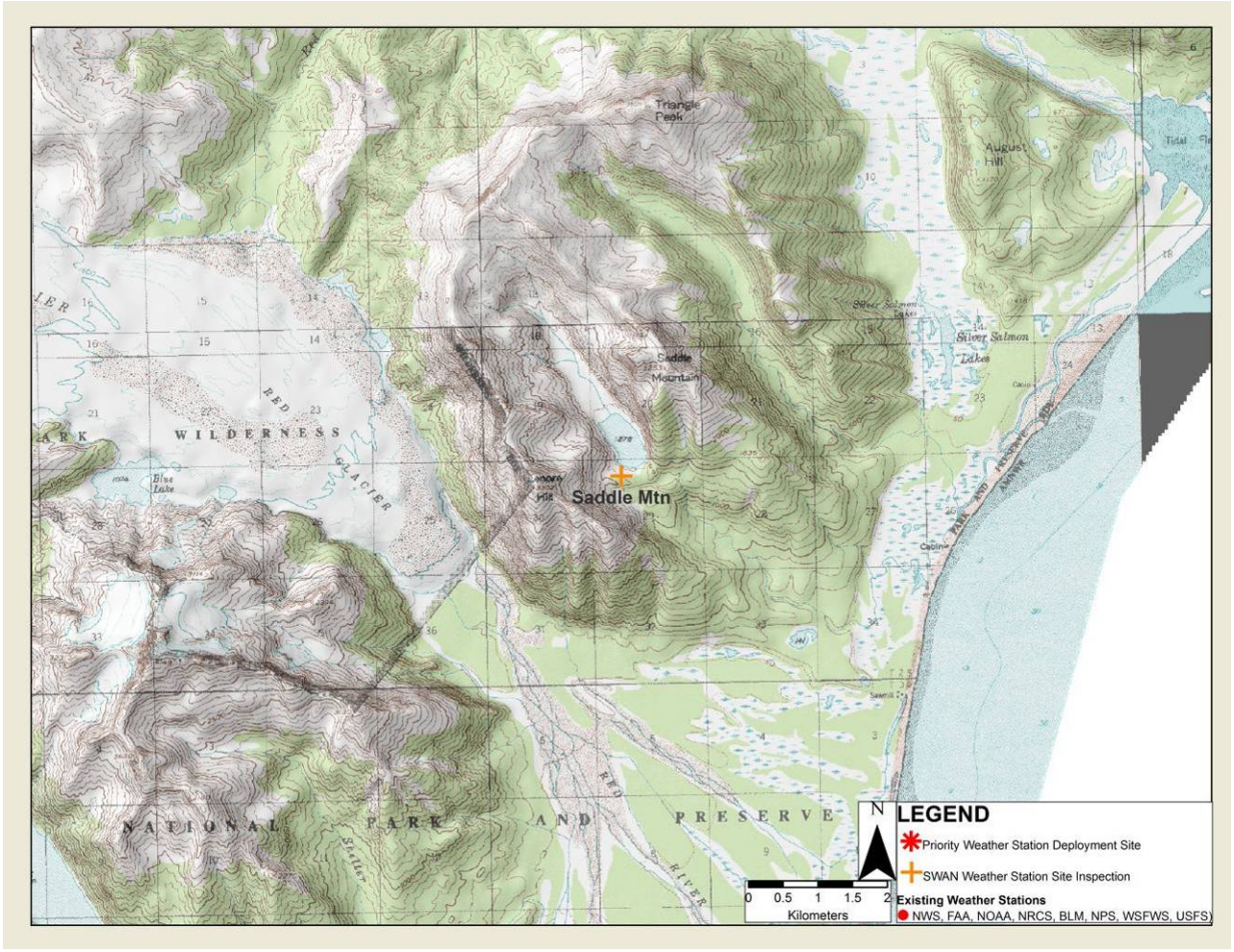


Figure 98. Detailed location of the Saddle Mountain site, Lake Clark National Park and Preserve.

Figure 99. Looking southeast across the Saddle Mountain site. Site would be located near the far end of the small lake. Lake Clark National Park and Preserve.

LAKE CLARK NATIONAL PARK AND PRESERVE

SITE NAME: Hickerson Lake

LOCATION: 59.914785N: 152.892598W

Elevation: 1,000 ft
Slope: Flat
Aspect: --
Type: Coastal

Description:
This site inspection was completed on the ground. This site is located on a hilltop approximately ½ mile from the southeast end of Hickerson Lake. The hilltop is uneven and composed of boulders up to 15 feet across.

This site overlooks Cook Inlet from to the northeast, east and south and is approximately 2.5 miles from the coast. The site is located at the mouth of the valley hosting Hickerson Lake. Two peaks, North Twin (7,703 ft) and South Twin (7,444 ft), lay approximately 8-miles northwest of the site. North Twin and South Twin are two peaks on the south flank of Iliamna Volcano (10,016 ft). Iliamna Volcano is approximately 10 miles northwest of the site.

The Hickerson Lake valley is not a very large watershed and it doesn't connect to another valley through a mountain pass. Though located at the mouth of a small valley there will be some local influence at this site. However, the regional view from the north through the east and to the south is excellent.

Based on flagging of the spruce tree limbs in the area, the prevailing wind here is from the northeast.

Vegetation/Cover Conditions:
Currents, high-bush blue berry, alder, ferns, grass, lichen, moss. Site is bouldery.

Surface Water:
This site is dry.

Distance to Ocean:
3,650 meters (2.268 miles) south to the ocean.

Obstructions:

No manmade obstructions. Ridgelines and Iliamna Volcano to the west and north.

Satellite antenna transmission:
Clear horizon for satellite transmission

Access:
Fixed-wing on floats or helicopter. Typical access to this site would be via float-plane in the summer.

Land Status
Lake Clark National Park – Not Wilderness

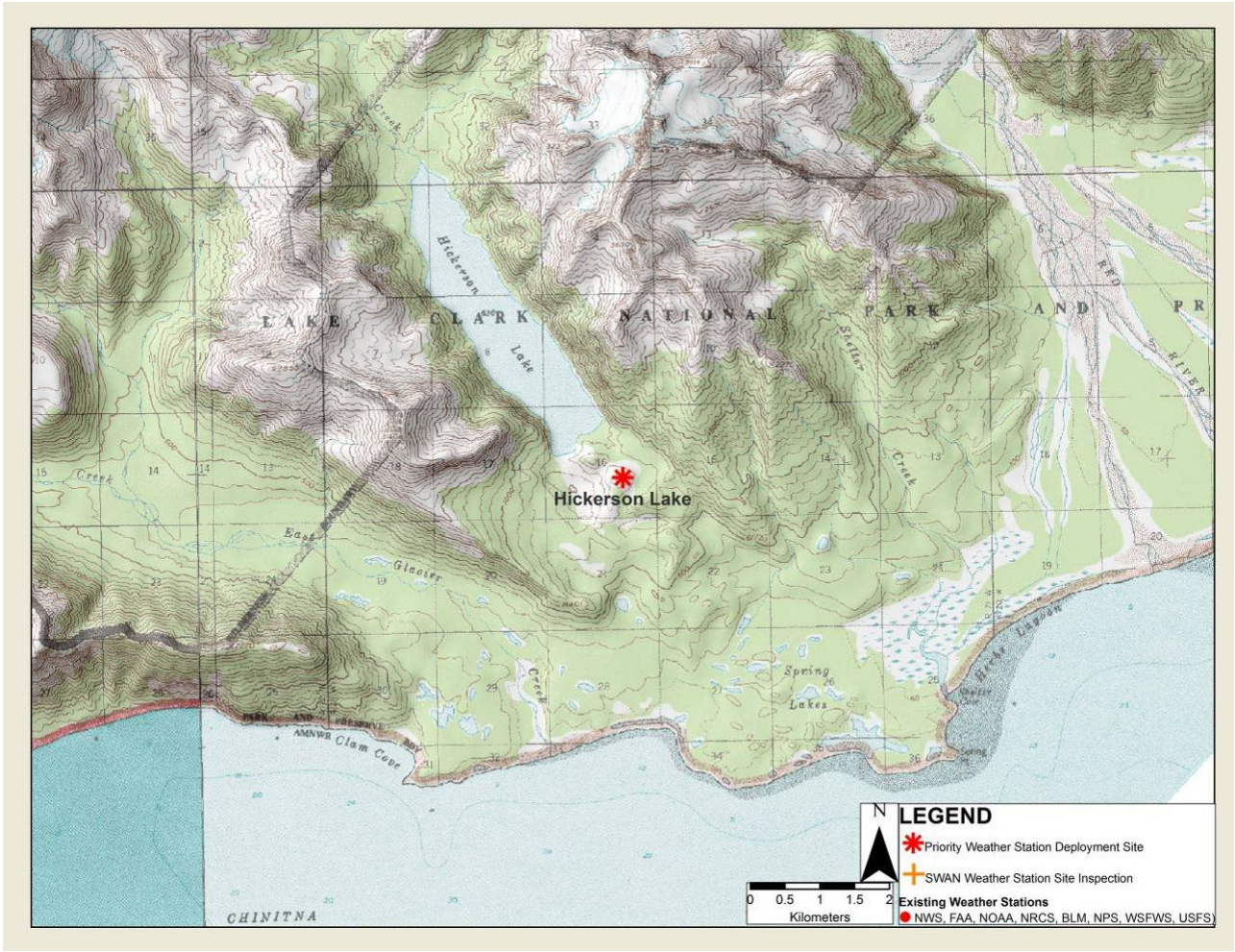


Figure 100. Detailed location of the Hickerson Lake site, Lake Clark National Park and Preserve.

Figure 101. Looking southeast across the Hickerson Lake site, Lake Clark National Park and Preserve.

LAKE CLARK NATIONAL PARK AND PRESERVE

SITE NAME: Snipe Lake

LOCATION: 60.61024N, 154.319868W
Elevation: 2,300 ft
Slope: None, gently rounded hilltop
Aspect: --
Type: Interior

Description:
This site inspection was completed on the ground.

This site is located on a hilltop approximately ½ mile to the southwest of Snipe Lake. The hilltop is rounded tundra covered with occasional low brush.

This site overlooks the broad open tundra and forested valley bottoms. The site is 8-miles west of the foothills of the Neacola Mountains. The area is drained by the Chilikadrotna and Little Mulchatna rivers.

The Bonanza Mountains (3,800 ft) are 12 miles northwest of the site. A small unnamed mountain (3,600) lies 2.5 miles south of the site. The foothills of the Neacola Mountains lie 8 miles to the east with high peaks (>9,000 ft) of the Neacola Mountains lying 30 to 40 miles to the northeast.

Vegetation/Cover Conditions:
Dryas, blueberry, wind flower, lichen. Dwarf birch, scrubby spruce, willow occur on the sides of the hill. Alder occurs on the lower slopes of the hill.

Surface Water:
This site is dry.

Obstructions:
No manmade obstructions.

Satellite antenna transmission:
Clear horizon for satellite transmission

Access:
Fixed-wing on floats or helicopter. Typical access to this site would be via float-plane in the summer.

Land Status
Lake Clark National Preserve – Not Wilderness

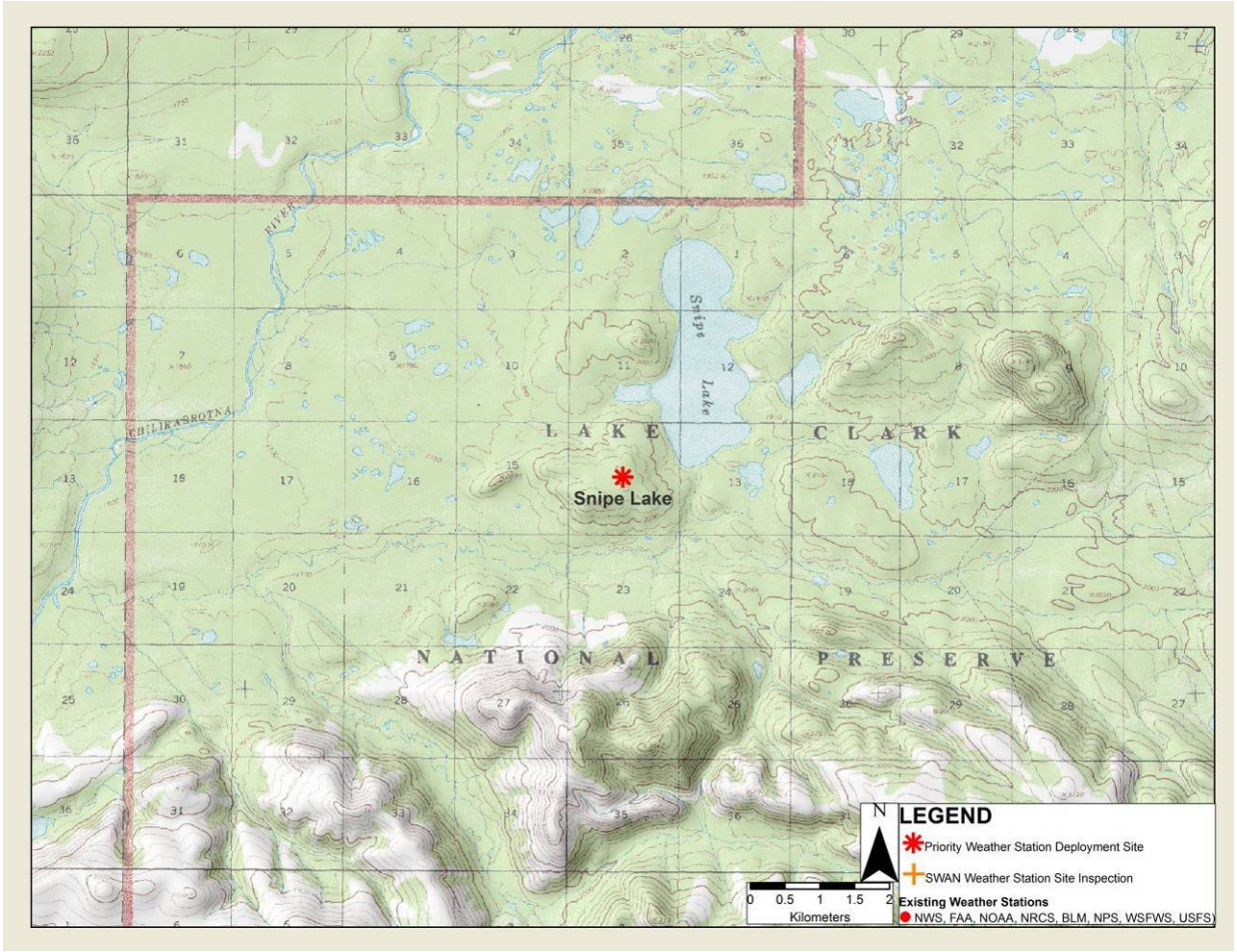


Figure 102. Detailed location of the Snipe Lake site, Lake Clark National Park and Preserve.

Figure 103. Looking southwest across the Snipe Lake site, Lake site, Lake Clark National Park and Preserve.

LAKE CLARK NATIONAL PARK AND PRESERVE

SITE NAME: Square Lake

LOCATION: 60.754809N; 154.214713W

Elevation: 2,800 ft
Slope: None, gently rounded hilltop
Aspect: --
Type: Interior

Description:
This site inspection was completed from the air. This site is located on a hilltop approximately ¾ mile to the southwest of Square Lake. The hilltop is rounded tundra covered with light brush on the lower hillsides.

This site overlooks the broad open tundra and forested valley bottoms. The site is 8-miles west of the foothills of the Neacola Mountains. The main stem of the Mulchatna flows within 1.5 miles of the site.

The Bonanza Mountains (3,800 ft) are 10 miles west of the site. The foothills of the Neacola Mountains lie 8 miles to the east with high peaks (>9,000 ft) of the Neacola Mountains lying 30 to 40 miles to the northeast.

Vegetation/Cover Conditions:
Likely very similar to what was observed at the Snipe Lake site: Dryas, blueberry, wind flower, lichen, dwarf birch, scrubby spruce, willow, alder.

Surface Water:
This site is dry.

Obstructions:
No manmade obstructions.

Satellite antenna transmission:
Clear horizon for satellite transmission

Access:
Fixed-wing on floats or helicopter. Typical access to this site would be via float-plane in the summer.
***Square lake is small and requires good conditions to land and take-off with pilot plus two on-board (Cessna 185).**

Land Status
Lake Clark National Preserve – Not Wilderness

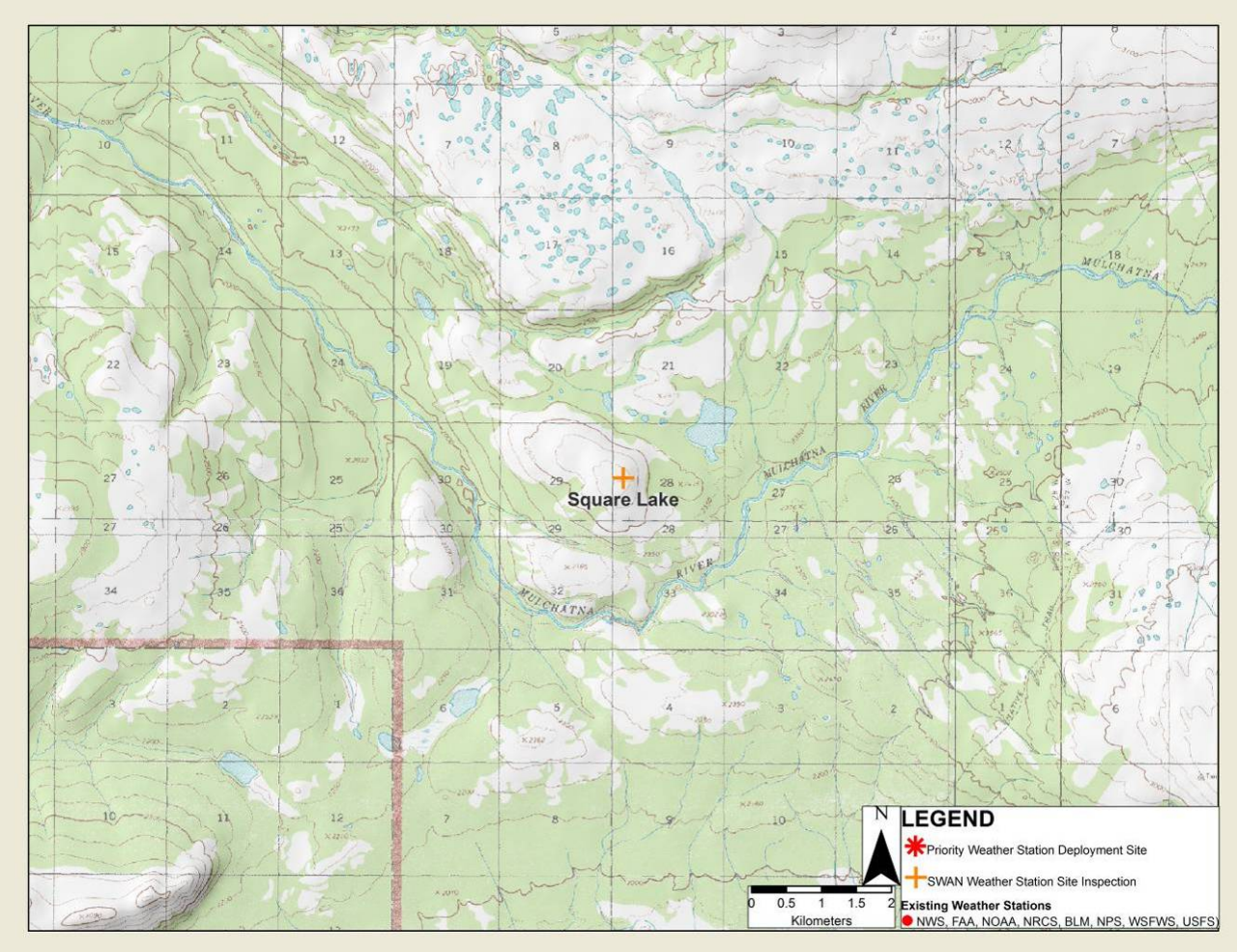


Figure 104. Detailed location of the Square Lake site, Lake Clark National Park and Preserve.

Figure 105. Looking northeast across the Square Lake site, Lake Clark National Park and Preserve.

LAKE CLARK NATIONAL PARK AND PRESERVE

SITE NAME: Trail Creek

LOCATION: 60.892927N; 153.84059W

Elevation: 3,400 ft
Slope: None, gently rounded hilltop
Aspect: --
Type: Interior

Description:
This site inspection was completed from the air. This site is located on higher ground (subdued rounded ridge) separating Trail Creek from Telequana Lake. The site is approximately 1.5 miles to the northwest of the landing site along Trail Creek. The ridge is rounded and tundra covered with light brush on the lower hillsides.

This site overlooks the broad open tundra and forested valley bottoms lie to the west and is at the foothills of the Neacola Mountains. The high peaks of the Neacola Mountains (>9,000 ft) lie 15 to 25 miles to the east.

Vegetation/Cover Conditions:
Likely very similar to what was observed at the Snipe Lake site: Dryas, blueberry, wind flower, lichen, dwarf birch, scrubby spruce, willow, alder. This is a higher elevation site so there will be less brush.

Surface Water:
This site is dry.

Obstructions:
No manmade obstructions.

Satellite antenna transmission:
Horizon for satellite transmission at this site is approx 9 degrees, which should be adequate.

Access:
Fixed-wing on wheels and/or skis or helicopter. Typical access to this site would be via wheel-plane in the summer or ski-plane in March/April.

Land Status
Lake Clark National Preserve - not wilderness

**The wilderness boundary follows the topographic divide where the site is located. Since the ridge top here is fairly broad, any station could be easily located outside the wilderness boundary without compromising the weather observations at the site.

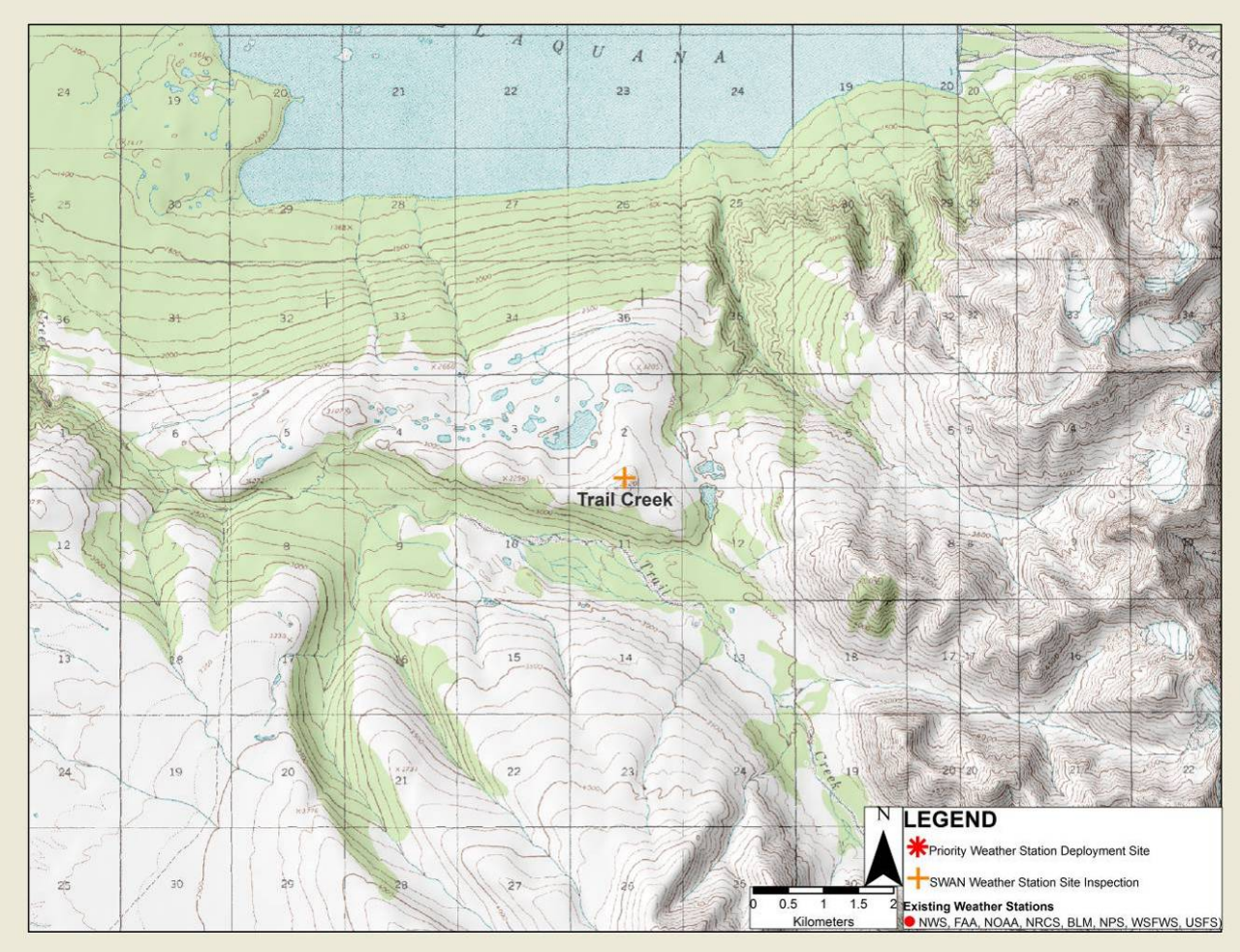


Figure 106. Detailed location of the Trail Creek site, Lake Clark National Park and Preserve.

Figure 107. Looking east across the Trail Creek site, Lake Clark National Park and Preserve.

LAKE CLARK NATIONAL PARK AND PRESERVE

SITE NAME: Portage Lake

LOCATION: 60.509265N, 153.881066W

Elevation: 1,500 ft
Slope: Broad valley bottom
Aspect: --
Type: Interior

Description:
This site inspection was completed from the air.

This site is located in the valley bottom near Portage Lake. Valley bottom here is heavily vegetated with spruce and alder.

The site is in a valley bottom draining the western Neacola Mountains via the Kijik River. Being in a valley bottom, the regional view from any site here would be limited and also effected by weather moving up and down the valley.

Vegetation/Cover Conditions:
Spruce, alder.

Surface Water:
Site is likely typical spongy tundra-forest floor.

Obstructions:
No manmade obstructions.

Satellite antenna transmission:
Satellite transmission maybe limited by large mountain to the south and south east.

Access:
Fixed-wing on floats followed by a hike to the site.

Land Status
Lake Clark National Park – Wilderness

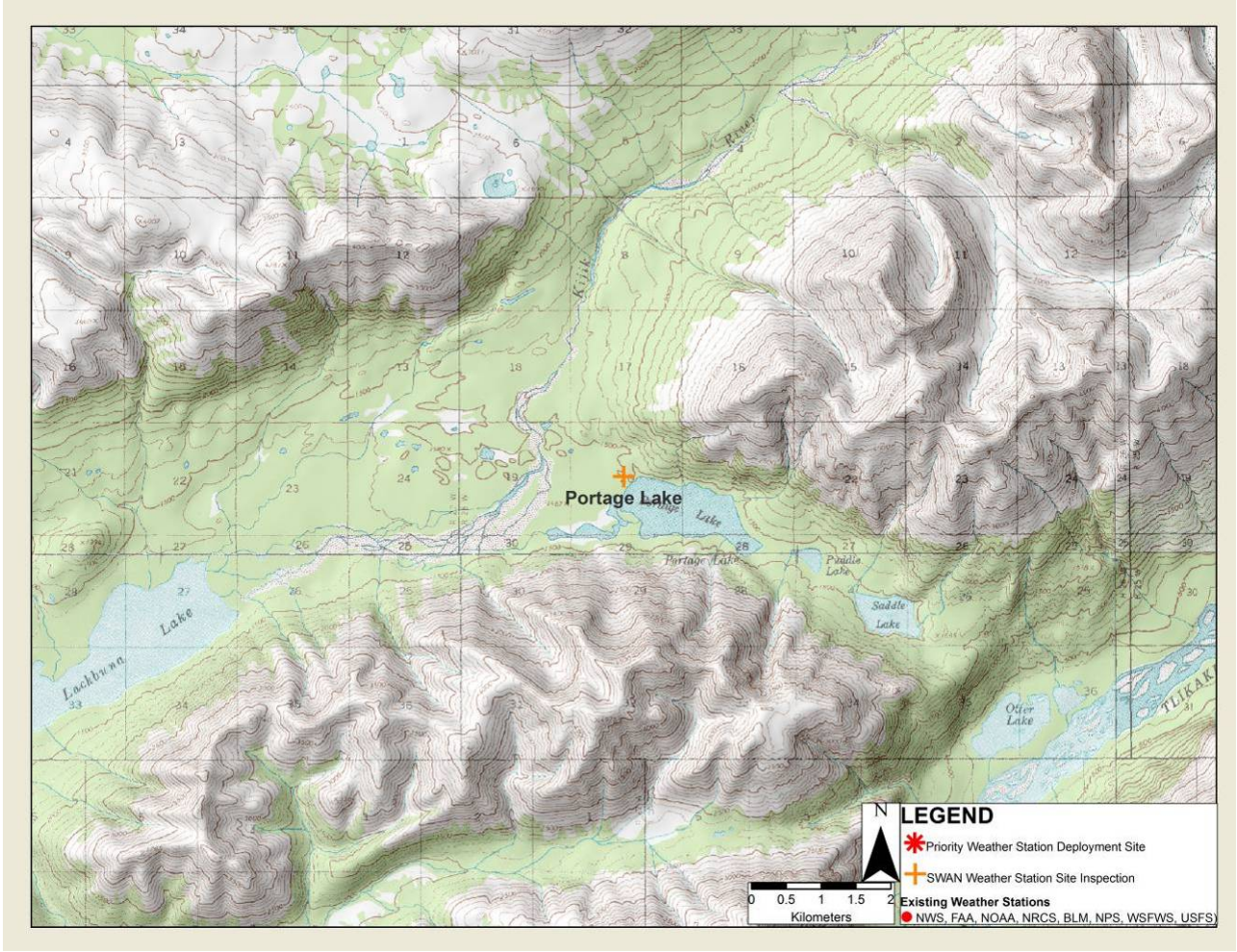


Figure 108. Detailed location of the Portage Lake site, Lake Clark National Park and Preserve.

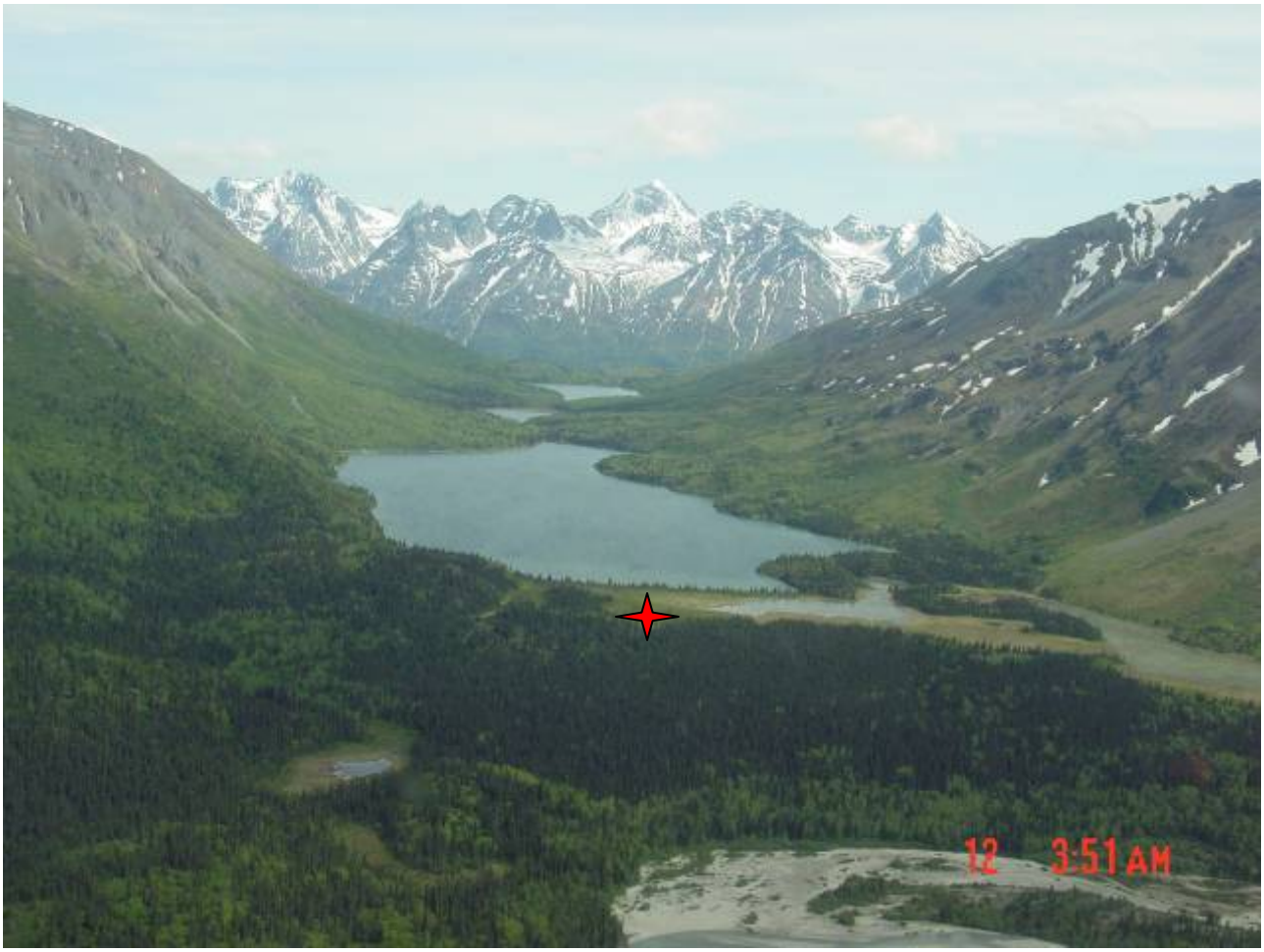


Figure 109. Looking southeast across the Portage Lake site, Lake Clark National Park and Preserve.

LAKE CLARK NATIONAL PARK AND PRESERVE

SITE NAME: Lachbuna Lake

LOCATION: 60.483526N, 154.055304W

Elevation: 2,000 ft
Slope: Northeast trending ridgeline in a broad valley bottom
Aspect: northeast
Type: Interior

Description:
This site inspection was completed from the air.

This site is located in a large valley bottom on a northeast-southwest trending ridge just west of Lachbuna Lake. Valley bottom here is heavily vegetated with spruce and alder.

The site is in a valley bottom draining the western Neacola Mountains via the Kijik River. Being in a valley bottom, the regional view from any site here would be limited and also effected by weather moving up and down the valley.

Vegetation/Cover Conditions:
Spruce, alder.

Surface Water:
Site is likely typical spongy tundra-forest floor.

Obstructions:
No manmade obstructions.

Satellite antenna transmission:
Satellite transmission maybe limited by large mountain to the south and south east.

Access:
Fixed-wing on floats followed by a hike to the site.

Land Status
Lake Clark National Preserve –Wilderness

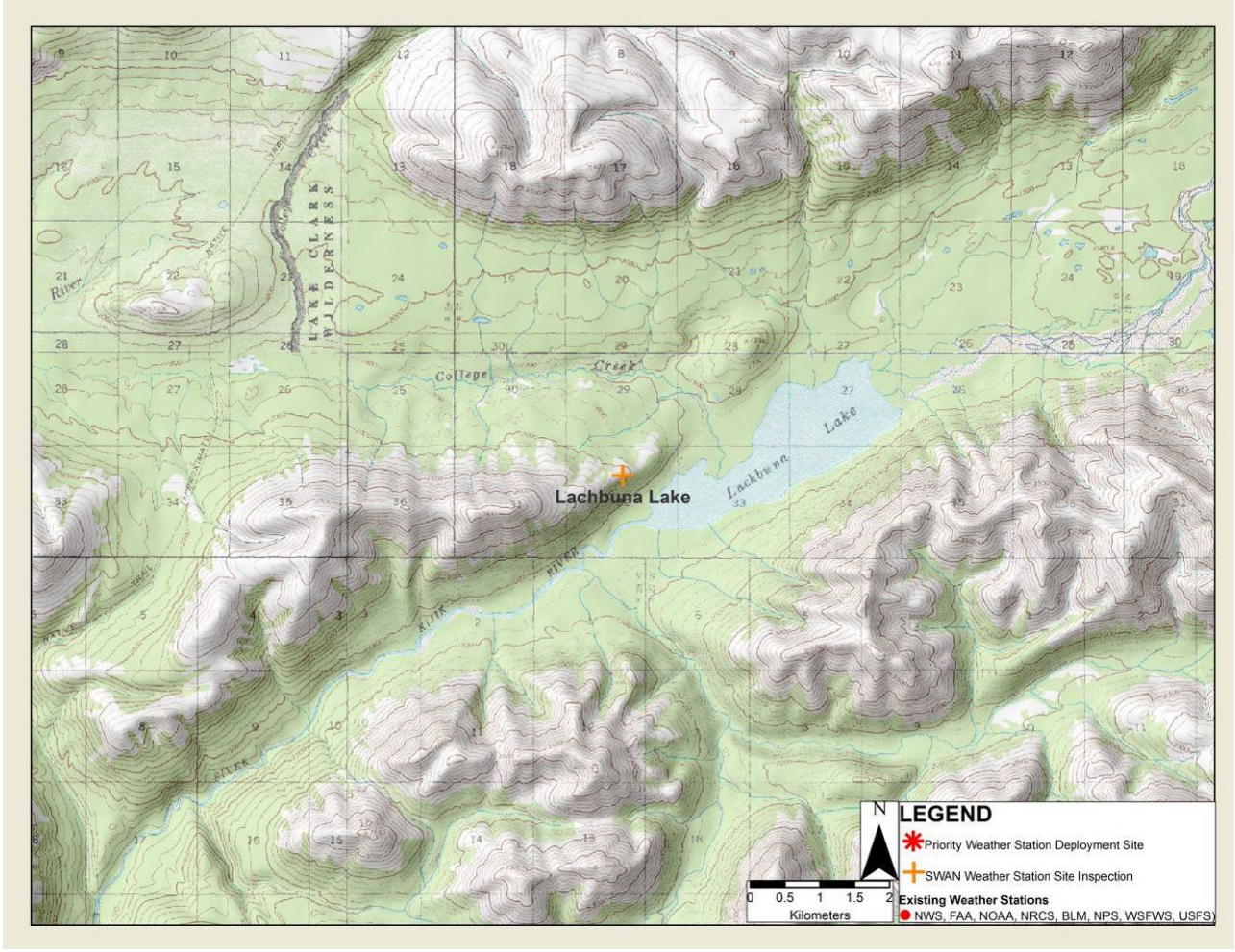


Figure 110. Detailed location of the Lachbuna Lake site, Lake Clark National Park and Preserve.

Figure 111. Looking south across the Lachbuna Lake site, Lake Clark National Park and Preserve.

LAKE CLARK NATIONAL PARK AND PRESERVE

SITE NAME: Fishtrap Lake

LOCATION: 60.486051N, 154.362305W

Elevation: 1,700 ft
Slope: Broad valley bottom
Aspect: --
Type: Interior

Description:
This site inspection was completed from the air.

This site is located in a large valley bottom just south of Fish Trap Lake. Valley bottom here is heavily vegetated with spruce and alder.

The site is in a valley bottom drained via the Mulchatna River. Being in a valley bottom, the regional view from any site here would be limited and also effected by weather moving up and down the valley.

Vegetation/Cover Conditions:
Spruce, alder.

Surface Water:
Site is likely typical spongy tundra-forest floor.

Obstructions:
No manmade obstructions.

Satellite antenna transmission:
Satellite transmission is clear.

Access:
Fixed-wing on floats followed by a hike to the site.

Land Status
Lake Clark National Preserve – Not Wilderness

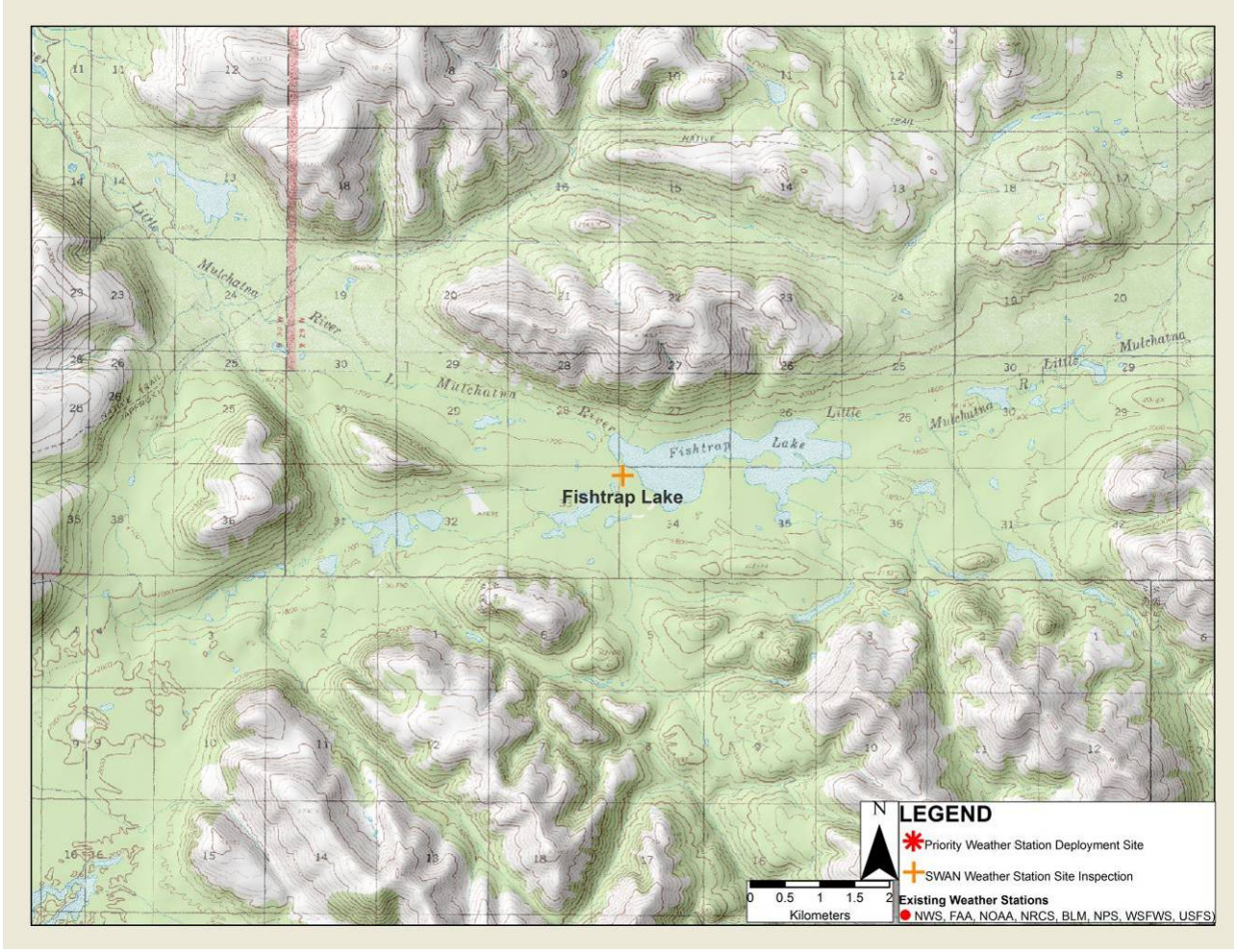
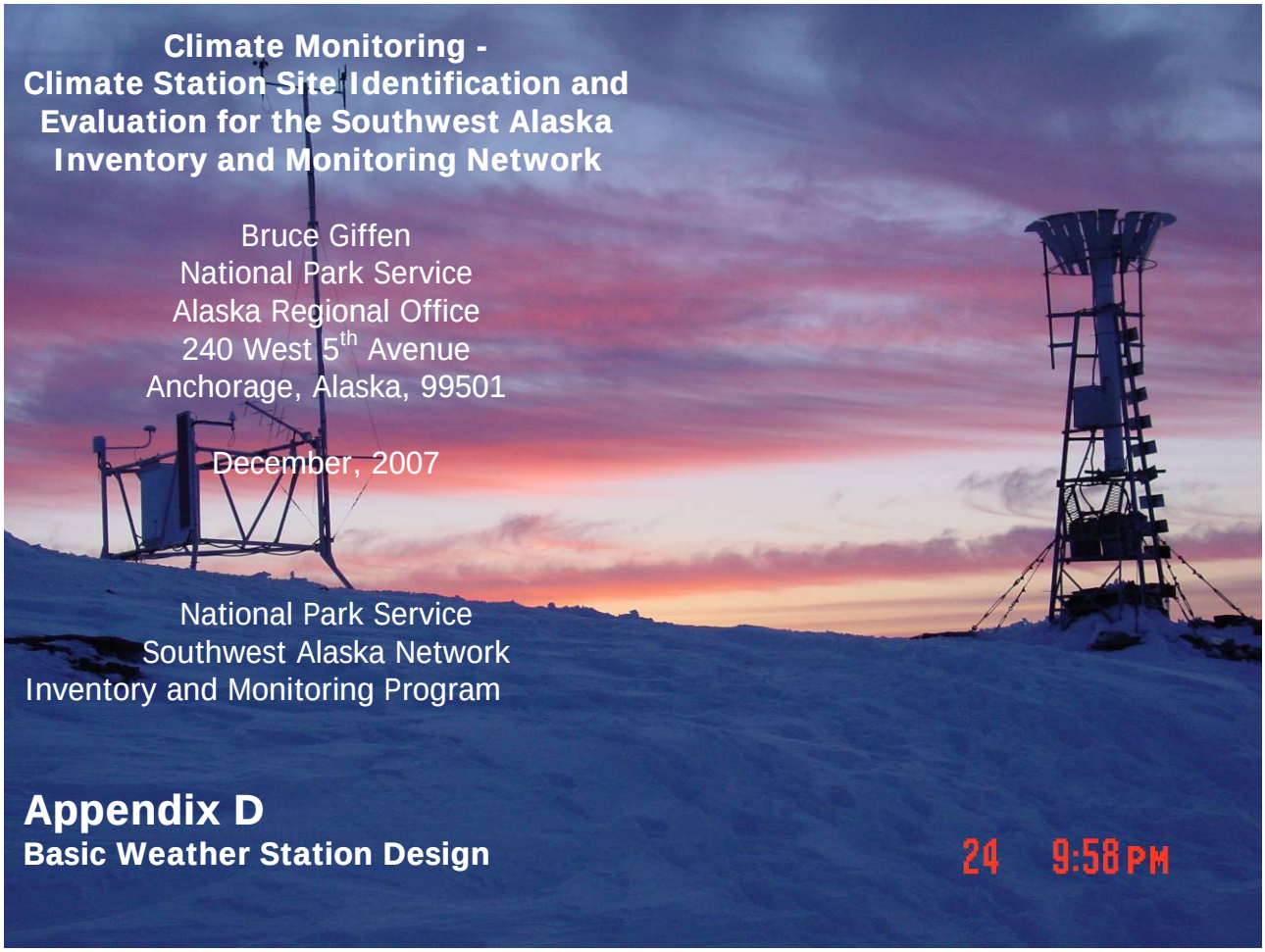


Figure 112. Detailed location of the Fishtrap Lake site, Lake Clark National Park and Preserve.

Figure 113. Looking west across the Fishtrap Lake site, Lake Clark National Park and Preserve.



Harding Icefield weather station, Kenai Fjords National Park.

In 2003 and 2004, discussions regarding climate station design and instrumentation were had with personnel at the NPS-Southwest Alaska Network, National Weather Service (Alaska Region and River Forecast Center), Bureau of Land Management (Alaska), Interagency Fire Center (Boise, ID), Long Term Ecological Research (LTER) areas at Bonanza Creek, Poker Flats and Toolik Lake in Alaska. Campbell Scientific, Handar and FTS weather stations were the three types of weather stations being deployed at remote sites across the state. The NPS Wildland Fire Program had converted all its fire weather stations to the FTS station. BLM was in the process of converting their fire weather station to FTS. There are currently over 50 FTS RAWS stations operating throughout Alaska. The NPS radio shop has developed the expertise in maintaining the FTS station and can provide assistance in that regard.

The SWAN has chosen the FTS RAWS to deploy for its climate monitoring program. Several factors influenced this decision:

- Currently over 50 FTS stations are deployed in Alaska
- The FTS RAWS station has operated successfully in Alaska and across the "lower 48" for years
- NPS radio shop is very experienced in maintenance of the FTS station and sensor array
- FTS has a suite of ice-rated sensors - an upgrade for Alaska conditions
- Data logger and sensor cables are color coded, water proof with military bayonet connectors
- Data loggers are delivered pre-programmed
- The FTS tri-leg tower (tower height – 20 ft) is standard applied to over 100 stations across Alaska
- The FTS tri-leg tower is a proven, durable design

The standard FTS tri-leg tower has a 20-foot mast, housing wind speed and direction sensors. The base of the tri-leg tower houses the FTS data logger, GOES satellite transmitter and power management system in a protective metal box. The remaining sensors and solar panel are mounted on the tower base. The sensor suite will include air temperature, relative humidity, wind speed and direction, snow depth, precipitation, solar radiation and soil temperature (some sites).

As with all automated weather stations, frozen precipitation is difficult to capture and measure accurately. In the SWAN parks, capturing winter-time precipitation is a challenge since a significant percentage of the SWAN parks are represented by high mountains. For winter-time precipitation, high elevation sites can typically be characterized as accumulation areas or as wind-scowered areas. If a station is located in an accumulation area, the typical station would be buried under the seasons accumulated snow pack. To avoid station burial, high elevation sites must be located in areas of wind

scower, i.e. nunataks. Nunataks are windy locations and thus are not good sites to capture precipitation, especially frozen precipitation.

One SWAN climate monitoring station has been deployed and has operated on a nunatak at 4,200 feet in elevation on the Harding Icefield in Kenai Fjords National Park since July 2004. The station is an FTS station with ice-rated sensors and an all-season precipitation gage designed and built by the USGS-Water Resources Division in Anchorage, Alaska. This site is in a maritime climate zone and is characterized by frequent high wind and high precipitation events. Precipitation at this site falls in the form of snow and ice between the months of October and May creating severe icing on the station. Frequent wind at the site makes catching winter-time precipitation a challenge. Icing conditions hamper wind speed and direction observations and satellite transmissions. Ice has damaged the satellite transmission antenna, but no other damage has occurred to any of the sensors or tower. This speaks to the very capable design of the FTS suite of ice-rated sensors and tower, especially after experiencing the severe conditions present at this site (max wind to date: 117 mph, and several other wind events in excess of 100 mph).

Prior to deployment of any SWAN weather station, the NWS Forecast Center is providing space at its Anchorage facility to assemble and operate stations prior to field deployment. This assures all stations are operating as designed prior to deployment. Stations are powered year-round by a 50 watt solar panel and two sealed gel cell batteries. Batteries, datalogger, transmitter and power manager are enclosed in a steel box located on the tri-leg tower.

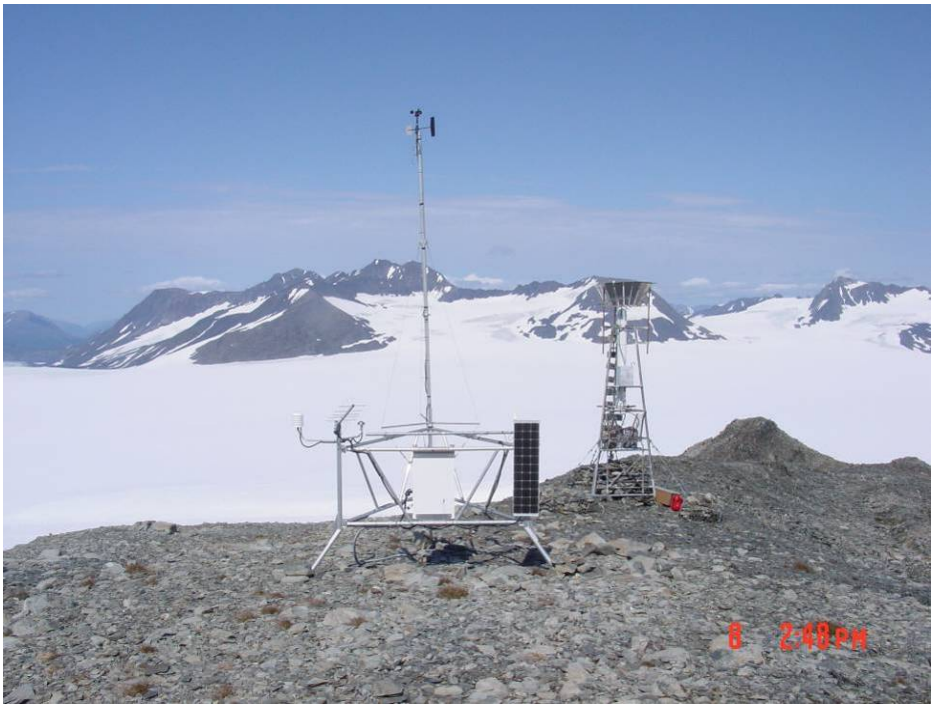


Figure 114. Typical remote automated weather station.

FTS tri-leg tower in foreground hosting wind speed and direction, temperature, relative humidity, snow depth and solar radiation sensors, a GPS antenna, satellite transition antenna and a steel cabinet housing a datalogger, satellite transmitter and a power manager. Tower in background is an all-season precipitation gage designed by the USGS–Alaska Region-Water Resources.