



# Climate Station Maintenance in the Arctic Network

## *2014 Summary*

Natural Resource Data Series NPS/ARCN/NRDS—2015/744



**ON THE COVER**

Imelyak weather station, Noatak National Park and Preserve.

Photograph by: Ken Hill

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## **Abstract**

The mission of the Arctic Network Inventory and Monitoring Program (ARCN) is to collect, compile and synthesize scientific information about the Arctic Network of parks in order to manage park resources "unimpaired for the enjoyment of future generations". The Inventory and Monitoring (I&M) Program is a major component of the National Park Service's (NPS) strategy to improve park management through greater reliance on scientific information.

In an attempt to better understand climate variation as well as long-term changes in park ecosystems, seventeen I&M climate stations have been installed in the five ARCN parks. The objective of the climate monitoring program is to monitor and record weather conditions at representative locations throughout ARCN in order to identify long and short-term trends, provide reliable climate data to other researchers, and to participate in large scale climate monitoring and modeling efforts beyond park boundaries. During the 2014 field season, one new I&M climate station was installed at Kugururok, sixteen existing I&M stations were maintained, four fire remote automated weather stations (RAWS) were maintained in cooperation with NPS staff in Anchorage, and the Kelly Snotel station was maintained by the Natural Resources Conservation Service (NRCS) staff. This report summarizes the 2014 field season and includes current sensor metadata.

## **Acknowledgments**

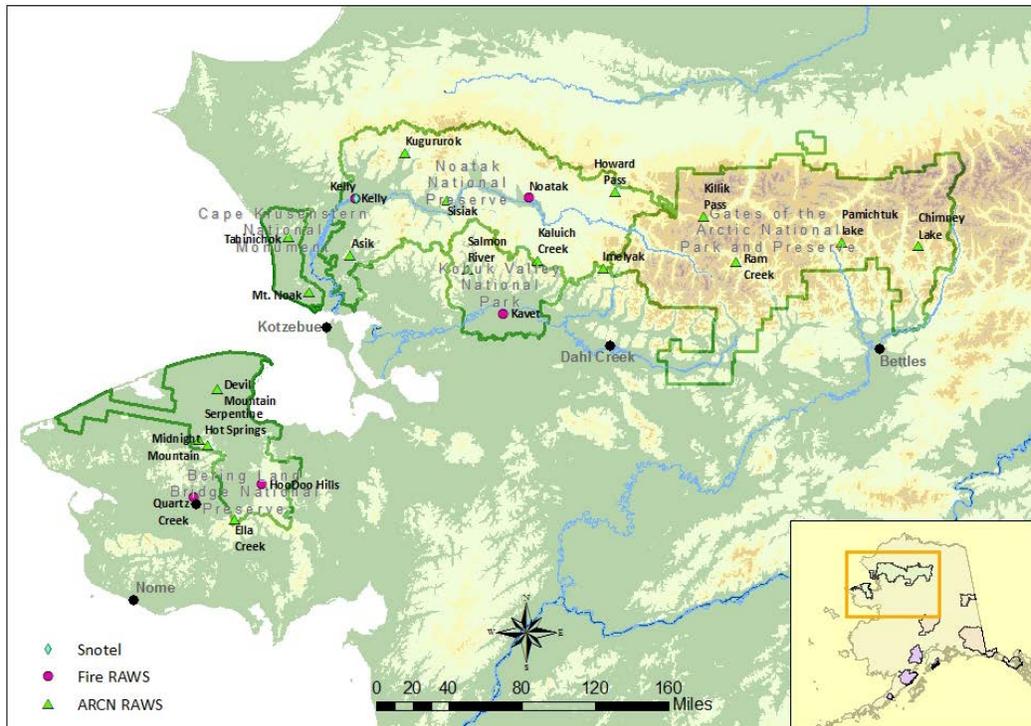
A successful field season would not have been possible without support from staff in Fairbanks, Nome, Kotzebue, and Bettles . Additional support was provided by pilots (Curtis Cebulski, Blake Malo, Shannon Bowman, Thomas St. Romain, and Jim Kincaid) and aviation staff (Alaska Regional Communication Center, Tara Whitesell, Susan Holly, and Scott Sample).

## List of Acronyms

Ah	Amp hour
AKDST	Alaska Daylight Savings Time
AKRO	Alaska Regional Office
OAS	Office of Aviation Services
ARCN	Arctic Network
AS350	A-star 350 Helicopter
AT-RH	Air Temperature- Relative Humidity
BELA	Bering Land Bridge National Preserve
C185	Cessna 185 airplane
C206	Cessna 206 airplane
CAKR	Cape Krusenstern National Monument
CS	Campbell Scientific
DCS	Data Collection System
DLP	Data Logger Program
FTS	Forest Technology Systems
GAAR	Gates of the Arctic National Park and Preserve
GOES	Geostationary Operational Environmental Satellite
GPS	Global Positioning System
I&M	Inventory and Monitoring
KOVA	Kobuk Valley National Park
LED	Light-Emitting Diode
NESDIS	National Environmental Satellite, Data, and Information Service
NIFC	National Interagency Fire Center
NOAT	Noatak National Park and Preserve
NPS	National Park Service
NRCS	Natural Resource Conservation Service
RAWS	Remote Automated Weather Station
RG-TB	Rain Gauge - Tipping Bucket
SD	Snow Depth
SDI	Serial Digital Interface
SR	Solar Radiation
ST	Soil Temperature
W	Watt
WEAR	Western Arctic National Parklands
WFMI	Wildland Fire Management Information
WRCC	Western Regional Climate Center
WS-WD	Wind Speed - Wind Direction
YUGA	Collective administrative unit for Yukon-Charley Rivers National Preserve and Gates of the Arctic National Park and Preserve

# Climate Station Locations

For the 2014 field season, the Arctic Network (ARCN) continued its climate monitoring program by maintaining sixteen existing stations and installing one new station (Kugururok) in the network (Figure 1, Table 1). These park units include, Gates of the Arctic National Park and Preserve (GAAR), Bering Land Bridge National Preserve (BELA), Cape Krusenstern National Monument (CAKR), Kobuk Valley National Park (KOVA), and Noatak National Preserve (NOAT). Maintenance includes downloading data, updating software and programming, replacing sensors, and troubleshooting problems. Maintenance is necessary in order to provide continuous, high-quality meteorological data. There are additional weather and climate stations in the parks run by other state and federal agencies with specific objectives. Remote automated weather stations (RAWS) deployed as part of the NPS fire program record real-time weather data for fire management. NRCS Snotel stations record weather and snow information. It is in the best interest of the ARCN program to cooperate with these and other entities by assisting in station maintenance; a total of 23 sites are maintained annually, including 17 ARCN RAWS, 5 fire RAWS and 1 Snotel station.



**Figure 1.** Locations of ARCN I&M stations, fire RAWS, Kelly Snotel, and base locations.

**Table 1.** Locations of ARCN stations maintained in 2014 field season.

<b>Station Name</b>	<b>Station Type</b>	<b>Latitude (N)</b>	<b>Longitude (W)</b>	<b>Elevation (ft)</b>	<b>Park</b>	<b>Work Summary</b>
Chimney Lake	I&M	67° 42.853'	150° 35.100'	3780	GAAR	Maintenance
Killik Pass	I&M	67° 59.007'	155° 00.782'	4355	GAAR	Maintenance
Pamichtuk Lake	I&M	67° 45.977'	152° 09.854'	3294	GAAR	Maintenance
Ram Creek	I&M	67°37.458'	154° 20.678'	4110	GAAR	Maintenance
Asik	I&M	67° 28.493'	162° 15.986'	1329	NOAT	Maintenance
Howard Pass	I&M	68° 09.361'	156° 53.749'	2062	NOAT	Maintenance
Imelyak	I&M	67°32.689'	157° 04.646'	3620	NOAT	Maintenance
Kaluich	I&M	67° 34.403'	158° 25.903'	2486	NOAT	Maintenance
Kavet Creek RAWS	Fire RAWS	67° 8.317'	159° 2.617'	235	KOVA	Maintenance
Kelly RAWS*	Fire RAWS	67° 55.778'	162° 17.775'	412	NOAT	Maintenance
Kelly Snotel	Snotel	67° 55.780'	162° 17.410'	310	NOAT	Maintenance
Kugururok	I&M	68° 19.003'	161° 29.518'	908	NOAT	Installation
Noatak RAWS	Fire RAWS	68° 4.222'	158° 42.224'	1040	NOAT	Maintenance
Salmon River	I&M	67° 27.594'	159° 50.475'	1262	KOVA	Maintenance
Sisiak	I&M	67° 59.702'	160° 23.739'	1823	NOAT	Maintenance
Tahinichok	I&M	67° 33.009'	163° 34.031'	966	CAKR	Maintenance
Mt. Noak	I&M	67° 08.486'	162° 59.672'	809	CAKR	Maintenance
Devil Mountain	I&M	66° 16.553'	164° 31.851'	285	BELA	Maintenance
Ella Creek	I&M	65° 16.289'	163° 48.681'	2258	BELA	Maintenance
Hoodoo Hills RAWS	Fire RAWS	65° 35.711'	163° 24.671'	1550	BELA	Maintenance
Midnight Mountain	I&M	65° 49.220'	164° 32.565'	2267	BELA	Maintenance
Quartz Creek RAWS	Fire RAWS	65° 24.429'	164° 39.444'	276	BELA	Maintenance
Serpentine	I&M	65° 51.138'	164° 42.469'	518	BELA	Maintenance

## Climate Station Installation and Maintenance Summaries

This next section describes the installation and maintenance details of sixteen climate stations in the Arctic Network organized by base locations. See Appendix A for detailed logistics for each of the base locations. Appendices B and C provide sensor specifications and metadata.

### **Bettles Base**

Stations maintained from Bettles include: Chimney Lake, Killik Pass, Pamichtuk Lake, and Ram Creek.

Logistics: NPS staff and equipment were transported via NPS pilot and aircraft (Curtis Cebulski; Cessna 206; N473YC) from Fairbanks on June 10. The helicopter and pilot (Quicksilver R44; N644AK; Blake Malo) arrived the same day and were used to ferry the crew and gear from the Bettles base to the climate station sites. All staff stayed in the NPS/FWS bunkhouse at Bettles.

### ***Chimney Lake***

Date: June 12, 2014

Time of visit: 1730-1900

Personnel: Ken Hill, Pam Sousanes, Blake Malo (pilot)

Mode of transport: R44 Helicopter – Quicksilver Aviation – N644AK

Purpose of trip: Annual Maintenance

Weather: 34°F, 5-15 mph, scattered showers, clearing

Sensors replaced:

AT-RH

SR

ST1 (10 cm)

ST3 (50 cm)

Narrative:

The Chimney Lake station was accessed by helicopter from Bettles - Pamichtuk. There was still patchy snow at/near the site including inside the fenced area. The station was in good condition except for the ST1 and ST3 soil temperature sensors which had been ripped out of the ground and were lying on the surface. All data were downloaded from the datalogger. The HMP45 AT-RH and SR sensors were replaced for routine calibration. The ST1 and ST3 soil temperature sensors and cable looked okay and were reinserted to the proper depths. The secondary 109-L AT sensor was placed in its own radiation shield instead of sharing with the primary ThermX AT sensor. A new datalogger program (*Chimney2014.CRI*) was sent to the datalogger. The height of the snow depth sensor was entered into the program at 79 inches. The electric fence was repaired and the fence charger was placed on the ground inside the fence instead of being mounted on the fence post. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 2.** Chimney Lake, June 10, 2014.

***Killik Pass***

Date: June 10, 2014

Time of visit: 1700-1830

Personnel: Ken Hill, Pam Sousanes, Blake Malo (pilot)

Mode of transport: R44 Helicopter – Quicksilver Aviation – N644AK

Purpose of trip: Annual Maintenance

Weather: 34°F, 10 mph, snow/rain mix

Sensors replaced:

AT-RH

SR

Narrative:

Killik Pass was accessed by helicopter from Bettles – Ram Creek. The station looked good upon arrival. All data were downloaded from the datalogger. The AT-RH and SR sensors were replaced for routine calibration. The secondary 109-L AT sensor was placed in its own radiation shield instead of sharing with the primary ThermX AT sensor. A new datalogger program (*Killik2014.CRI*) was sent to the datalogger. The height of the snow depth sensor was measured and entered into the program. The desiccant packets were replaced in the enclosure. Because of exceedingly wet and cold conditions, only a few photos were obtained.



**Figure 3.** Killik Pass, June 10, 2014.

***Pamichtuk***

Date: June 12, 2014

Time of visit: 1530-1700

Personnel: Ken Hill, Pam Sousanes, Blake Malo (pilot)

Mode of transport: R44 Helicopter – Quicksilver Aviation – N644AK

Purpose of trip: Annual Maintenance

Weather: 38 F, 5-15 mph, scattered showers

Sensors replaced:

AT-RH

Narrative:

The Pamichtuk was accessed by helicopter from Bettles. The station looked good upon arrival. All data were downloaded from the datalogger. The AT-RH sensor (HMP45) was replaced for routine calibration. The secondary 109-L AT sensor was placed in its own radiation shield instead of sharing with the primary ThermX AT sensor. The cable on the 109-L backup AT sensor was repaired in 2013 and looked good. It should be monitored in the future. A new datalogger program (*Pamichtuk2014.CR1*) was sent to the datalogger. The height of the snow depth sensor was entered into the program at 81 inches. The electric fence was repaired as needed. Photos were downloaded from the CC5MPX phenology camera at the site. The camera firmware was updated to version 1.22. The SE corner electric fence post was marked incrementally as a way to monitor snow depth from the photos. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 4.** Pamichtuk, June 10, 2014.

### **Ram Creek**

Date: June 10, 2014

Time of visit: 1400-1630

Personnel: Ken Hill, Pam Sousanes, Blake Malo (pilot)

Mode of transport: R44 Helicopter – Quicksilver Aviation – N644AK

Purpose of trip: Annual Maintenance

Weather: 42°F, 5-10 mph, scattered showers

Sensors replaced:

AT-RH

SR

WS-WD

RG-TB

TX312

GPS Cable

AT-RH Radiation Shield

Narrative:

The Ram Creek station was accessed by helicopter from Bettles. The station had been damaged by wildlife (bear). The AT-RH sensor was destroyed along with the radiation shield. Plastic pieces of the radiation shield were dispersed around the vicinity of the site. The RG-TB was destroyed with multiple puncture holes. The GPS cable, 109-L AT cable, and WS-WD cables were cut. All data were downloaded from the datalogger. The HMP45 AT-RH and SR sensors were replaced for routine calibration. The damaged WS-WD sensor, RG-TB sensor, GPS cable, AT-RH radiation shield were replaced. The 109-L AT sensor cable was repaired by splicing and placed in its own radiation shield instead of sharing with the ThermX AT sensor. After extensive troubleshooting, it was discovered that the TX312 transmitter clock was not functioning. Although the LED status lights on the transmitter did not indicate a syncing problem, the “transmitting” LED did not activate during the scheduled transmission window. To solve the problem, the TX312 was replaced. Staff waited on site until a proper transmission was confirmed

by calling NESDIS. A new datalogger program (*Ram2014.CRI*) was sent to the datalogger. The height of the snow depth sensor was entered into the program at 78 inches. An electric fence was installed in an effort to prevent future damage by wildlife. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 5.** Ram Creek, June 10, 2014. Damaged RG-TB shown at right.

### **Dahl Creek Base**

I&M stations maintained from Dahl Creek include: Howard Pass, Imelyak, Kaluich, and Salmon River. Additionally, Kavet Creek and Noatak fire RAWS stations were maintained.

Logistics: The Temsco helicopter (N6015S; NPS Western Area Fire contract; pilot Shannon Bowman) was used to access the sites. Climate staff flew in the helicopter to and from Dahl Creek from Fairbanks. All staff stayed in the NPS bunkhouse at Dahl Creek.

### **Howard Pass**

Date: July 25, 2014

Time of visit: 0900-1030

Personnel: Ken Hill, Pam Sousanes, Shannon Bowman (pilot)

Mode of transport: A-star helicopter – Temsco (NPS Western Area Fire) – N-6015S

Purpose of trip: Annual maintenance

Weather: 31°F, 30-35 mph, 100% RH

Sensors replaced:

AT-RH (HMP60 replaced with HMP155)

WS-WD

Radiation Shield (for ThermX)

Narrative:

The Howard Pass station was accessed from Dahl Creek by helicopter. The WS-WD sensor propeller and shaft had broken off from its base. The sensor stopped transmitting after a prolonged wind event in mid-February 2014. The last gust recorded from this sensor was 96 mph at which point the wind sensor was probably ripped off its base mount. The sensor was found about 100 meters downwind with extensive damage. The radiation shield for the ThermX AT sensor was damaged and replaced. It is unclear if this damage was from wind, ice, or blowing

debris. The HMP60 AT-RH sensor was replaced with a HMP155 AT-RH sensor. A new WS-WD sensor was installed. The lightning rod at the top of the tripod, which was reattached with zip ties in 2014, was still in place and appeared sturdy. A few antenna tines were missing/damaged and replaced/repared as necessary. A new program (*HowardPass2014.CRI*) was sent to the datalogger with a snow depth sensor height of 93 inches. All bolts and guy wires were tightened. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 6.** Howard Pass, July 25, 2014 (left). WS-WD and radiation shield damage (right).

### ***Imelyak***

Date: July 15, 2014

Time of visit: 1600-1730

Personnel: Ken Hill, Pam Sousanes, Shannon Bowman (pilot)

Mode of transport: A-star helicopter – Temsco (NPS Western Area Fire) – N-6015S

Purpose of trip: Annual Maintenance

Weather: Breezy, 40°F, 5-10 mph, partly cloudy

Sensors replaced:

AT-RH (HMP60 replaced with HMP155)

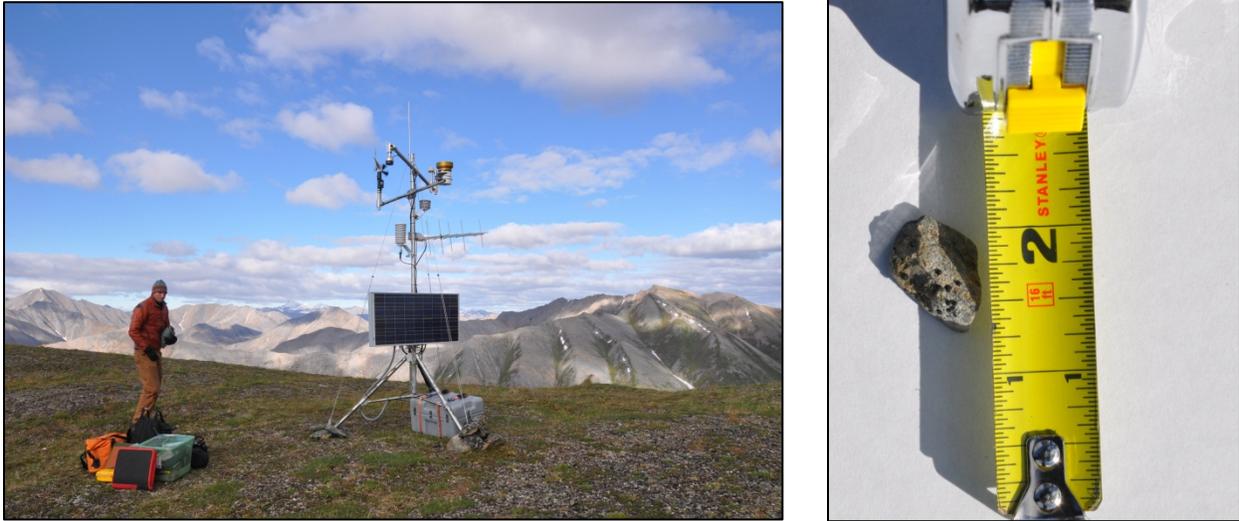
WS-WD

SD

Narrative:

The Imelyak site was accessed by helicopter from Dahl Creek – Howard Pass – Noatak RAWS – Kaluich. The site was in good condition upon arrival. All data were downloaded from the datalogger. The AT-RH and WS-WD sensors were replaced for routine calibration. The HMP60 AT-RH sensor was replaced with a HMP155 AT-RH sensor. The WS-WD propeller was damaged, perhaps indicating blowing debris. Likewise, a small stone (~1 inch diameter) was found inside the tipping bucket, ostensibly blown in during a wind event – impressive, considering the tipping bucket is mounted ~seven feet off the ground. A new datalogger program (*Imelyak2014.CRI*) was sent to the datalogger with the measured snow depth sensor height of 100 inches. The SD sensor was replaced. Green discoloration on the old sensor suggests

corrosion damage. Three antenna tines were missing/damaged and replaced as needed. All bolts and guy wires were tightened. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 7.** Imelyak, July 25, 2014. A small stone (right) was found inside the rain gage, indicating blowing debris.

### ***Kaluich***

Date: July 25, 2014

Time of visit: 1330-1500

Personnel: Ken Hill, Pam Sousanes, Shannon Bowman (pilot)

Mode of transport: A-star helicopter – Temsco (NPS Western Area Fire) – N-6015S

Purpose of trip: Annual Maintenance

Weather: 55°F, 5-10 mph, partly cloudy

Sensors replaced:

AT-RH (HMP60 replaced with HMP155)

SR

WS-WD

Narrative:

The Kaluich site was accessed by helicopter from Dahl Creek – Howard Pass – Noatak RAWS. The site was in good condition upon arrival. All data were downloaded from the datalogger. The AT-RH, SR, and WS-WD sensors were replaced for routine calibration. The HMP60 AT-RH sensor was replaced with a HMP155 AT-RH sensor. A new datalogger program (*Kaluich2014.CRI*) was sent to the datalogger with the measured snow depth sensor height of 80.6 inches. All bolts and guy wires were tightened. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 8.** Kaluich, July 25, 2014.

***Kavet Creek fire RAWS***

Date: July 24-25, 2014

Time of visit: 1630-1800

Personnel: Ken Hill, Pam Sousanes, Shannon Bowman (pilot)

Mode of transport: A-star helicopter – Temsco (NPS Western Area Fire) – N-6015S

Purpose of trip: Annual Maintenance

Weather: 10-15 mph, 45°F, mostly cloudy, isolated showers

Sensors replaced:

AT-RH

SR

Sensors installed:

ST1 (-10 cm)

ST2 (-20 cm)

ST3 (-50 cm)

Narrative:

The Kavet Creek fire RAWS station was accessed via helicopter from Dahl Creek – Salmon River on July 24. The station looked good upon arrival. All data were downloaded from the datalogger. The AT-RH and SR sensors were replaced for routine calibration. The RG-TB was tested and reset. All sensors were scanned. The Fuel Moisture / Fuel Temperature parameter was removed from the datalogger program; the sensor had been removed a few years ago. Staff returned on 7/25 to install three soil temperature sensors at -10 cm, -20 cm, and -50 cm depths. The ST sensors were connected to the main datalogger via a Serial Digital Interface (SDI) expansion port. All bolts and guy wires were tightened.



**Figure 9.** Kavet Creek fire RAWS, July 24, 2014.

***Noatak fire RAWS***

Date: July 25, 2014

Time of visit: 1530-1830

Personnel: Ken Hill, Pam Sousanes, Shannon Bowman (pilot)

Mode of transport: A-star helicopter – Temsco (NPS Western Area Fire) – N-6015S

Purpose of trip: Annual Maintenance

Weather: 10-15 mph, 45°F, mostly cloudy, isolated showers

Sensors replaced:

AT-RH

ST1 (-10 cm)

ST2 (-20 cm)

ST3 (-50 cm)

Narrative:

The Noatak fire RAWS station was accessed via helicopter from Dahl Creek – Howard Pass. The station looked good upon arrival. All data were downloaded from the datalogger. The AT-RH sensor was replaced for routine calibration. The RG-TB was tested and reset. All sensors were scanned. The Fuel Moisture / Fuel Temperature parameter was removed from the datalogger program; the sensor had been removed a few years ago. Three soil temperature sensors were added to the site at -10 cm, -20 cm, and -50 cm. The ST sensors were connected to the main datalogger via a Serial Digital Interface (SDI) expansion port. All bolts and guy wires were

tightened. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 10.** Noatak fire RAWS, July 25, 2014.

### ***Salmon River***

Date: July 24, 2014

Time of visit: 1300-1600

Personnel: Ken Hill, Pam Sousanes, Shannon Bowman (pilot)

Mode of transport: A-star helicopter – Temsco (NPS Western Area Fire) – N-6015S

Purpose of trip: Annual Maintenance

Weather: 10-15 mph, 45°F, mostly cloudy, isolated showers

Sensors replaced:

AT-RH

SR

Antenna Coax Cable

Narrative:

The Salmon River site was accessed by helicopter from Dahl Creek. The station appeared to have some disturbance upon arrival and data were not being transmitted. After connecting to the CR1000 datalogger, the software indicated that no program was present. Therefore, no data were stored on the datalogger. The cause of the program loss remains unknown. The datalogger was not replaced, but a new program was sent to the datalogger which clears the memory. The *Salmon2014.CR1* program was loaded into the datalogger with a snow depth sensor height of 86 inches. The sensors and hardware were in good condition. The AT-RH and SR sensors were replaced for routine calibration. The HMP60 AT-RH sensor was replaced with the HMP155 model. The solar panel wiring had been damaged and was replaced. The antenna coax cable was replaced because it was kinked and longer than necessary. A few antenna tines were missing/damaged and replaced as needed. All photos were downloaded from the CC5MPX phenology camera mounted on the station. The camera did not power back on properly in the spring. No photos were captured after mid-November. The camera firmware was updated to

version 1.22. The camera power settings were changed to “Deep Sleep” mode as advised by Campbell Scientific. The camera was moved and mounted on the mast instead of the cross arm to improve stability. The electric fence was repaired as needed. A white T-post insulator was added to the north fence post to aid in camera image calibration and processing. All bolts and guy wires were tightened. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 11.** Salmon River, July 24, 2014.

### **Kotzebue Base**

I&M stations maintained from Kotzebue include: Asik, Kugururok (installation), Mt. Noak, Sisiak, and Tahinichok. The Kelly fire RAWS and Kelly Snotel stations were also maintained.

Logistics: NPS climate staff flew commercially on Alaska Airlines. Keys were obtained for the NPS warehouse from the Kotzebue expediter Adam Hrnicek. Extra cargo was shipped by Northern Air Cargo. All sites were accessed via R44 Bering Air helicopter. A Cessna 206 charter was arranged with Northwestern Aviation for transport of equipment and staff from Kotzebue to Kelly River bar on 7/17/2014. Michael Wendt (WEAR archaeologist) accompanied climate staff to the Kugururok site for an archaeological compliance check. Fuel was temporarily shuttled to Kelly River bar because two trips were necessary to shuttle the new station equipment to the Kugururok site. All staff were housed at the BLM bunkhouse in Kotzebue.

### **Asik**

Date: July 15, 2014

Time of visit: 1800-2000

Personnel: Ken Hill, Pam Sousanes, Thomas St. Romain (pilot)

Mode of transport: R44 helicopter – Bering Air – N4237W

Purpose of trip: Annual maintenance

Weather: Rain, fog, 45°F, 15-20 mph

Sensors replaced:

AT-RH

SR

Narrative:

Asik station was accessed by helicopter from Kotzebue – Mt. Noak – Tahinichok. The station looked good upon arrival. All data were downloaded from the datalogger. The AT-RH and SR sensors were replaced for routine calibration. A new datalogger program (*Asik2014.CRI*) was sent to the datalogger with a snow depth sensor height of 72 inches. All bolts and guy wires were tightened. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 12.** Asik, July 15, 2014.

***Kelly fire RAWS***

Date: July 17, 2014

Time of visit: 1300-1430

Personnel: Pam Sousanes, Ken Hill, Thomas St. Romain (pilot)

Mode of transport: Cessna-206 (Northwestern Aviation; Pilot Jim Kincaid; N8287Q) and R44 helicopter (Bering Air; Pilot Thomas St. Romain; N4237W)

Purpose of trip: Annual maintenance

Weather: 48°F, 5 mph

Sensors replaced:

AT-RH

SR

Narrative:

The Kelly fire RAWS station was accessed via helicopter from Kotzebue – Kelly Bar. The station looked good upon arrival. All data were downloaded from the datalogger. The AT-RH and SR sensors were replaced for routine calibration. The RG-TB was tested and reset. All sensors were scanned. The Fuel Moisture / Fuel Temperature parameter was removed from the datalogger program; the sensor had been removed a few years ago. Note: The fire RAWS program is run out of the National Interagency Fire Center. The removal of the fuel moisture and

temperature sensor was a program-wide decision based on the applicability of the measurement to fire weather models. It was determined that the solar radiation measurement provides input to the model that produces derived fuel moisture/fuel temperature values that are more reflective of actual conditions. This program change was made at all of the fire RAWS that we visited.

### ***Kelly Snotel***

Date: July 17, 2014

Personnel: Daniel Fisher (NRCS), Michael Wendt (WEAR archaeologist), Thomas St. Romain (pilot)

Mode of transport: Cessna-206 (Northwestern Aviation; Pilot Jim Kincaid; N8287Q) and R44 helicopter (Bering Air; Pilot Thomas St. Romain; N4237W)

Purpose of trip: Annual maintenance

Sensors replaced: as needed by NRCS

Narrative: Daniel Fischer (NRCS) and Michael Wendt (WEAR archaeologist) completed the annual maintenance at the Kelly Snotel site on July 17. The precipitation gauges were flushed and 10 gallons of fresh antifreeze liquid added for the winter. The electric fences were repaired. The sensors were tested and the site was working great on departure.

### ***Kugururok***

Date: July 17-18, 2014

Time of visit: 1000-1400

Personnel: Pam Sousanes, Michael Wendt (WEAR Archaeology), Adam Hrnicek (Kotzebue expediter), Thomas St. Romain (pilot)

Mode of transport: R44 helicopter – Bering Air – N4237W

Purpose of trip: Installation

Weather: 40°F, 20 mph

All sensors installed:

AT-RH (HMP45)

AT (ThermX)

WS-WD

SR

SD

TB-RG

ST (ST1=10 cm, ST2=20 cm, ST3=50 cm)

Narrative:

The Kugururok site was assessed for archaeological compliance on July 17. The site is located at 68° 19.003', -161° 29.518', about 2.5 miles northwest of the confluence of Kagvik Creek at an elevation of 908 feet. Site installation occurred on July 18. Two bears were near the vicinity of the station during the installation. The assigned NESDIS identifier for the station is 396203F8 with a transmission time of 00:23:20. A new datalogger program (*Kug2014.CRI*) was sent to the datalogger with the measured snow depth sensor height. The tripod and all sensors were leveled. All bolts and guy wires were tightened. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 13.** Kugururok, July 18, 2014.

***Mt. Noak***

Date: July 15, 2014

Time of visit: 1400-1600

Personnel: Ken Hill, Pam Sousanes Thomas St. Romain (pilot)

Mode of transport: R44 helicopter – Bering Air – N4237W

Purpose of trip: Annual maintenance

Weather: Light rain, intermittent fog, 52°F, 10-15 mph

Sensors replaced:

AT-RH

WS-WD

TB-RG

TX-312 Transmitter

GPS Cable

Narrative:

Access to Mt. Noak was by helicopter from Kotzebue. The station had been damaged, presumably by bear. The long cross bar was out of level, the TB-RG was damaged, the AT-RH sensor and radiation shield were damaged, and the station was not transmitting. All data were downloaded from the datalogger. The AT-RH and WS-WD sensors were replaced for routine calibration. A new datalogger program (*Noak2014.CRI*) was sent to the datalogger with a snow depth sensor height of 77.5 inches. The GPS cable was replaced. The antenna was realigned. A few damaged/missing antenna tines were replaced. The TX312 transmitter clock was not functioning. Although the LED status lights did not indicate a synching problem, the “transmitting” LED did not activate during the scheduled transmission window. To solve the problem, the TX312 was replaced. Staff waited on site until a proper transmission was confirmed by calling NESDIS. The 12-plate AT-RH radiation shield was damaged and temporarily repaired with tape on site. The shield should be replaced during the next field visit. All photos were downloaded from the CC5MPX phenology camera mounted on the station. The camera did not power back on properly in the spring. No photos were captured after mid-November. The camera firmware was updated to version 1.22. The camera power settings were changed to “Deep Sleep”

mode as advised by Campbell Scientific. The camera image capture settings were edited to capture five images each day at hourly intervals between 1200 and 1600. All bolts and guy wires were tightened and all sensors were leveled. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 14.** Mt. Noak, July 15, 2014. Site shown before (left) and after (right) repairs. The AT-RH radiation shield (middle) should be replaced during the next field visit.

### ***Sisiak***

Date: July 18, 2014

Time of visit: 1430-1530

Personnel: Pam Sousanes, Adam Hrnicek (Kotzebue expediter), Thomas St. Romain (pilot)

Mode of transport: R44 helicopter – Bering Air – N4237W

Purpose of trip: Annual maintenance

Weather: 40°F, 20 mph

Sensors replaced:

AT-RH

WS-WD

Narrative:

Sisiak station was accessed via helicopter from Kotzebue - Kugururok - Sisiak. The station looked good upon arrival. All data were downloaded from the datalogger. The AT-RH and WS-WD sensors were replaced for routine calibration. A new datalogger program (*Sisiak2014.CRI*) was sent to the datalogger with the measured snow depth sensor height. The black wire had been pulled out of the solar panel and was reconnected. All bolts and guy wires were tightened. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 15.** Sisiak, July 18, 2014.

### ***Tahinichok***

Date: July 15, 2014

Time of visit: 1400-1600

Personnel: Ken Hill, Pam Sousanes Thomas St. Romain (pilot)

Mode of transport: R44 helicopter – Bering Air – N4237W

Purpose of trip: Annual maintenance

Weather: Light rain, intermittent fog, 52°F, 10-15 mph

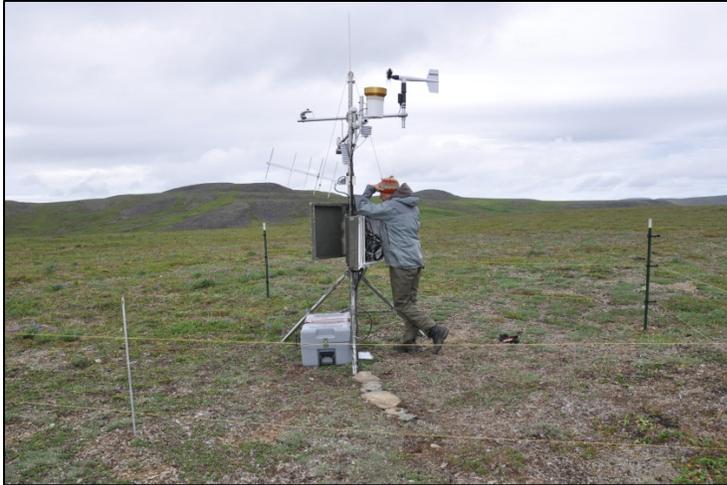
Sensors replaced:

AT-RH

WS-WD

Narrative:

Tahinichok station was accessed via helicopter from Kotzebue – Mt. Noak. On the approach to the station, a bear was seen approximately two miles south of the site. All sensors were functional, but the long cross bar (TB-RG and SD) was out of level, probably due to icing. The AT-RH cable was disconnected from the sensor head and had fallen out of the radiation shield. All data were downloaded from the datalogger. The AT-RH and WS-WD sensors were replaced for routine calibration. A new datalogger program (*Tahinichok2014.CRI*) was sent to the datalogger with a snow depth sensor height of 80.5 inches. The cross bars and all sensors were re-leveled. All bolts and guy wires were tightened. The electric fence was repaired as needed. Four antenna tines were missing/damaged. Three of the tines were replaced; the fourth one was from the driver element that was not repairable. (Note: The antenna and antenna cable were replaced in early October by Stan Hermen, a helicopter pilot doing work in the area. Stan replaced both the antenna and antenna cable). The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 16.** Tahinichok, July 15, 2014.

### **Nome Base**

I&M stations maintained from Nome include Devil Mountain, Ella Creek, Midnight Mountain, and Serpentine Hot Springs. Fire RAWs stations at Hoodoo Hills and Quartz Creek were also maintained.

Logistics: NPS staff flew via commercial airline to Nome and based out of Nome and Quartz Creek for the station maintenance. All equipment was checked on Alaska Airlines. A Bering Air R-44 helicopter was used to reach the site locations from Quartz Creek. Staff stayed at the NPS bunkhouse in Nome, the DOT cabin in Quartz Creek and used an NPS vehicle for transport.

### ***Devil Mountain***

Date: September 3, 2014

Time of visit: 1730-1900

Personnel: Ken Hill, Pam Sousanes Thomas St. Romain (pilot)

Mode of transport: R44 helicopter – Bering Air – N4237W

Purpose of trip: Annual Maintenance

Weather: 42°F, 5-10 mph

Sensors replaced:

AT-RH

Coax cable

Narrative:

Devil Mountain was accessed by helicopter from Quartz Creek. The station was in good condition upon arrival. All data were downloaded from the datalogger. The AT-RH sensor was replaced for routine calibration. A new datalogger program (*Devil2014.CRI*) was sent to the datalogger with the measured snow depth sensor height of 84 inches. Some of the fence posts were bent, but were repairable. The fence charger was damaged, but no replacement was available. The charger should be replaced during the next field visit. Low signal strengths were noted before the site visit, but the antenna and alignment appeared okay. The antenna coax cable showed signs of corrosion near the connection to the transmitter and so it was replaced. Signal

strengths after the field visit have improved. The cause of the corrosion is unknown. All bolts and guy wires were tightened. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 17.** Devil Mountain, September 3, 2014. The corroded antenna coax cable (right) was replaced.

### ***Ella Creek***

Date: September 3, 2014

Time of visit: 1130-1330

Personnel: Ken Hill, Pam Sousanes Thomas St. Romain (pilot)

Mode of transport: R44 helicopter – Bering Air – N4237W

Purpose of trip: Annual Maintenance

Weather: 32°F, 5-10 mph

Sensors replaced:

AT-RH

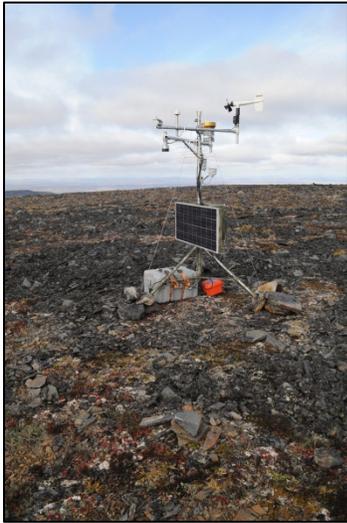
SR

WS-WD

Antenna

Narrative:

Ella Creek was accessed by helicopter from Quartz Creek. The station was in good condition upon arrival. All data were downloaded from the datalogger. The AT-RH, SR, and WS-WD sensors were replaced for routine calibration. A new datalogger program (*Ella2014.CR1*) was sent to the datalogger with the measured snow depth sensor height of 76 inches. Low signal strengths were noted before the site visit. Many antenna tines were missing or damaged, including driver elements. The antenna was replaced. Signal strengths have improved since the site visit. The station is missing a RG-TB screen and a lightning rod (presumably blown off). All bolts and guy wires were tightened. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 18.** Ella Creek, September 3, 2014.

***Hoodoo Hills fire RAWS***

Date: September 3, 2014

Time of visit: 1400-1600

Personnel: Ken Hill, Pam Sousanes Thomas St. Romain (pilot)

Mode of transport: R44 helicopter – Bering Air – N4237W

Purpose of trip: Annual Maintenance

Weather: 42°F, light winds

Sensors replaced:

AT-RH

Datalogger

Antenna

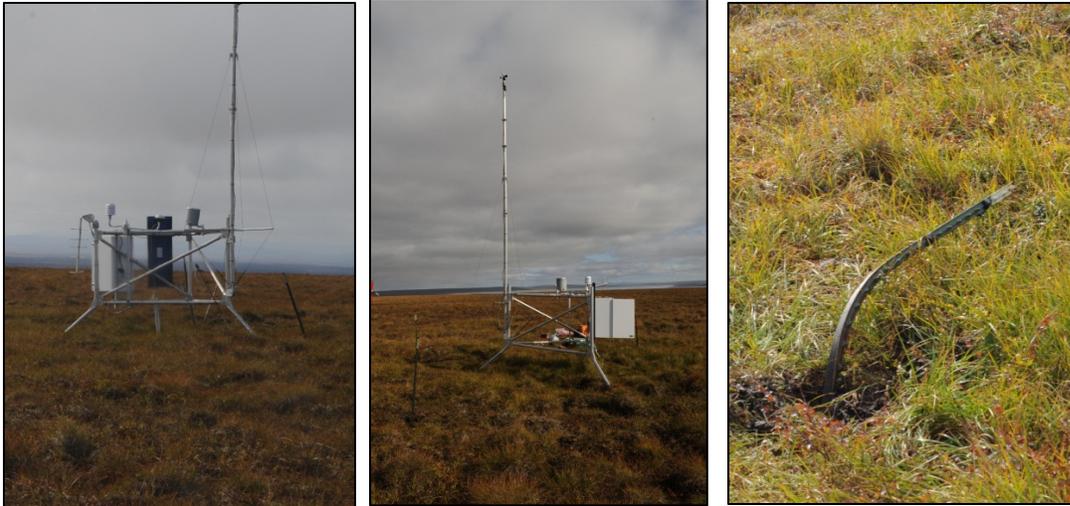
ST1 (-10 cm)

ST2 (-20 cm)

ST3 (-50 cm)

Narrative:

The Hoodoo Hills fire RAWS station was accessed via helicopter from Quartz Creek – Ella Creek. All data were downloaded from the datalogger. The 12S datalogger was replaced with an F6 datalogger. The AT-RH sensor was replaced for routine calibration. The antenna was damaged and replaced. The damage may have been caused by icing. The electric fence was also damaged and there were no fence posts available for replacement. The fence posts, poly-wire, and charger should be replaced during the next field visit. The RG-TB was tested and reset. All sensors were scanned. The Fuel Moisture / Fuel Temperature parameter was removed from the datalogger program; the sensor had been removed a few years ago. Three soil temperature sensors were added to the site at -10 cm, -20 cm, and -50 cm. The ST sensors were connected to the main datalogger via a Serial Digital Interface (SDI) expansion port. All bolts and guy wires were tightened.



**Figure 19.** Hoodoo Hills fire RAWS, September 3, 2014. Station shown before (left) and after (middle) maintenance. Fence posts were damaged (right).

### ***Midnight Mountain***

Date: September 3, 2014

Time of visit: 1930-2030

Personnel: Ken Hill, Pam Sousanes Thomas St. Romain (pilot)

Mode of transport: R44 helicopter – Bering Air – N4237W

Purpose of trip: Annual maintenance

Weather: 34°F, 10-15 mph

Sensors replaced/repared:

ST2 (-20cm): spliced

Battery

Narrative:

Midnight Mountain was accessed by helicopter from Quartz Creek – Devil Mountain. Because of heavy riming in winter months, only air and soil temperature sensors are installed at this site. All data were downloaded from the datalogger. A new battery was installed at the station and the old battery was left at the cache at the repeater tower. Rime ice was present at the site during the time of the site visit. One soil temperature sensor cable was damaged and was repaired by splicing. The desiccant packets were replaced in the enclosure.



**Figure 20.** Midnight Mountain, September 3, 2014.

***Quartz Creek fire RAWS***

Date: September 4, 2014

Time of visit: 0900-1100

Personnel: Ken Hill, Pam Sousanes

Mode of transport: NPS vehicle

Purpose of trip: Annual Maintenance

Weather: 42°F, light winds

Sensors replaced:

AT-RH

ST1 (-10 cm)

ST2 (-20 cm)

ST3 (-50 cm)

Narrative:

The Quartz Creek fire RAWS station was accessed from the air strip. The station looked good upon arrival. All data were downloaded from the datalogger. The AT-RH sensor was replaced for routine calibration. The RG-TB was tested and reset. All sensors were scanned. The Fuel Moisture / Fuel Temperature parameter was removed from the datalogger program; the sensor had been removed a few years ago. All bolts and guy wires were tightened.



**Figure 21.** Quartz Creek fire RAWS, September 4, 2014.

***Serpentine Hot Springs***

Date: September 3, 2014

Time of visit: 2030-2200

Personnel: Ken Hill, Pam Sousanes Thomas St. Romain (pilot)

Mode of transport: R44 helicopter – Bering Air – N4237W

Purpose of trip: Annual Maintenance

Weather: 42 F, light winds

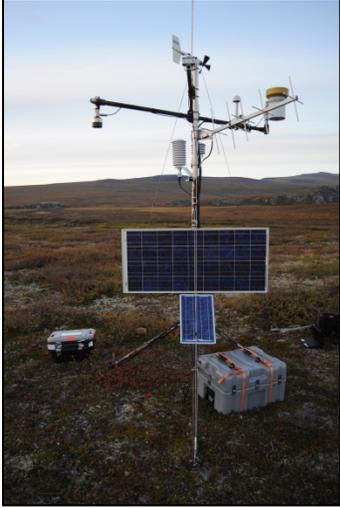
Sensors replaced:

AT-RH

WS-WD

Narrative:

Serpentine was accessed by helicopter from Quartz Creek – Devil Mountain – Midnight Mountain. The station was in good condition upon arrival. All data were downloaded from the datalogger. The AT-RH and WS-WD sensors were replaced for routine calibration. A new datalogger program (*Serpentine2014.CRI*) was sent to the datalogger with the measured snow depth sensor height of 88.6 inches. The SD sensor was slightly out of level upon arrival and was re-leveled. All photos were downloaded from the CC5MPX phenology camera mounted on the station. Unlike other sites, the camera powered back on correctly in the spring. The camera power settings were changed to “Deep Sleep” mode as advised by Campbell Scientific. The camera image capture settings were edited to capture five images each day at hourly intervals between 1300 and 1700 (centered near solar noon). All bolts and guy wires were tightened. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 22.** Serpentine, September 3, 2014.

## **Appendix A: Logistics Summary 2014**

### **Bettles Logistics June 9-12**

Ken and Pam traveled to Bettles on 6/9 with NPS pilot Curtis Cebulski in NPS aircraft (Cessna-2016; N-473YC). Quicksilver aviation pilot Blake Malo met NPS staff in Bettles on 6/10 with the helicopter (R44; N-644AK). Staff stayed in the NPS/USFWS bunk house after checking in with maintenance staff at the NPS office in Bettles. A government vehicle was used as needed to ferry gear from the bunkhouse to the air strip. Killik Pass, Ram Creek, Pamichtuk Lake, and Chimney Lake stations were maintained from the Bettles base. Ten gallons of fuel was transported outside the helicopter for the Ram Creek – Killik leg. Ken returned to Fairbanks with the helicopter on 6/12. Pam returned to Fairbanks after personal travel.

### **Dahl Creek Logistics July 24-26**

Ken and Pam flew by helicopter to Dahl Creek (Temsco/NPS Western Area Fire; Pilot Shannon Bowman; N60152S). Additional equipment was shipped to Dahl Creek earlier in the summer on various scheduled NPS flights. On 7/24, Salmon River and Kavet Creek RAWS were serviced. Howard Pass, Noatak RAWS, Kaluich, Kavet Creek, and Imelyak were serviced on 7/25. All staff were housed at the NPS bunkhouse in Dahl Creek. Staff slept in tents and cooked in the cabin. The facilities were shared with archaeology staff. Ken and Pam returned to Fairbanks in the helicopter on 7/26. Some equipment was backhauled on a scheduled NPS flight.

### **Kotzebue Logistics July 14-19**

Ken and Pam traveled to Kotzebue on an Alaska Airlines commercial flight arriving in Kotzebue at 1815 on 7/14. Local staff picked Ken and Pam up at the airport and provided keys/combinations for BLM housing. Extra cargo (tripod mast, etc.) was shipped with Northern Air Cargo and picked up on 7/15. The Kugururok station had been stored at the NPS warehouse since 2013. The Kotzebue expediter (Adam Hrnicek) provided access to the warehouse and Tara Whitesell provided the combination code to the I&M cache.

On 7/15, weather delayed the start time until 1300. Mt. Noak, Tahinichok, and Asik sites were accessed by R44 helicopter from Kotzebue on 7/15 (Pilot Thomas St. Romain; Bering Air N4237W). Further weather delays occurred on 7/16 and no field work was completed.

On 7/17, Pam Sousanes and Michael Wendt (WEAR archaeologist) flew in the helicopter from Kotzebue to Kugururok to assess the site. Ken and Daniel Fisher (NRCS) were shuttled to Kelly Bar by fixed wing (Northwestern Aviation; Pilot Jim Kincaid; N-8287Q). Pam and Michael finished the Kugururok assessment and met Ken and Daniel at Kelly Bar. The helicopter shuttled Daniel and Michael to the Kelly Snotel. Ken and Pam were helicoptered to the Kelly RAWS. After a few hours waiting for the fixed wing aircraft to return to Kelly Bar, Daniel and Michael returned to Kotzebue in the Cessna. Ken and Pam returned to Kotzebue with the helicopter. 10-20 gallons of fuel was carried to Kelly Bar with the helicopter to aid in reaching Kugururok and all of the shuttles near Kelly.

On 7/18, Pam and Adam accessed Sisiak and Kugururok by helicopter. Ken returned to Anchorage via Alaska Airlines commercial flight. Pam flew out on Alaska Airlines on 7/19.

### **Nome Logistics August 5-8**

Pam and Ken traveled to Nome on a scheduled Alaska Airline flights from Fairbanks on 9/2. Local staff picked Pam and Ken up from the airport. Pam and Ken had reserved beds at the NPS bunkhouse. Extra equipment was sent with Everts/Northern Air Cargo. A vehicle was reserved to transport gear to the end of the Kougarok Road at Quartz Creek. An R44 helicopter (Bering Air; Pilot Thomas St. Romain; N4237W) met Pam and Ken for transport to Ella Creek, Hoodoo Hills RAWS, Devil Mountain, Midnight Mountain, and Serpentine on 9/3. After returning from site maintenance, the pilot returned to Nome. Pam and Ken stayed at the Quartz Creek cabin. Local hunters arrived in the cabin at 4:00 a.m. and shared the cabin space. Pam and Ken completed the maintenance at Quartz Creek on 9/4 and drove back to Nome. One spare antenna was stored at the warehouse in Nome. Extra equipment was shipped back to Fairbanks with Everts/Northern Air Cargo. Ken flew back to Fairbanks the evening of 9/4 on an Alaska Airlines flight. Pam returned on 9/5.

## Appendix B: ARCN I&M Station Specifications

**Table 2.** Sensor Specifications.

Measurements	Model/Manufacturer/Item#	Purchased from:
Air Temperature 1/Relative Humidity	HMP-45C Temperature and Relative Humidity Probe	Campbell Scientific
Air Temperature 2	Resistance Temperature Detector (RTD) Thermistor. Custom build.	Therm-X
Wind Speed and direction	RM Young 05103	Campbell Scientific
Precipitation (summer rainfall)	Texas Electronics TE525WS Rain Gage	Campbell Scientific
Solar Radiation (incoming)	LI-COR LI200X	Campbell Scientific
Snow Depth	SR50A sonic ranging sensor	Campbell Scientific
Soil Temperature	107 Temperature Probe (3)	Campbell Scientific

**Table 3.** Datalogger Specifications.

Datalogger	Purchased from:
CR1000-XT Measurement and Control System	Campbell Scientific

**Table 4.** Satellite Communication Specifications

Satellite Communication	Model/Item #	Purchased From:
GOES Satellite transmitter	TX312/TX320 High Data rate GOES Transmitter	Campbell Scientific
GPS Antenna	GPS Antenna 3.3 V 17992	Campbell Scientific
GPS Cable	Antenna Cable 18017	Campbell Scientific
GOES Antenna	GOES 11 dBi YAGI RHCP Antenna 25316	Campbell Scientific
Coaxial Cable	Antenna Cable RG8 COAXNTN	Campbell Scientific

**Table 5.** Power Specifications

Power	Model	Purchased form:
Batteries	Concorde Sun Extender PV 1040 T 12 Volt 100 Amp hour (2)	ABS Alaskan
Solar Panel	60-75 watt	Varies depending on prices
Battery Box	Pelican Hardigg Single Lid Case	AllCases
Charging Regulator	CH100 12V Charging Regulator	Campbell Scientific

**Table 6.** Hardware Specifications

<b>Station Hardware - Item</b>	<b>Type/Model</b>	<b>Purchased from:</b>
Tripod	CM110 10 ft. stainless-steel tripod w/grounding kit	Campbell Scientific
Guy Kit	Guy Kit for Tripod 19239	Campbell Scientific
Crossarm – 4 ft.	CM204 Sensor crossarm with mounting hardware – 4ft	Campbell Scientific
Crossarm – 6 ft.	CM206 Sensor crossarm with mounting hardware – 6ft	Campbell Scientific
Enclosure with (2) 1.5” diameter holes and mounting hardware for tripod	Weather Resistant 16” x 18” enclosure ENC 16/18 – DC - MM	Campbell Scientific

**Table 7.** Electric Fence Specifications

<b>Electric Fence Parts</b>	<b>Type/Model</b>	<b>Purchased from:</b>
Metal fence posts	6 ft. T-Posts	Various local vendors
T-Post Insulators	5-inch extender insulators	
Poly wire	200 ft. Poly-wire	Various local vendors
Solar fence charger	10 mile low impedance fence charger – various models	Various local vendors

## Appendix C: ARCN I&M Components by Station

**Table 8.** Metadata for Asik I&M.

Station Name	Item	Model	Start Date
Asik	Antenna	25316 YAGI	7/13/2012
Asik	AT	ThermX	7/13/2012
Asik	AT-RH	HMP45	7/15/2014
Asik	Battery	100 AH (x2)	7/13/2012
Asik	Cross arm	CM204	7/13/2012
Asik	Cross arm	CM206	7/13/2012
Asik	Datalogger	CR1000	7/13/2012
Asik	DLP	Asik2014	7/15/2014
Asik	GPS	17992 GPS	7/13/2012
Asik	RG-TB	TE525	7/13/2012
Asik	SD	SR50a	7/13/2012
Asik	Solar Panel	75 W	7/13/2012
Asik	SR	Li200x	7/15/2014
Asik	ST -10 cm	107	7/13/2012
Asik	ST -20 cm	107	7/13/2012
Asik	ST -50 cm	107	7/13/2012
Asik	Tripod	CM106	7/13/2012
Asik	TX312	NESDIS ID 3961A40E	7/13/2012
Asik	WS/WD	5103	7/13/2012

**Table 9.** Metadata for Chimney Lake I&M.

<b>Station Name</b>	<b>Item</b>	<b>Model</b>	<b>Start Date</b>
Chimney Lake	Antenna	25316 YAGI	8/7/2012
Chimney Lake	AT	T-109	8/7/2012
Chimney Lake	AT	ThermX	5/27/2013
Chimney Lake	AT-RH	HMP45	6/12/2014
Chimney Lake	Battery	100 AH (x2)	8/7/2012
Chimney Lake	Cross arm	CM204	8/7/2012
Chimney Lake	Cross arm	CM206	8/7/2012
Chimney Lake	Datalogger	CR1000	8/7/2012
Chimney Lake	Datalogger	Chimney2014	6/12/2014
Chimney Lake	Electric Fence	T-post, poly-wire solar charger	5/27/2013
Chimney Lake	GPS	17992 GPS	8/7/2012
Chimney Lake	RG-TB	TE525	8/7/2012
Chimney Lake	SD	SR50a	8/7/2012
Chimney Lake	Solar Panel	75 W	8/7/2012
Chimney Lake	SR	Li200x	6/12/2014
Chimney Lake	ST -10 cm	107	8/7/2012
Chimney Lake	ST -20 cm	107	8/7/2012
Chimney Lake	ST -50 cm	107	8/7/2012
Chimney Lake	ST -75 cm	107	5/27/2013
Chimney Lake	Tripod	CM106	8/7/2012
Chimney Lake	TX312	NESDIS ID 3961F472	8/7/2012
Chimney Lake	WS/WD	5103	8/7/2012

**Table 10.** Metadata for Devil Mountain I&M.

<b>Station Name</b>	<b>Item</b>	<b>Model</b>	<b>Start Date</b>
Devil Mountain	Antenna	25316 YAGI	8/23/2012
Devil Mountain	AT	ThermX	8/18/2011
Devil Mountain	AT-RH	HMP45	9/3/2014
Devil Mountain	Battery	100 AH (x2)	8/18/2011
Devil Mountain	Cross arm	CM204	8/18/2011
Devil Mountain	Cross arm	CM206	8/6/2013
Devil Mountain	Datalogger	CR1000	8/18/2011
Devil Mountain	DLP	Devil2014	8/6/2013
Devil Mountain	Electric Fence	T-post, poly-wire solar charger	8/23/2012
Devil Mountain	Enclosure	ENC 16/18	8/18/2011
Devil Mountain	GPS	17992 GPS	8/18/2011
Devil Mountain	RG-TB	TE525	8/18/2011
Devil Mountain	SD	SR50a	8/6/2013
Devil Mountain	Solar Panel	75 W	8/18/2011
Devil Mountain	SR	Li200x	8/18/2011
Devil Mountain	ST -10 cm	107	8/18/2011
Devil Mountain	ST -20 cm	107	8/18/2011
Devil Mountain	ST -50 cm	107	8/18/2011
Devil Mountain	Tripod	CM106	8/18/2011
Devil Mountain	TX312	NESDIS ID 3961221A	8/18/2011
Devil Mountain	WS/WD	5103	8/23/2012

**Table 11.** Metadata for Ella Creek I&M.

<b>Station Name</b>	<b>Item</b>	<b>Model</b>	<b>Start Date</b>
Ella Creek	Antenna	25316 YAGI	8/7/2013
Ella Creek	AT	ThermX	9/18/2012
Ella Creek	AT-RH	HMP45	9/3/2014
Ella Creek	Battery	100 AH (x2)	9/18/2012
Ella Creek	Cross arm	CM204	9/18/2012
Ella Creek	Cross arm	CM206	9/18/2012
Ella Creek	Datalogger	CR1000	9/18/2012
Ella Creek	DLP	Ella2014	8/7/2013
Ella Creek	Enclosure	ENC 16/18	9/18/2012
Ella Creek	GPS	17992 GPS	9/18/2012
Ella Creek	RG-TB	TE525	8/7/2013
Ella Creek	SD	SR50a	8/7/2013
Ella Creek	Solar Panel	75 W	9/18/2012
Ella Creek	SR	Li200x	9/3/2014
Ella Creek	ST -10 cm	107	9/18/2012
Ella Creek	ST -20 cm	107	9/18/2012
Ella Creek	ST -50 cm	107	9/18/2012
Ella Creek	Tripod	CM106	9/18/2012
Ella Creek	TX312	396182E2	8/7/2013
Ella Creek	WS/WD	5103	9/3/2014

**Table 12.** Metadata for Howard Pass I&M.

<b>Station Name</b>	<b>Item</b>	<b>Model</b>	<b>Start Date</b>
Howard Pass	Antenna	25316 YAGI	7/7/2011
Howard Pass	AT	ThermX	7/7/2011
Howard Pass	AT-RH	HMP155	7/25/2014
Howard Pass	Battery	100 AH (x2)	7/7/2011
Howard Pass	Cross arm	CM204	7/7/2011
Howard Pass	Cross arm	CM206	7/7/2011
Howard Pass	Datalogger	CR1000	7/7/2011
Howard Pass	DLP	Howard2014	7/17/2013
Howard Pass	Enclosure	ENC 16/18	7/7/2011
Howard Pass	GPS	17992 GPS	7/7/2011
Howard Pass	RG-TB	TE525	7/7/2011
Howard Pass	SD	SR50a	7/17/2013
Howard Pass	Solar Panel	75 W	7/7/2011
Howard Pass	SR	Li200x	7/17/2013
Howard Pass	ST -10 cm	107	7/7/2011
Howard Pass	ST -20 cm	107	7/7/2011
Howard Pass	ST -50 cm	107	7/7/2011
Howard Pass	Tripod	CM106	7/7/2011
Howard Pass	TX312	NESDIS ID 39617266	7/7/2011
Howard Pass	WS/WD	5103	7/25/2014

**Table 13.** Metadata for Imelyak I&M.

<b>Station Name</b>	<b>Item</b>	<b>Model</b>	<b>Start Date</b>
Imelyak	Antenna	25316 YAGI	7/6/2011
Imelyak	AT	ThermX	7/6/2011
Imelyak	AT-RH	HMP155	7/25/2014
Imelyak	Battery	100 AH (x2)	7/6/2011
Imelyak	Cross arm	CM204	7/6/2011
Imelyak	Cross arm	CM206	7/6/2011
Imelyak	Datalogger	CR1000	7/20/2012
Imelyak	DLP	Imelyak2014	7/18/2013
Imelyak	Enclosure	ENC 16/18	7/6/2011
Imelyak	GPS	17992 GPS	7/6/2011
Imelyak	RG-TB	TE525	7/6/2011
Imelyak	SD	SR50a	7/6/2011
Imelyak	Solar Panel	75 W	7/6/2011
Imelyak	SR	Li200x	7/25/2014
Imelyak	ST -10 cm	107	7/6/2011
Imelyak	ST -20 cm	107	7/6/2011
Imelyak	ST -50 cm	107	7/6/2011
Imelyak	Tripod	CM106	7/6/2011
Imelyak	TX312	NESDIS ID 3961316C	7/20/2012
Imelyak	WS/WD	5103	7/25/2014

**Table 14.** Metadata for Kaluich I&M.

<b>Station Name</b>	<b>Item</b>	<b>Model</b>	<b>Start Date</b>
Kaluich	Antenna	25316 YAGI	7/20/2012
Kaluich	AT	ThermX	7/20/2012
Kaluich	AT-RH	HMP155	7/25/2014
Kaluich	Battery	100 AH (x2)	7/20/2012
Kaluich	Cross arm	CM204	7/20/2012
Kaluich	Cross arm	CM206	7/20/2012
Kaluich	Datalogger	CR1000	7/20/2012
Kaluich	DLP	Kaluich2014	7/18/2013
Kaluich	Enclosure	ENC 16/18	7/20/2012
Kaluich	GPS	17992 GPS	7/20/2012
Kaluich	RG-TB	TE525	7/20/2012
Kaluich	SD	SR50a	7/20/2012
Kaluich	Solar Panel	75 W	7/20/2012
Kaluich	SR	Li200x	7/25/2014
Kaluich	ST -10 cm	107	7/20/2012
Kaluich	ST -20 cm	107	7/20/2012
Kaluich	ST -50 cm	107	7/20/2012
Kaluich	Tripod	CM106	7/20/2012
Kaluich	TX312	NESDIS ID 39617266	7/20/2012
Kaluich	WS/WD	5103	7/25/2014

**Table 15.** Metadata for Killik Pass I&M.

<b>Station Name</b>	<b>Item</b>	<b>Model</b>	<b>Start Date</b>
Killik Pass	Antenna	25316 YAGI	8/8/2012
Killik Pass	AT	T109	8/8/2012
Killik Pass	AT	ThermX	5/29/2013
Killik Pass	AT-RH	HMP45	6/10/2014
Killik Pass	Battery	100 AH (x2)	8/8/2012
Killik Pass	Cross arm	CM204	8/8/2012
Killik Pass	Cross arm	CM206	8/8/2012
Killik Pass	Datalogger	CR1000	8/8/2012
Killik Pass	DLP	Killik2014	6/10/2014
Killik Pass	Enclosure	ENC 16/18	8/8/2012
Killik Pass	GPS	17992 GPS	8/8/2012
Killik Pass	RG-TB	TE525	8/8/2012
Killik Pass	SD	SR50a	8/8/2012
Killik Pass	Solar Panel	75 W	8/8/2012
Killik Pass	SR	Li200x	6/10/2014
Killik Pass	ST -10 cm	107	8/8/2012
Killik Pass	ST -20 cm	107	8/8/2012
Killik Pass	ST -50 cm	107	8/8/2012
Killik Pass	Tripod	CM106	8/8/2012
Killik Pass	TX312	NESDIS ID 3961C1E8	8/8/2012
Killik Pass	WS/WD	5103	8/8/2012

**Table 16.** Metadata for Kugururok I&M.

<b>Station Name</b>	<b>Item</b>	<b>Model</b>	<b>Start Date</b>
Kugururok	Antenna	25316 YAGI	7/18/2014
Kugururok	AT	T109	7/18/2014
Kugururok	AT	ThermX	7/18/2014
Kugururok	AT-RH	HMP45	7/18/2014
Kugururok	Battery	100 AH (x2)	7/18/2014
Kugururok	Cross arm	CM204	7/18/2014
Kugururok	Cross arm	CM206	7/18/2014
Kugururok	Datalogger	CR1000	7/18/2014
Kugururok	DLP	Kug2014	7/18/2014
Kugururok	Enclosure	ENC 16/18	7/18/2014
Kugururok	GPS	17992 GPS	7/18/2014
Kugururok	RG-TB	TE525	7/18/2014
Kugururok	SD	SR50a	7/18/2014
Kugururok	Solar Panel	75 W	7/18/2014
Kugururok	SR	Li200x	7/18/2014
Kugururok	ST -10 cm	107	7/18/2014
Kugururok	ST -20 cm	107	7/18/2014
Kugururok	ST -50 cm	107	7/18/2014
Kugururok	Tripod	CM106	7/18/2014
Kugururok	TX312	NESDIS ID 396203F8	7/18/2014
Kugururok	WS/WD	5103	7/18/2014

**Table 17.** Metadata for Midnight Mountain I&M.

<b>Station Name</b>	<b>Item</b>	<b>Model</b>	<b>Start Date</b>
Midnight Mountain	AT_1	ThermX	8/6/2013
Midnight Mountain	AT_2	ThermX	8/6/2013
Midnight Mountain	AT_3	ThermX	8/6/2013
Midnight Mountain	Battery	12 V	9/3/2014
Midnight Mountain	Datalogger	CR1000	8/6/2013
Midnight Mountain	DLP	Midnight_2013_ThermX_6	8/6/2013
Midnight Mountain	Enclosure	ENC 16/18	7/8/2011
Midnight Mountain	Solar Panel	75 W	7/8/2011
Midnight Mountain	ST -10 cm	ThermX	8/6/2013
Midnight Mountain	ST -20 cm	ThermX	8/6/2013
Midnight Mountain	ST -50 cm	ThermX	8/6/2013
Midnight Mountain	Tripod	CM106	7/8/2011

**Table 18.** Metadata for Mt. Noak I&M.

<b>Station Name</b>	<b>Item</b>	<b>Model</b>	<b>Start Date</b>
Mt. Noak	Antenna	25316 YAGI	7/11/2011
Mt. Noak	AT	ThermX	7/11/2011
Mt. Noak	AT-RH	HMP45	7/15/2014
Mt. Noak	Battery	100 AH (x2)	7/11/2011
Mt. Noak	Camera	CC5MPX	6/29/2013
Mt. Noak	Cross arm	CM204	7/11/2011
Mt. Noak	Cross arm	CM206	7/11/2011
Mt. Noak	Datalogger	CR1000	7/11/2011
Mt. Noak	DLP	Noak2014	7/15/2014
Mt. Noak	Enclosure	ENC 16/18	7/11/2011
Mt. Noak	GPS	17992 GPS	7/11/2011
Mt. Noak	RG-TB	TE525	7/11/2011
Mt. Noak	SD	SR50a	6/29/2013
Mt. Noak	Solar Panel	75 W	7/11/2011
Mt. Noak	SR	Li200x	6/29/2013
Mt. Noak	ST -10 cm	107	7/11/2011
Mt. Noak	ST -20 cm	107	7/11/2011
Mt. Noak	ST -50 cm	107	6/29/2013
Mt. Noak	ST -75 cm	107	6/29/2013
Mt. Noak	Tripod	CM106	7/11/2011
Mt. Noak	TX312	NESDIS ID 39616110	7/15/2014
Mt. Noak	WS/WD	5103	7/15/2014

**Table 19.** Metadata for Pamichtuk I&M.

<b>Station Name</b>	<b>Item</b>	<b>Model</b>	<b>Start Date</b>
Pamichtuk	Antenna	25316 YAGI	8/6/2012
Pamichtuk	AT	T109	8/6/2012
Pamichtuk	AT	ThermX	5/29/2013
Pamichtuk	AT-RH	HMP45	6/12/2014
Pamichtuk	Battery	100 AH (x2)	8/6/2012
Pamichtuk	Camera	CC5MPX	5/28/2013
Pamichtuk	Cross arm	CM204	8/6/2012
Pamichtuk	Cross arm	CM206	8/6/2012
Pamichtuk	Datalogger	CR1000	8/6/2012
Pamichtuk	DLP	Pamichtuk2014	6/12/2014
Pamichtuk	Electric Fence	T-post, poly-wire solar charger	5/28/2013
Pamichtuk	Enclosure	ENC 16/18	8/6/2012
Pamichtuk	GPS	17992 GPS	8/6/2012
Pamichtuk	RG-TB	TE525	8/6/2012
Pamichtuk	SD	SR50a	8/6/2012
Pamichtuk	Solar Panel	75 W	8/6/2012
Pamichtuk	SR	Li200x	5/28/2013
Pamichtuk	ST -10 cm	107	8/6/2012
Pamichtuk	ST -20 cm	107	8/6/2012
Pamichtuk	ST -50 cm	107	8/6/2012
Pamichtuk	Tripod	CM106	8/6/2012
Pamichtuk	TX312	NESDIS ID 3961E704	8/6/2012
Pamichtuk	WS/WD	5103	5/28/2013

**Table 20.** Metadata for Ram Creek I&M.

<b>Station Name</b>	<b>Item</b>	<b>Model</b>	<b>Start Date</b>
Ram Creek	Antenna	25316 YAGI	8/7/2012
Ram Creek	AT	T109	8/7/2012
Ram Creek	AT	ThermX	5/28/2013
Ram Creek	AT-RH	HMP45	6/10/2014
Ram Creek	Battery	100 AH (x2)	8/7/2012
Ram Creek	Cross arm	CM204	8/7/2012
Ram Creek	Cross arm	CM206	8/7/2012
Ram Creek	Datalogger	CR1000	8/7/2012
Ram Creek	DLP	Ram2014	6/10/2014
Ram Creek	Electric Fence	T-post, poly-wire solar charger	6/10/2014
Ram Creek	Enclosure	ENC 16/18	8/7/2012
Ram Creek	GPS	17992 GPS	8/7/2012
Ram Creek	RG-TB	TE525	6/10/2014
Ram Creek	SD	SR50a	8/7/2012
Ram Creek	Solar Panel	75 W	8/7/2012
Ram Creek	SR	Li200x	6/10/2014
Ram Creek	ST -10 cm	107	8/7/2012
Ram Creek	ST -20 cm	107	8/7/2012
Ram Creek	ST -50 cm	107	8/7/2012
Ram Creek	Tripod	CM106	8/7/2012
Ram Creek	TX312	NESDIS ID 3961D29E	6/10/2014
Ram Creek	WS/WD	5103	6/10/2014

**Table 21.** Metadata for Salmon River I&M.

<b>Station Name</b>	<b>Item</b>	<b>Model</b>	<b>Start Date</b>
Salmon River	Antenna	25316 YAGI	7/17/2013
Salmon River	AT	T109	7/17/2013
Salmon River	AT-RH	HMP155	7/24/2014
Salmon River	Battery	100 AH (x2)	7/8/2011
Salmon River	Camera	CC5MPX	7/17/2013
Salmon River	Cross arm	CM204	7/8/2011
Salmon River	Cross arm	CM206	7/8/2011
Salmon River	Datalogger	CR1000	7/17/2013
Salmon River	DLP	Salmon2014	7/24/2014
Salmon River	Electric Fence	T-post, poly-wire solar charger	7/17/2013
Salmon River	Enclosure	ENC 16/18	7/8/2011
Salmon River	GPS	17992 GPS	7/17/2013
Salmon River	RG-TB	TE525	7/17/2013
Salmon River	SD	SR50a	7/17/2013
Salmon River	SR	Li200x	7/24/2014
Salmon River	ST -10 cm	107	7/17/2013
Salmon River	ST -20 cm	107	7/17/2013
Salmon River	ST -50 cm	107	7/17/2013
Salmon River	Tripod	CM106	7/17/2013
Salmon River	TX312	NESDIS ID 3960F688	7/24/2014
Salmon River	WS/WD	5103	7/17/2013

**Table 22.** Metadata for Serpentine I&M.

<b>Station Name</b>	<b>Item</b>	<b>Model</b>	<b>Start Date</b>
Serpentine	Antenna	25316 YAGI	8/18/2011
Serpentine	AT	ThermX	8/18/2011
Serpentine	AT-RH	HMP155	9/3/2014
Serpentine	Battery	100 AH (x2)	8/18/2011
Serpentine	Camera	CC5MPX	8/7/2013
Serpentine	Cross arm	CM204	8/18/2011
Serpentine	Cross arm	CM206	8/18/2011
Serpentine	Datalogger	CR1000	8/18/2011
Serpentine	DLP	Serpentine2014	9/3/2014
Serpentine	Enclosure	ENC 16/18	8/18/2011
Serpentine	GPS	17992 GPS	8/18/2011
Serpentine	RG-TB	TE525	8/18/2011
Serpentine	SD	SR50a	8/18/2011
Serpentine	Solar Panel	75 W	8/18/2011
Serpentine	SR	Li200x	8/7/2013
Serpentine	ST -10 cm	107	8/18/2011
Serpentine	ST -20 cm	107	8/18/2011
Serpentine	ST -50 cm	107	8/18/2011
Serpentine	Tripod	CM106	8/18/2011
Serpentine	TX312	NESDIS ID 3961C1E8	8/18/2011
Serpentine	WS/WD	5103	9/3/2014

**Table 23.** Metadata for Sisiak I&M.

<b>Station Name</b>	<b>Item</b>	<b>Model</b>	<b>Start Date</b>
Sisiak	Antenna	25316 YAGI	7/13/2011
Sisiak	AT	ThermX	7/13/2011
Sisiak	AT-RH	HMP45	7/18/2014
Sisiak	Battery	100 AH (x2)	7/13/2011
Sisiak	Cross arm	CM204	7/13/2011
Sisiak	Cross arm	CM206	7/13/2011
Sisiak	Datalogger	CR1000	7/13/2011
Sisiak	DLP	Sisiak2014	7/18/2014
Sisiak	Enclosure	ENC 16/18	7/13/2011
Sisiak	GPS	17992 GPS	7/13/2011
Sisiak	RG-TB	TE525	7/13/2011
Sisiak	SD	SR50a	7/13/2011
Sisiak	Solar Panel	75 W	7/13/2011
Sisiak	SR	Li200x	7/1/2013
Sisiak	ST -10 cm	107	7/13/2011
Sisiak	ST -20 cm	107	7/13/2011
Sisiak	ST -50 cm	107	7/13/2011
Sisiak	ST -75 cm	107	7/1/2013
Sisiak	Tripod	CM106	7/13/2011
Sisiak	TX312	NESDIS ID 3961548A	7/13/2011
Sisiak	WS/WD	5103	7/18/2014

**Table 24.** Metadata for Tahinichok I&M.

<b>Station Name</b>	<b>Item</b>	<b>Model</b>	<b>Start Date</b>
Tahinichok	Antenna	25316 YAGI	7/10/2011
Tahinichok	AT	ThermX	7/10/2011
Tahinichok	AT-RH	HMP45	7/15/2014
Tahinichok	Battery	100 AH (x2)	7/10/2011
Tahinichok	Cross arm	CM204	7/10/2011
Tahinichok	Cross arm	CM206	7/10/2011
Tahinichok	Datalogger	CR1000	7/10/2011
Tahinichok	DLP	Tahinichok2014	7/15/2014
Tahinichok	Electric Fence	T-post, poly-wire solar charger	7/12/2012
Tahinichok	Enclosure	ENC 16/18	7/10/2011
Tahinichok	GPS	17992 GPS	7/10/2011
Tahinichok	RG-TB	TE525	7/10/2011
Tahinichok	SD	SR50a	7/10/2011
Tahinichok	Solar Panel	75 W	7/10/2011
Tahinichok	SR	Li200x	6/30/2013
Tahinichok	ST -10 cm	107	7/10/2011
Tahinichok	ST -20 cm	107	7/10/2011
Tahinichok	ST -50 cm	107	7/10/2011
Tahinichok	ST -75 cm	107	6/30/2013
Tahinichok	Tripod	CM106	7/10/2011
Tahinichok	TX312	NESDIS ID 3961548A	7/10/2011
Tahinichok	WS/WD	5103	7/15/2014

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NPS 953/127579, January 2015

**National Park Service**  
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