Environmental Assessment of: Installation of Temporary Seismometer Stations on Multiple Wildlife Refuges in Alaska (EarthScope)

Prepared by: United States Department of the Interior U.S. Fish and Wildlife Service Anchorage Alaska

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Title	Environmental Assessment of: Installation of Temporary Seismometer Stations on Multiple Wildlife Refuges in Alaska. (EarthScope)
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Executive Summary	The Incorporated Research Institutions for Seismology (IRIS) is seeking a right of way to install up to 11 seismic stations on National Wildlife Refuges in Alaska. These seismograph stations would contribute as a part of the EarthScope Transportable Array (USArray). They would be installed temporarily, for a term of five (5) years. The USArray is one segment of EarthScope, an extensive earth science research project funded by the National Science Foundation and operated by IRIS, a nonprofit 503(c) corporation comprised of a consortium of over 100 US universities dedicated to the operation of science facilities seismological data. The USArray is a temporary seismic monitoring network that collects and analyzes seismic data for use in improving the understanding of active tectonics, and geologic history of the North American continent. Data collected will provide new insights into earthquake processes and improve earthquake and tsunami warning systems for hazard mitigation. The array images the deep structure of the earth and records earthquakes. The resulting data is made immediately available to Federal agencies and researchers worldwide. The USArray has installed over 1,700 seismometer stations across the contiguous United States and Canada in a dense array with approximately 42 mile grid spacing. Now the USArray project is beginning in Alaska and northwestern Canada, where the installation of approximately 294 seismometers at a nominal spacing of 51 miles is planned. These seismometers in Alaska and Canada will remain in place for up to 5 years at which time the equipment will be removed and the sites restored to their original condition.

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1. Introduction

The EarthScope/Transportable Array (USArray) is a seismic monitoring network. It uses continuously operating seismic stations to measure ground motion caused by earthquakes and volcanic processes. The locations proposed will supplement or enhance existing seismic stations currently operated by the Alaska Earthquake Center, Alaska Volcano Observatory, and the Tsunami Warning Center. From 2003 to 2013 USArray installed over 1,700 seismometer stations across the contiguous United States and southern Canada in a dense semi-permanent array at a 42 by 42 mile grid spacing. The USArray is one segment of EarthScope, an extensive earth science research project funded by the National Science Foundation. The USArray is operated by the Incorporated Research Institutions for Seismology (IRIS), a consortium of over 100 US universities dedicated to the operation of science facilities for the acquisition, management, and distribution of seismological data. USArray proposes to install up to 11 seismic stations on National Wildlife Refuges (NWRs) in the Alaska Region for a term of up to five (5) years.

IRIS has secured full funding (subject to annual appropriations) from the National Science Foundation to install, operate, maintain, and subsequently remove the seismic stations related to the USArray project. Data collected at the seismic stations are telemetered back to the Array Network Facility at the University of California, San Diego. From there the data are sent to the IRIS Data Management Center in Seattle, WA, where all of the data is publically available at no cost.

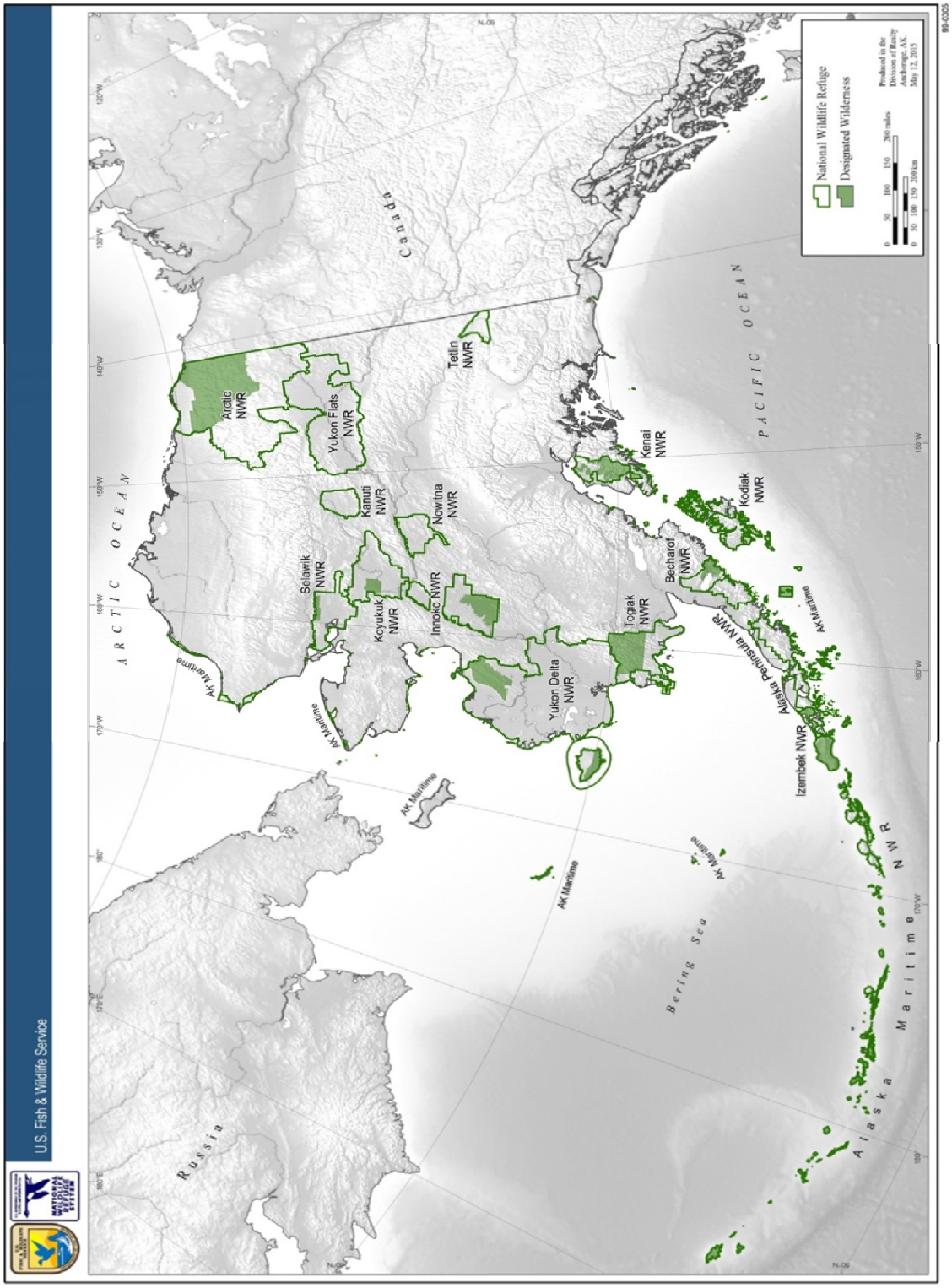
Alaska is a region that is prone to tectonic movements and volcanic eruptions. The proposed sites are located to fill in gaps in existing seismic networks and allow for better measurement of background plate tectonics motions. A positive impact would occur as a result of the implementation of the proposed project by improving the knowledge of active faulting and earthquake/volcanic hazards in Alaska. Also, an incremental positive impact would occur as a result of implementation of the proposed project by generating revenue to the local and regional economy.

1.1 Purpose of Action

The U.S. Fish and Wildlife Service (Service) is considering a request from IRIS for a right of way permit that would provide authorization to install, operate, maintain, and subsequently remove seismic monitoring stations on seven (7) NWRs in Alaska. These stations would be located at sites selected to fill in a 51 by 51 mile grid. The proposed seismometers would complement existing seismometers in operation throughout the Alaska. Data from the sites would be analyzed to improve earthquake detection and hazard forecasting in the region.

The purpose of this Environmental Assessment (EA) is to analyze the proposed action, alternatives, and their potential impacts. The EA is prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 (42 USC §§ 4321-4347) and regulations of the Council on Environmental Quality (40 CFR 1500-1508).

Figure 1: Locations of National Wildlife Refuges in Alaska



1.2 Need for Action

This action is needed to provide the Service with sufficient analysis and information regarding the proposed project to make informed decisions regarding the project.

IRIS proposes to install new seismometers on seven (7) NWRs in Alaska. Placement of seismometers on refuges is necessary due to the size of refuges in Alaska. A grid of data collection points cannot be maintained without locating sites on refuges.

A location on bedrock is of critical importance because the quality of seismic signals detected by a seismometer is directly related to the amount of signal attenuation caused by any soils or unconsolidated materials overlying the bedrock in a given area. A seismometer located on bedrock would encounter little or no attenuation of seismic signals, allowing significantly greater accuracy in the analysis of earthquake locations, depths, magnitudes, and mechanisms. Stations located on bedrock tend to be more accurate than those located on unconsolidated materials.

The ability to detect and characterize micro-earthquakes (seismic events of magnitudes 0.1 to 3.0) is a function of the quality of the seismic signals that are detected. This information could tell us if significant tectonic stress is accumulating on the fault over time, which could lead to large magnitude earthquakes capable of causing significant damage. The information could also inform seismologists where the stress is being released over time by the more numerous smaller magnitude seismic events.

- Proposed locations have been selected to avoid designated Wilderness
- They close gaps in the network of seismic sensors,
- They provide locations that would allow the best possible detection of seismic signals.

1.3 Land Status

These NWRs are part of the National Wildlife Refuge System (System) a network of refuges across the United States. Management of individual NWRs reflects the specific refuge's purposes, the missions of the Service and the System, and/or the Alaska National Interests Lands Conservation Act (ANILCA) of 1980, which established or enhanced many NWRs.

1.3.1 The U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (Service) is the principal Federal agency responsible for conserving, protecting, and enhancing fish, wildlife, plants, and their habitats for the continuing benefits of the American people. In addition to the National Wildlife Refuge System the Service also operates National Fish Hatcheries, fishery resource offices, and Ecological Services field stations. The Service enforces Federal wildlife laws, administers the Endangered Species Act, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat such as wetlands, and helps foreign governments with their conservation efforts. It also oversees the Federal Aid in Wildlife Restoration program, which distributes to State fish and wildlife agencies hundreds of millions of dollars derived from excise taxes on fishing and hunting equipment.

The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people.

1.3.2 The National Wildlife Refuge System

The National Wildlife Refuge System comprises more than 96 million acres of Federal lands, which encompasses more than 545 NWRs, thousands of small wetlands, and other special management areas. Units of the System are located in all 50 states and the territories of the United States. Their conservation mission includes providing Americans with opportunities to participate in compatible wildlife-dependent recreation on System lands and to better appreciate the value of and need for fish and wildlife conservation.

Alaska contains 16 NWRs (Figure 1). These refuge lands contain a wide range of habitats and terrain that includes mountains, glaciers, tundra, grasslands, wetlands, lakes, woodlands, and rivers. Together, the 16 refuges comprise 76.8 million acres and constitute about 80 percent of the System.

The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans (National Wildlife Refuge System Administration Act, as amended).

1.4 Refuges with proposed sites

1.4.1 Alaska Peninsula - Becharof NWR

These are two separate NWRs administered as a single unit by the Service. One (1) site is proposed for the Alaska Peninsula unit of this refuge. These refuges were established with the passage of ANILCA in 1980 and have been managed as a complex since 1983. The decision to manage the two

refuges as a complex was based on biology and logistics. The two northern units of the Alaska Peninsula Refuge (Ugashik and Chignik units), the 9,900 acre Seal Cape area of Alaska Maritime Refuge, and the Becharof Refuge share common resources and resource issues and can be easily accessed from the refuge headquarters in King Salmon. On the other hand, distance and weather create barriers to managing the two southern units (Pavlof and North Creek) from the King Salmon office. Management of these units was assumed by the Izembek Refuge, headquartered in Cold Bay.

Of the 4,932,600 acres within the Alaska Peninsula/Becharof Refuge, 910,050 acres (18%) are either selected by or conveyed to Native corporations, the State of Alaska, or private entities. Ten (10) Alaska Native Claims Settlement Act (ANCSA) village corporations, representing 12 villages, have selections and/or conveyances within the refuge. Most conveyances to village corporations (85%) are in the Chignik unit near the villages of Ivanof Bay, Perryville, Chignik, Chignik Lagoon, Chignik Lake, and Port Heiden.

ANILCA Section 302(1)(B) and (2)(B) sets forth the following purposes for which Alaska Peninsula and Becharof NWRs were established and are to be managed:

(i) to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, brown bear, the Alaska Peninsula caribou herd, moose sea otters, and marine mammals, shorebirds and other migratory birds, raptors, including bald eagles and peregrine falcons, and salmonoids and other fish;

(ii) to fulfill the international treaty obligations of the United States with respect to fish and wildlife and their habitats;

(iii) to provide, in a manner consistent with the purposes set forth in subparagraphs (i) and (ii), the opportunity for continued subsistence uses by local residents; and

(iv) to ensure, to the maximum extent practicable and in a manner consistent with the purposes set forth in paragraph (i), water quality and necessary water quantity within the refuge.

1.4.2 Arctic NWR

Four (4) sites and three (3) alternates are proposed for the Arctic National Wildlife Refuge.

The 8.9-million-acre Arctic National Wildlife Range was established on December 6, 1960, through Public Land Order 2214. ANILCA added 9.2 million acres to the Arctic Range, designated 8 million acres as wilderness, designated three wild rivers, and renamed it the Arctic National Wildlife Refuge. This Refuge now encompasses approximately 19.3 million acres in northeastern Alaska.

The Refuge's Revised Comprehensive Conservation Plan and Final Environmental Impact Statement (January 2015) recommends an additional 12.3 million acres for inclusion in the National Wilderness Preservation System, and four rivers for inclusion in the National Wild and Scenic Rivers System. These lands are being managed to protect their wilderness character and the rivers to protect the characteristics which make them eligible.

ANILCA Section 303(2)(B) sets forth the following purposes for which Arctic NWR was established and is to be managed:

(i) to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, Porcupine caribou herd (including participation in coordinated ecological studies and management of this herd and the Western Arctic caribou herd), polar bears, grizzly bears, muskox, Dall sheep, wolves, wolverines, show geese, peregrine falcons and other migratory birds and Arctic char and grayling;

(ii) to fulfill the international treaty obligations of the United States with respect to fish and wildlife and their habitats;
(iii) to provide, in a manner consistent with the purposes set forth in subparagraphs (i) and (ii), the opportunity for continued subsistence uses by local residents; and
(iv) to ensure, to the maximum extent practicable and in a manner consistent with the purposes set forth in paragraph (i), water quality and necessary water quantity within the refuge.

1.4.3 Koyukuk-Nowitna-Innoko NWR

These are three (3) individual NWRs administered as a single unit by the Service. Two (2) primary and two (2) alternate sites have been proposed for this refuge.

These refuges were established as part of the System by ANILCA December 2, 1980,

The Koyukuk Refuge contains 4,500,000 acres. The southern boundary is located seven miles north of Galena, which is located on the Yukon River. The refuge is situated in a circular floodplain basin of the Koyukuk River just north of its confluence with the Yukon River. The variably forested floodplain is surrounded by the Nulato Hills on the west, the Purcell Mountains and Zane Hills on the north, Galena Mountain on the east, and the Yukon River on the south. Numerous lakes, sloughs, and rivers are prominent across the refuge with the Koyukuk River being the dominant natural feature.

The Nowitna Refuge contains 2,051,000 acres and is located less than two miles east of Ruby and south of the Yukon River. The refuge is bounded by the Yukon River on the north, the Boney Creek Bench lands on the east, the upper slopes of the Nowitna River Canyon on the south, and the Poorman Road Mountains on the west.

The Innoko Refuge contains 4,550,000 acres. The refuge lies within an extensive floodplain with over 80 percent of the area being either water or wetlands and is bounded on the north and west by the Yukon River and on the east and south by the Kaiyuh Mountains.

The Innoko Refuge is situated on a relatively flat plain with the highest point reaching just over 1,460 feet in elevation. Water dominates the Innoko Refuge landscape. The Yukon River defines the north and west boundaries of the refuge, while the Innoko, Iditarod, Dishna, and Yetna rivers flow through it. The Innoko River forms the north and west boundaries of the Congressionally-designated Innoko Wilderness. These rivers tend to be sluggish and silty with constantly meandering courses. Extensive wetlands with countless small lakes, streams, and bogs are particularly abundant in the southeast portion of the refuge. Many of the bogs support thick floating mats of vegetation that give the appearance of solid ground. Much of this rich wetland area depends on the yearly flooding and drawdown regime for nutrient input. The rest of the terrain is marked by hills, most of which are less than 1,000 feet in elevation.

ANILCA Section 302(3)(B), (5)(B), (6)(B) sets forth the following purposes for which the Koyukuk, Nowitna, and Innoko NWRs, respectively, were established and are to be managed:
(i) [Innoko] to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, waterfowl, peregrine falcons, other migratory birds, black bear, moose, furbearers, and other mammals and salmon; [Koyukuk] … waterfowl and other migratory birds, moose caribou, (including participation in coordinated ecological studies and management of the Western Arctic caribou herd), furbearers, and salmon; [Nowitna] …trumpeter swans, white-fronted geese, canvasbacks and other waterfowl and

migratory birds, moose, caribou, martens, wolverines, and other furbearers, salmon, sheefish, and northern pike;

(ii) to fulfill the international treaty obligations of the United States with respect to fish and wildlife and their habitats;

(iii) to provide, in a manner consistent with the purposes set forth in subparagraphs (i) and (ii), the opportunity for continued subsistence uses by local residents; and

(iv) to ensure, to the maximum extent practicable and in a manner consistent with the purposes set forth in paragraph (i), water quality and necessary water quantity within the refuge.

1.4.4 Togiak NWR

One (1) site and one (1) alternate are proposed for the Togiak Refuge. On January 20, 1969, the Secretary of the Interior issued Public Land Order (PLO) 4583, withdrawing approximately 249,022 acres to establish Cape Newenham National Wildlife Refuge. With this order, the Service assumed its first refuge management responsibilities in the area: to protect and preserve Cape Newenham's outstanding wildlife values, including bird colonies and important habitat, for other terrestrial and marine wildlife.

The area that was combined with the Cape Newenham Refuge to form the Togiak Refuge was first withdrawn by PLO 5179, signed March 9, 1972 (Section 17(d)(2) of the Alaska Native Claims Settlement Act.

On February 11, 1980, PLO 5703 established the Togiak Refuge under Section 204(c) of FLPMA; thus, the area became part of the System under the management by the Service.

The passage of ANILCA rescinded PLO 5703 and redesignated withdrawn lands as part of the Togiak Refuge. It also incorporated Cape Newenham Refuge as a unit of the Togiak Refuge and designated 2,381,095 acres of the Refuge as Wilderness.

ANILCA Section 303(6)(B) sets forth the following purposes for which Togiak NWR was established and is to be managed:

(i) to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, salmonoids, marine mammals (including their restoration to historic levels);

(ii) to fulfill the international treaty obligations of the United States with respect to fish and wildlife and their habitats;

(iii) to provide, in a manner consistent with the purposes set forth in subparagraphs (i) and (ii), the opportunity for continued subsistence uses by local residents; and

(iv) to ensure, to the maximum extent practicable and in a manner consistent with the purposes set forth in paragraph (i), water quality and necessary water quantity within the refuge.

1.4.5 Yukon Flats NWR

Three (3) sites and one (1) alternate are proposed for the Yukon Flats Refuge. This refuge was established by ANILCA in 1980. Containing the largest interior basin in Alaska, the Yukon Flats Refuge encompasses 11.18 million acres of land (8.48 million acres in federal ownership) in east central Alaska. Extending 220 miles east-west along the Arctic Circle, the refuge lies between the Brooks Range (to the north) and the White-Crazy Mountains (to the south). The "Trans Alaska Pipeline Corridor" runs along the refuge's western boundary while the eastern boundary extends to

within 30 miles of the Canadian border. The Yukon River bisects the refuge, creating the dominant terrain features of the refuge.

As many as 40,000 lakes and ponds occur on the refuge, most concentrated in the flood plain along the Yukon and other rivers. Upland terrain, where lakes are less abundant, is an important component of the watersheds.

The abundance of water in lakes, ponds, and streams provides habitat for waterfowl from all four North American flyways. Though the refuge supports a varied population of mammals, fish, and birds which are important in maintaining the traditional subsistence lifestyle of local residents, it is the waterfowl nesting and rearing habitat which are of national significance. The Yukon Flats Refuge is a segment of the continental waterfowl breeding grounds almost unequaled in extent and continuous high productivity. It has been estimated that waterfowl from the Yukon Flats Refuge provide 400,000 days of recreation annually to sport hunters in Canada, Mexico, and the continental United States (USDI-BSFW 1974).

ANILCA Section 302(9)(B) sets forth the following purposes for which Yukon Flats NWR was established and is to be managed:

(i) to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, canvasbacks and other migratory birds, Dall sheep, bears, moose, wolves, wolverines and other furbearers, caribou (including participation in coordinated ecological studies and management of the Porcupine and Fortymile caribou herds) and salmon;

(ii) to fulfill the international treaty obligations of the United States with respect to fish and wildlife and their habitats;

(iii) to provide, in a manner consistent with the purposes set forth in subparagraphs (i) and (ii), the opportunity for continued subsistence uses by local residents; and

(iv) to ensure, to the maximum extent practicable and in a manner consistent with the purposes set forth in paragraph (i), water quality and necessary water quantity within the refuge.

1.5 Compatibility Determination

The National Wildlife Refuge System Improvement Act of 1997 requires that refuge managers determine whether proposed uses of refuge lands are compatible with the purposes for which the refuge was established and with the mission of the refuge system.

The mission of the refuge system is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." Preserving the ecological integrity of refuge lands is a key component of the mission. Any use that might be expected to fragment or reduce the quality or quantity of habitat would not be compatible.

Proposed uses must be compatible with the purposes for which each refuge was established. Each refuge, whether established by ANILCA or other legislation, has a list of founding purposes. These purposes are detailed in the comprehensive conservation plans for each refuge

A compatible use is one that does not "materially interfere with or detract from" the ability of the refuge to carry out its purposes or fulfill the mission of the refuge system. The compatibility determination is a written determination, based on sound professional judgment, signed and dated

by the Refuge Manager and Regional Chief. Consistent with the National Wildlife Refuge System Improvement Act, the Refuge Manager provides an opportunity for public review and comment on the proposed action.

Similar projects have been determined to be compatible with refuge purposes on several occasions. In 1997, seismic monitoring equipment was installed in the Pavlof Unit of the Alaska Peninsula Refuge following a determination that the use was compatible with refuge purposes. In 1998, the seismic network was extended to the Unimak Island Wilderness of the Alaska Maritime Refuge (administered by the Izembek Refuge). In 1999, the network was extended to Adak and surrounding islands in the Alaska Maritime Refuge.

After considering the previous Compatibility Determinations and the proven history of minimal impacts of the existing network, we propose to find the USArray stations to be compatible with refuge purposes.

1.6 Decisions to be Made

The decisions that must be made regarding this proposal are:

1) whether the proposed action would have a significant impact on the refuges, requiring an environmental impact statement;
2) whether to issue or deny the right-of-way permit to IRIS; and
3) if a permit is issued, what management constraints or mitigation measures could be implemented to minimize or compensate for environmental damage or disturbances. This might include denying access at certain times to avoid disturbing sensitive populations.

1.7 Issues Considered for Evaluation

To focus the EA, the Service selected specific issues for further analysis. Discussions of the affected environment and environmental consequences related to each alternative focus on the selected issue topics. A brief rationale for the selection of each issue is given below.

1.7.1 Effects on Noise/Soundscape

Helicopters are used for equipment installation, occasional maintenance, and site decommissioning. They produce loud, pulsating, mechanical noises that could disrupt natural sounds. Larger and louder helicopters would be used to transport and install new equipment than for routine annual maintenance. Drilling operations and human activity will generate localized noise.

1.7.2 Effects on Vegetation

The project could result in the removal or disturbance of small plots of vegetation where instruments are installed and where helicopters land.

1.7.3 Effects on Visual Characteristics

Equipment shelters and antenna sizes, color, and shapes could all affect scenic qualities in the area. Solar panels associated with remote communications facilities could affect the natural scenic integrity.

1.7.4 Effects on Wildlife and Habitat

Human presence during installation will potentially temporarily displace wildlife. Bears and small mammals could visit sites with communications equipment and be attracted to and damage wires, solar panels, and other equipment.

1.8 Issues Considered but Not in Detail

The following issues were considered but not in detail for the reasons provided below.

1.8.1 Effects on Cultural Resources

Any new site would have reviews pursuant to Section 106 of the 1966 National Historic Preservation Act. Preliminary review by Service Archaeologist found that, due to the small size of permanent disturbance (an 8" diameter hole) and topographic siting (i.e., elevation, lack of permanent water, and thin organic horizons), the likelihood of encountering or damaging cultural resources is very low.

1.8.2 Effects on Endangered, Threatened, and Species of Special Concern

There are no known threatened or endangered species, or habitats thereof, at the proposed seismic monitoring sites.

1.8.3 Effects on Floodplains and Wetlands

Because the seismic monitoring sites would be temporary with small (8" diameter) disturbances, the seismic installations and occasional maintenance activities would not have any effect on floodplains or wetlands.

1.8.4 Effects on Minority and Low-Income Populations

Executive Order 12898 requires federal agencies to incorporate environmental justice into their missions by identifying and addressing high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. The proposed project would not result in disproportionately high direct or indirect adverse effects on any minority or low-income population or community.

1.8.5 Effects on Subsistence Resources and Uses

Potential effects on subsistence users and subsistence resources from the project would be negligible. An ANILCA Section 810 subsistence evaluation is included in Appendix D.

2. Alternatives Considered

This chapter describes the range of alternatives being considered and the recommended mitigation measures for offsetting potential adverse impacts. Because of the nature of the proposed action (issuance of a right-of-way permit) only two alternatives are being considered. The action alternative would involve issuing a right-of-way permit that would allow IRIS to place its seismic monitoring stations on NWRs in Region 7. The no action alternative would maintain the status quo by denying the permit application.

2.1 Alternative A: No Action (Deny Right-of-Way Permit)

Under this alternative, the Service would deny IRIS's application for a right-of-way. No seismic stations would be installed. The Service would continue current management. There would be no changes to the affected environment.

2.2 Alternative B: Proposed Action (Issue Right-of-Way Permit)

Under Alternative B, the Service would issue the requested right-of-way permit for the temporary placement of seismic monitoring stations on seven (7) NWRs in Alaska.

IRIS proposes to install up to 11 new seismic monitoring stations on NWRs in Alaska. Data would be telecommunicated from each site. Access to each site would be by contract helicopter and would require 4 to 6 trips over 2 to 3 days to transport and install each monitoring station. A helicopter would also be needed for access to perform occasional routine maintenance at the sites and for removal of all equipment at the end of the project.

The footprints for the new seismic monitoring stations would be about 120 ft^2. A specially designed fiberglass hut would house an antenna, electronic equipment, and lithium ion batteries that are charged by a solar panel array attached to the hut. The huts could be gel-coated to blend with surrounding areas to reduce visibility (Figure 2). A seismometer would be inserted into a borehole at each location approximately 15 feet from the equipment hut. The seismometer would be housed in a 6" diameter PVC pipe buried to approximately 15 feet or bedrock. A cable, placed in a shallow cut in the tundra mat to prevent disruption from animals and other natural phenomena, would connect the seismometer to the equipment hut (Figure 3).

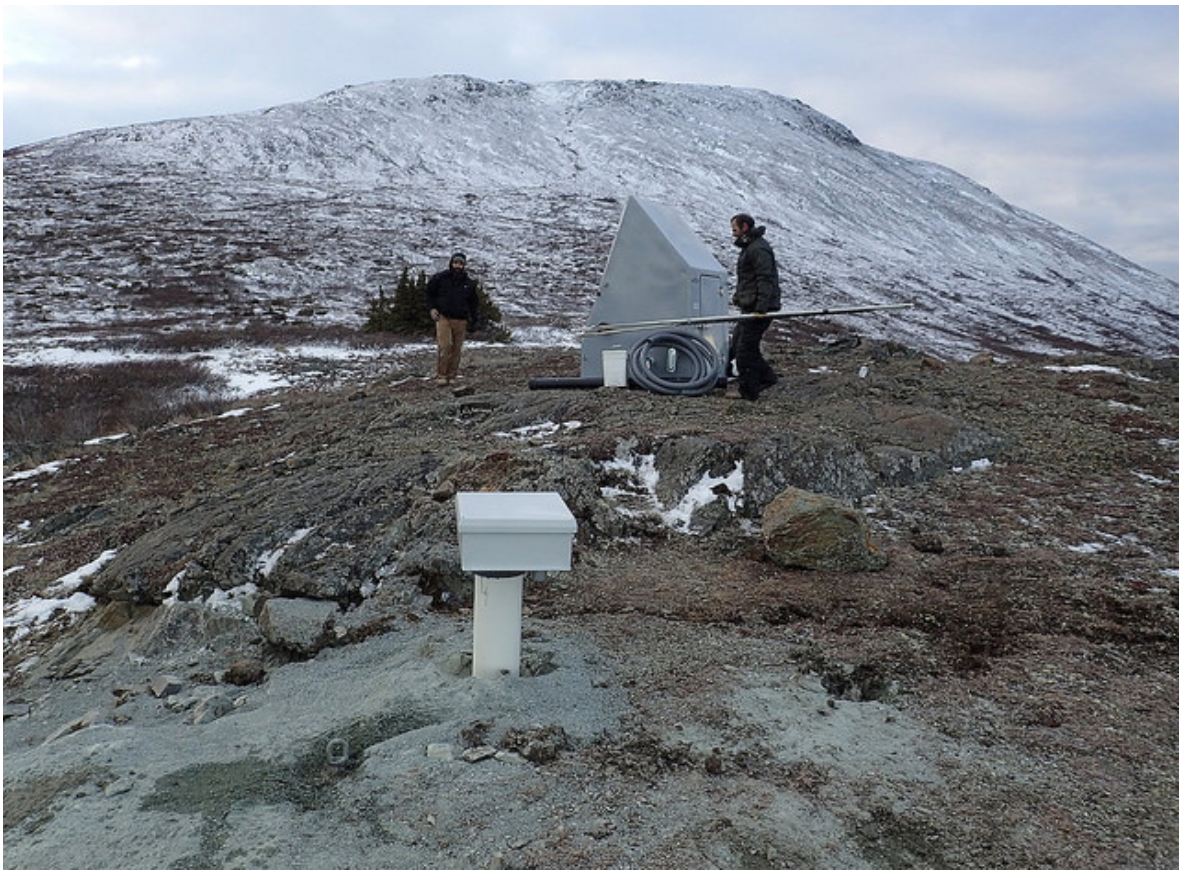


Figure 2: Typical station configuration, with the borehole sensor within PVC casing (prior to trimming) in the foreground and equipment hut in the background. (IRIS)

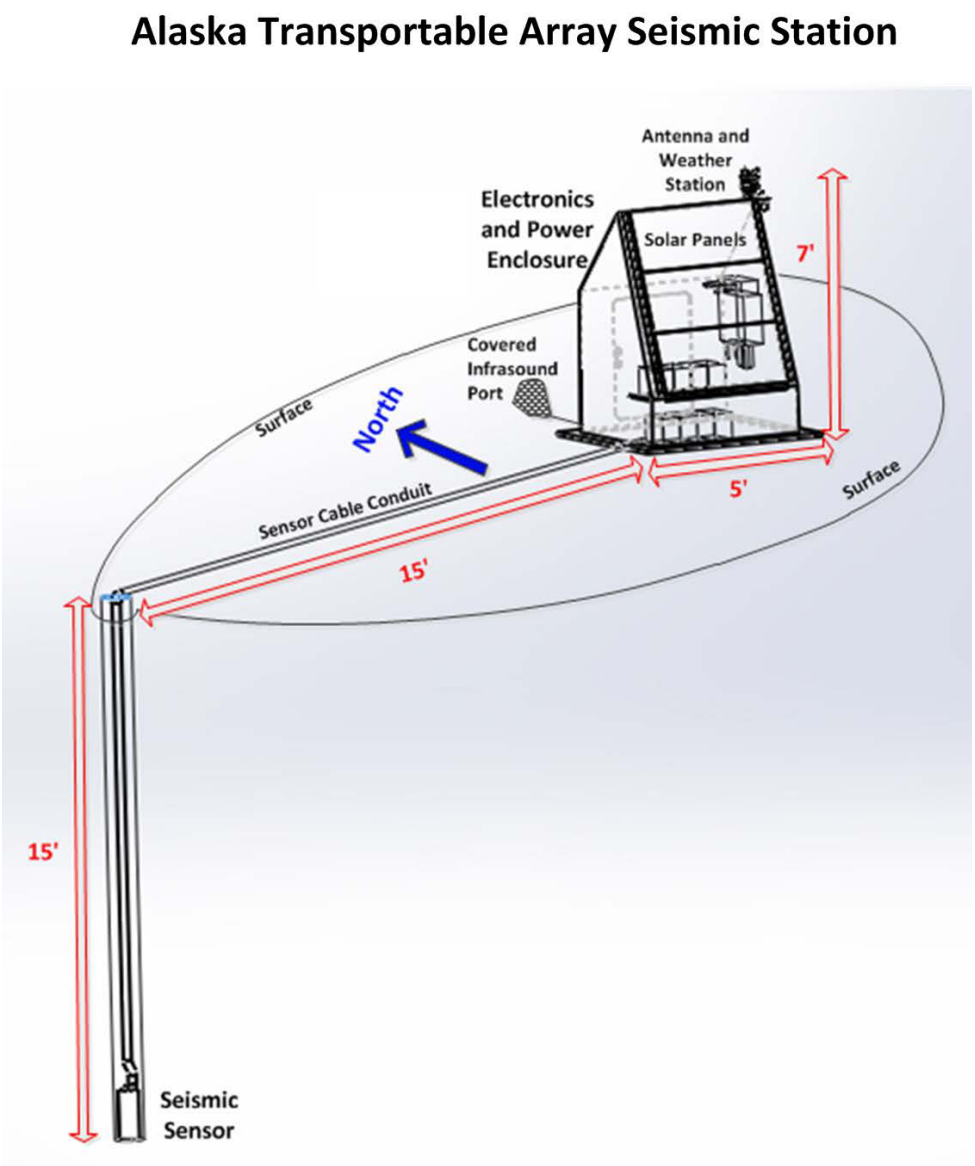


Figure 3: USArray seismic station with borehole sensor connected to the equipment hut via sensor cable conduit. (IRIS)

3. Affected Environment

This chapter describes the physical, biological, and socioeconomic components of the Refuge's ecosystems.

3.1 Introduction to Affected Environment

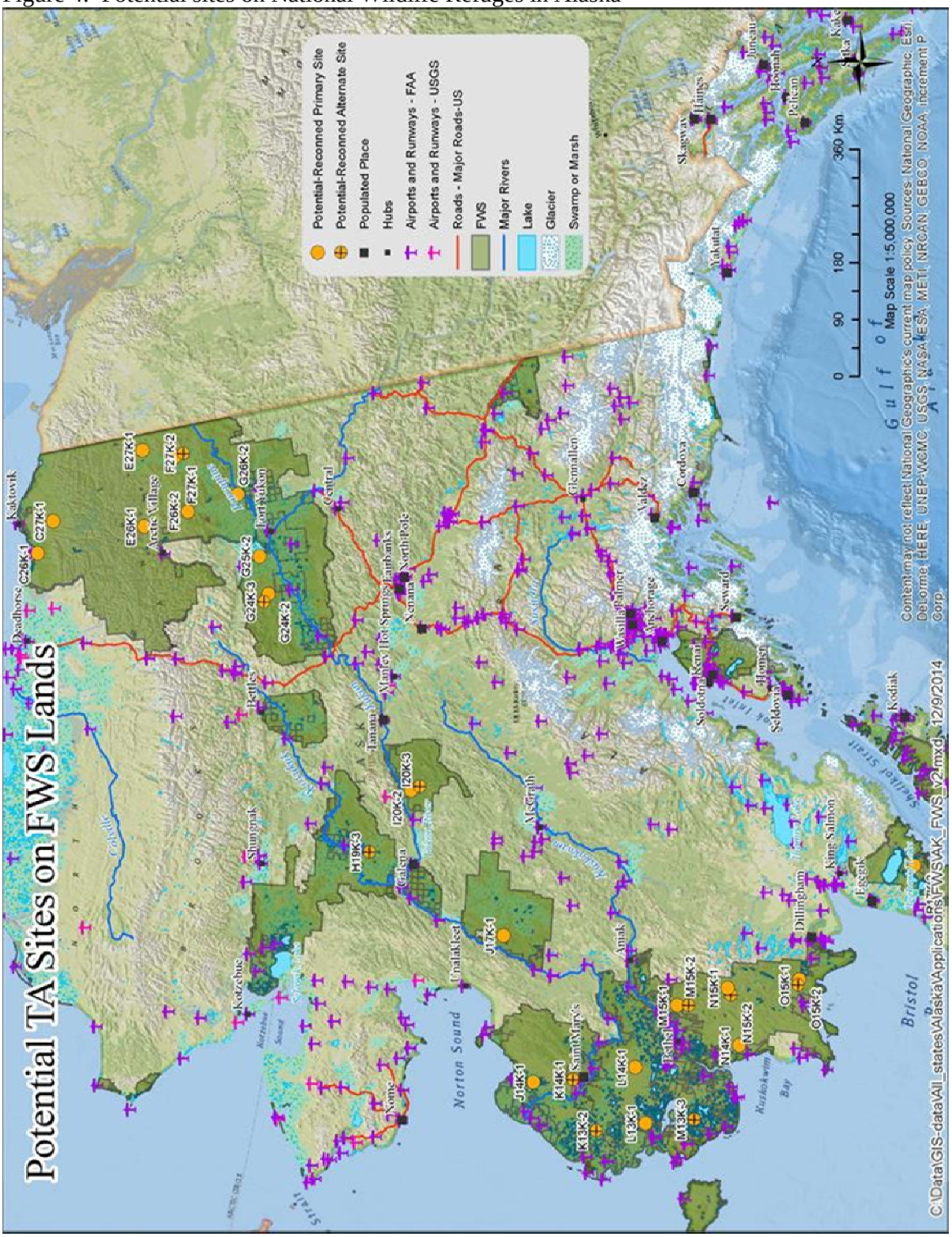
The affected environment is that which may be influenced or altered through the proposed action. The affected environment baseline conditions are described below, with four (4) resources areas identified and analyzed. Those resources are: noise/soundscape, vegetation, visual characteristics, and wildlife (terrestrial mammals) and habitats. For a more detailed description of the affected environment for each refuge, refer to the Comprehensive Conservation Plans or Land Protection Plans for each refuge located at **http://www.fws.gov/alaska/nwr/planning/plans.htm**. The Service has determined that the following resource areas will not be affected by the proposed action: air quality, geology and soils, hydrology, hazardous materials, fish, birds, marine life, threatened and endangered species, land use, transportation, cultural resources, environmental justice, and subsistence.

This chapter describes the relevant resource components of the existing environment (baseline conditions) that could be affected by, the no action and proposed alternatives. In addition, important resources that may occasionally be found in the project area (such as endangered species) are briefly discussed, regardless of whether they would be affected by the proposed action.

3.2 The Project Area

The proposed action would take place on seven (7) refuges in Alaska, (as shown in Figure 4 and listed in Appendix B). These seven (7) refuges cover a vast area, and include nearly every habitat type found in Alaska including mountains, glaciers, tundra, grasslands, wetlands, lakes, woodlands, and coastlines. Together, these seven (7) refuges comprise approximately 45.8 million acres of land and water, and constitute approximately 49 percent of the entire System. Refuges in Alaska are world-renowned for their relatively intact ecosystems and natural diversity. Alaska refuges are places where natural and biological diversity, integrity, and environmental health are maintained for the continuing benefit of future generations. Systems function naturally with little interference or manipulation by humans and there is a relatively intact, connection between all biotic and abiotic components and processes.

Figure 4: Potential sites on National Wildlife Refuges in Alaska



3.3 Physical Environment

3.3.1 Natural Sound Environment

These proposed sites are in remote locations, far from general human activity. The natural soundscapes of the proposed sites are relatively free from motorized or other human intrusions. Generally the disturbances to natural sounds would only be the occasional airplane or boat.

3.3.2 Vegetation

Vegetation on the proposed sites is currently undisturbed by humans. Vegetative cover varies from none (bare rock), to tundra, to grasslands, to spruce/shrub, open woodland, wetlands, and black-spruce forests.

3.3.3 Visual Characteristics

The proposed sites are in locations where signs of human activity are not evident. Many are in areas with no, or short, vegetation.

3.3.4 Wildlife

The sites are proposed for undisturbed locations remote from human activity. Depending upon the habitat and season, any of these sites could see activity from black bear, grizzly bear, marmot, pika, porcupine, caribou, moose, wolf, and various migratory and resident birds.

4. Environmental Analysis

This Section describes the probable impacts of each alternative on the issues identified in Chapter 1. A comparison of the likely environmental impacts between the alternatives is summarized below.

4.1 Effects of Alternative A, the No Action Alternative:

This alternative would deny the Right-of-Way Permit.

4.1.1 Noise/Soundscape

No changes from the current situation would occur.

4.1.2 Vegetation

No changes from the current situation would occur.

4.1.3 Visual Characteristics

No changes from the current situation would occur.

4.1.4 Wildlife and Habitat

No changes from the current situation would occur.

4.2 Effects of Alternative B, the Proposed Action

This alternative would issue the Right-of-Way Permit for the project.

4.2.1 Noise/Soundscape

These refuges provide outstanding opportunities for solitude—places to retreat from the sights, sounds, and presence of others, and from the developments and evidence of man. There is a concern that visitors may be disturbed by noise from helicopter flights. Helicopters can be an intrusion on a visitor's opportunity for solitude.

Noise impacts would be short-term since flights would only occur during installation, occasional maintenance visits, and during removal of the equipment at the termination of the right of way. However, during periods of helicopter activity, there could be an irretrievable loss of solitude.

Noise from helicopter flights can disturb wildlife and alter their activities. This could potentially disturb hunting activities.

Noise levels would be reduced by requiring the helicopters to fly at a minimum altitude of 2,000 feet above ground level (AGL), as detailed in the Federal Aviation Administration Advisory Circular 91-36C, "Visual Flight Rules Flight Near Noise-Sensitive Areas". In addition, noise

impacts on other users could be reduced or eliminated by scheduling flights during periods when there are few other users in the area.

Permit stipulations would require coordination of flight schedules with the Refuge Manager.

Drilling operations and human activity would also generate local noise.

Impacts of noise on the soundscape would be minor. They would be temporary and managed by altitude and date stipulations.

4.2.2 Vegetation

The footprint for the equipment housing is small (approximately 4 ft. by 4 ft.), and the proposed installation sites for the seismic equipment would generally be located where vegetation is thin and interspersed with bare rock and gravel.

Minor crushing and trampling effects are expected in the areas where the huts and bore holes will be placed during installation and removal of equipment. There is potential for introduction of non-native plants. Permit stipulations specify actions required to avoid introduction of non-native plants.

Impacts on the vegetative cover resulting from the proposed project would be minimal.

4.2.3 Visual Characteristics

Each equipment hut modifies the naturalness of the area in which it is sited. Visual impacts would be minimized by designing/camouflaging equipment huts to blend with the natural summer surroundings of the area.

Minor effects on the visual characteristics of the areas are expected.

4.2.4 Wildlife and Habitat

Most of the seismic monitoring equipment would be installed at elevations that receive little use by wildlife. Disturbance may cause temporary displacement and stress for individual animals, but is not expected to result in measureable population changes.

The potential for disturbance to ground nesting birds and for entrapment of wildlife in bore holes will be avoided by region-wide stipulations.

There is a potential for visual and noise disturbance to some colonial wildlife populations, resulting from the use of helicopters to access the proposed sites. Refuge specific stipulations would be implemented as necessary to avoid those areas. There is a potential for noise disturbance to other sensitive bird species. Where known, refuge specific stipulations will call for avoidance of sensitive areas.

Disturbance to wildlife would be minimized by requiring helicopters to fly at a minimum altitude of 2,000 feet above ground level (AGL), as detailed in the Federal Aviation Administration Advisory Circular 91-36C, "Visual Flight Rules Flight Near Noise-Sensitive Areas".

Impacts to wildlife would be minimal.

4.3 Mitigation

Potential adverse impacts resulting from the implementation of this proposed project would be managed when and avoided where possible, through the use of region-wide and refuge specific stipulations. Various means of mitigating impacts would be used, including avoiding the impact altogether, minimizing the impacts by limiting the degree or magnitude of the action, and rehabilitating or restoring the affected environment. Mitigation would consist of standard region-wide stipulations and refuge specific stipulations. Stipulations will be issued as part of any right-of-way permit.

4.4 Relationship Between Short-Term Use of the Environment and Long-Term Productivity

This short-term use would not affect the long-term productivity of the refuge ecosystems or the human environment.

4.5 Irreversible and Irretrievable Commitment of Resources

The irreversible commitment of resources means that nonrenewable resources are consumed or destroyed (e.g., the destruction of cultural resources by other management activities, mineral extraction that consumes nonrenewable minerals, etc). There will be no irreversible commitment of resources associated with implementation of the proposed project.
The irretrievable commitment of resources represents trade-offs (opportunities forgone) in the use and management of natural resources. Irretrievable commitment of resources includes the expenditure of funds, loss of production, or restriction on resources use. No irretrievable commitment of resources would be associated with implementation of this proposed project.

4.6 Environmental Justice

All Federal agencies are required to identify and address, as appropriate, any disproportionately high adverse human health or environmental effects of its programs, policies, and/or activities on minority and low-income populations (U.S. Government 1994). This includes health risks and other impacts for people who rely principally on fish or wildlife for subsistence.
The sites proposed for these seismic installations are remote from villages and will have minimal, short term, impacts on the environment.
The proposed installations will not adversely affect the environment. They are very different from the proposals often associated with environmental justice issues, such as the siting of pollution-causing facilities. The proposed project would not place a disproportionate weight of any adverse effects on minority or low-income populations.

4.7 Section 810 Evaluation

The Alaska National Interest Lands Conservation Act (ANILCA) section 810 requires an evaluation of the effects on subsistence uses for any action to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands.

This evaluation consists of:

- A finding of whether or not a proposed action would have a significant restriction on subsistence uses

- A notice and hearing of an action is found to have a significant restriction on subsistence uses
- A three-part determination prior to authorization of any action if there is a significant restriction on subsistence uses

The proposed project (Alternative B) has minimal impacts on the environment, all impacts are of short duration, and the project is has a lifespan if five (5) years.
The proposed project does not contain actions that would significantly reduce subsistence uses because of direct effects on wildlife or habitat resources or that would significantly increase competition for resources.

Similarly, the proposed project would not significantly change the availability of resources by altering their distribution or location.

Finally, the proposed project would not significantly reduce subsistence uses because of limitations on access—by physical or legal barriers—to harvestable resources. This evaluation concludes that the action would not result in significant restrictions of subsistence uses.

Table 1: Comparison of Anticipated Impacts.

Category	Alternative A (No Action)	Alternative B (Proposed Action)
Noise/Soundscape	No new impacts on the natural sounds of the areas.	Minor transitory adverse impacts on the natural sounds of the areas. Helicopter flights can disturb game and disrupt hunting activities. Helicopter noise may detract from visitor solitude or primitive recreational experiences. Minimum altitude of 2,000 feet AGL will be required. Drilling operations will generate localized noise while boreholes are being drilled.
Vegetation	No new impacts on vegetation	Minor crushing and trampling effects in the areas where the huts and bore holes will be placed.
Visual Characteristics	No new impacts on the visual characteristics of the areas.	Minor effects on the visual characteristics of the areas. Equipment hut modifies the naturalness of the area. Visual impacts would be minimized by designing equipment huts to blend with the natural summer setting.
Wildlife and Habitat	No new impacts on wildlife or habitats	Potential temporary displacement of wildlife. Helicopter flights can disturb game and disrupt hunting activities. Potential for disturbance to ground nesting birds. Potential for entrapment of wildlife in bore holes. Minimum altitude of 2,000 feet AGL will be required. Other stipulations will avoid disturbances.

Appendix A - Project Description

Attachment A: PoD

General Project Summary

From 2003 to 2013 the EarthScope: Transportable Array (USArray) installed over 1,700 seismometer stations across the continental United States and southern Canada in a dense semi-permanent array at a 70 km (42 mile) grid spacing. The USArray is one segment of EarthScope, an extensive earth science research project funded by the National Science Foundation. The USArray is operated by the Incorporated Research Institutions for Seismology (IRIS), a nonprofit 503C founded in 1984 that is a consortium of over 100 US universities dedicated to the operation of science facilities for the acquisition, management, and distribution of seismological data.

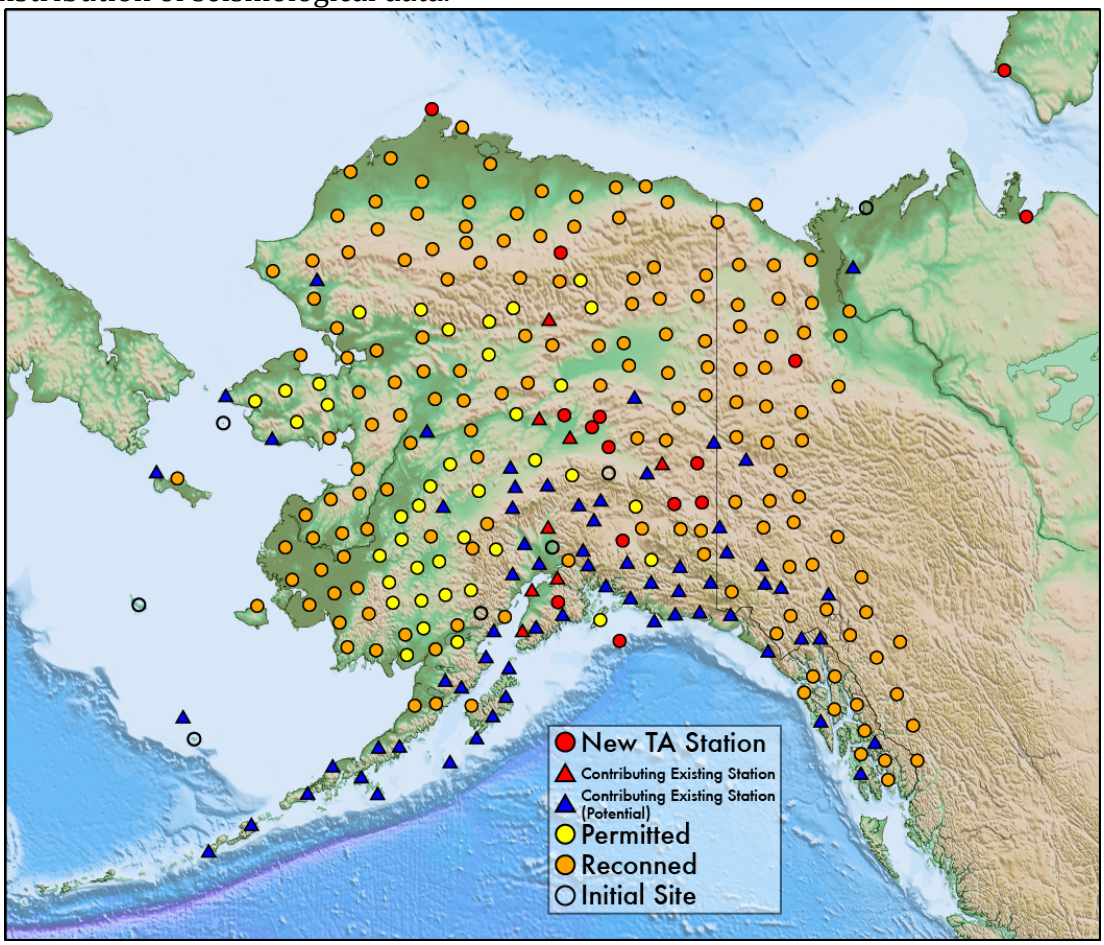


Figure 1: Proposed sites for the EarthScope: Transportable Array in Alaska, based on 2013 and 2014 reconnaissance efforts. Note that actual station locations are subject to permit approval.

Following the completion of the seismic installations in the lower 48 states, the EarthScope: Transportable Array project is beginning work in Alaska. This project consists of a large deployment (approximately 294) of ground motion sensors (seismometers) throughout Alaska and western Canada at a nominal spacing of 85 km (51 miles) over the next 4 years. See www.usarray.org/alaska and Figure 1. Stations will remain in place for up to 5 years,

at which time the equipment will be recovered and sites will be restored to their original state. Rolling station removals are expected to start in 2018.

USArray is seeking participation from private landowners (~20 sites), state (DNR ~50 sites) and federal agencies (BLM ~20, NPRA ~15, FWS ~20, and NPS ~5 sites), Tribal Governments/Councils, First Nations, and Native Corporations (~30 sites) to help accomplish this unprecedented research and public education project. USArray has been in communication with these groups since 2011.

Purpose and Need

One of the main objectives of the project is to improve our understanding of the active tectonics and geologic history of the North American continent. EarthScope: Transportable Array will create images of the deep structure of the earth, from depths of about 5 km to the core of the earth. The instruments are spread too far apart to provide detailed imaging commonly used for exploration for oil and gas (whose drills go less than 4 km deep). Further science objectives and rationale for the deployment of this large array are explained in a 63-page report found at:
http://www.iris.edu/hq/Alaska_Workshop_2011/report.phph

The seismometers record earthquakes that occur locally, regionally, and throughout the world. The unique value of data produced from this array is due to the large area covered, and to the dense, regular spacing of hundreds of high-quality seismometers. Data from these stations are open and freely available and are forwarded immediately to USGS National Earthquake Information Center in Golden CO, Alaska Earthquake Center at UAF, the Canadian Hazard Information Service in Ottawa, the Alaska Volcano Observatory, and NOAA's Tsunami Warning Center and distributed to hundreds of researchers worldwide. The data help scientists gain new insights into earthquake processes and source characteristics, expand our understanding of earthquakes and lower crustal processes, and improve earthquake and tsunami warning systems for hazard mitigation.

The locations proposed in Alaska will supplement or enhance existing seismic stations currently operated by the Alaska Earthquake Center (AEC), Alaska Volcano Observatory (AVO), and the Tsunami Warning Center (TWC). About a dozen seismic stations will be co-located with existing GPS stations constructed by the EarthScope: Plate Boundary Observatory (PBO). As the stations become operational, some of the partnering networks may seek to retain certain stations. These stations would be left in place, becoming a part of Alaska's permanent seismic monitoring network. It is difficult to predict the number and locations of these selections or the funding levels of the partnering networks, but USArray will work with agencies to adapt permits where possible and to accommodate the enhanced observational capability the seismic network.

A) Type of System or Facility

A continuously operating seismic station that will consists of a seismic sensor, electronics, radio antenna, and a surface mount communication module. The general design and construction of the USArray stations will be uniform for all site locations across the state.

Slight variations may be required for individual sites based on local and environmental conditions.

Sites were selected based on a number of criteria:

- Maintaining a grid spacing of approximately 85 km between stations.
- Selecting geologic conditions that would maximize the quality of the signal recorded, e.g. bedrock and/or permafrost.
- Avoiding conditions that would degrade the signal quality (e.g. generators, towers, trees) or reduce solar panel effectiveness.
- Wherever possible pre-disturbed locations were favored.
- Radio Line-of-sight, strong signal strength of satellite communications, or direct access to wireless, radio, broadband, or satellite hook ups.

B) Related Structures and Facilities

The typical USArray station will occupy a footprint not to exceed 20 x 20 feet (6 x 6 meters), with a low physical profile. The equipment does not produce any noise or motion. To protect the sensor and reduce interference from surface noise, the seismometer will be placed in a PVC or steel cased hole 3 to 15 feet (1 to 5 meters) below the surface of the ground. The PVC or steel casing is secured in place by grout. The hole will either be augured or drilled via a helicopter sling/transportable drill, will be 6 inches (15 cm) in diameter, and extend only 6 inches above grade. Ground conditions at the site will dictate hole depth and creation technique. Additionally, a soil temperature string probe will be installed roughly 3 feet from the seismometer, within a ~1" diameter hole, at a depth of 3 to 15 feet. The hole will be created with the same drill machine or with air driven hand tools. This collaboratory science activity is contingent on funding and approvals from NASA.

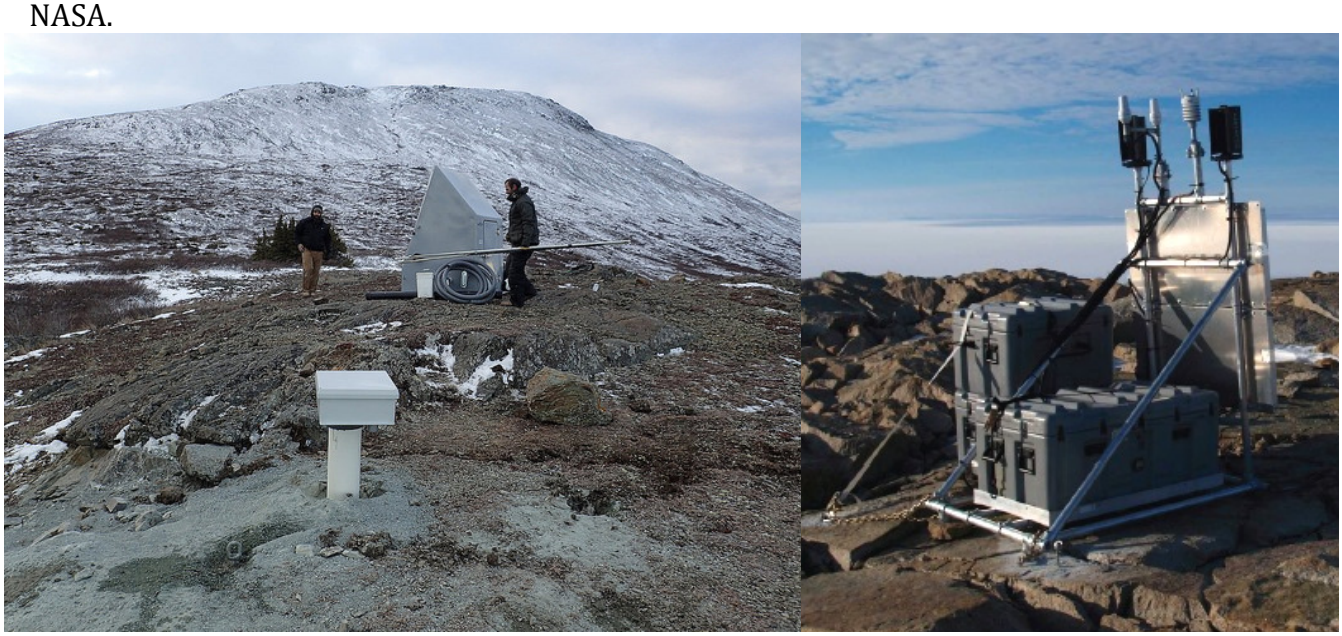


Figure 2: Left Image: Typical station configuration, with the borehole sensor within PVC casing (prior to trimming) in the foreground and grey hut enclosure in the background. Right Image: Alternate station configuration, with box enclosures and anchoring/mounting frame.

At most USArray stations, the electronics and power system will be housed in an above ground-insulated enclosure. The most common enclosure is a grey hut, measuring approximately 5'x5'x7'H, and made of fiberglass that can be painted to blend in with the form, line, and color of the surrounding landscape (Figure 2). Solar panels are mounted directly to the hut. The alternate station configuration consists of boxes/containers, which are secured to a frame, and anchored to the ground; this frame will also serve as the mount for the solar panel. Additionally, weatherproof informational signage will be placed on enclosures (Figure 3).

Figure 3: Example of informational signage to be placed on hut enclosure.

The enclosure will house a power system comprising 1400AH of rechargeable lithium ion and lead-acid AGM batteries charged by solar panels*. The solar panels will be mounted on the outside of the hut or on a vertical bracket attached to the base frame. The batteries inside the enclosure will power a Quanterra Q330 datalogger connected to a three-component broadband seismometer (STS-4B, STS-5A, T120PH, or CMG-3T) residing in the augured or drilled hole. Ground motion data is recorded continuously at up to 40 samples per second. Average power of the entire system is about 7 watts.

A standard USArray atmospheric sensor package containing a MEMS barometer, a Hyperion IFS-4232 infrasound sensor (hyperiontg.com), and a Setra 278 microbarograph (setra.com) will be included at each station. When present, weather station sensors will be mounted on top of the hut or on the enclosure support frame. Additional sensors that could be deployed at some stations as part of collaborative projects include a strong-motion accelerometer, and/or soil temperature profiler. Weather and pressure data is recorded at 1 sample every second, with infrasound also recorded at 40 samples per second. The UTC accuracy of time labels, which is required for seismology, is unusual in weather monitoring.

* Fuel cells are NOT being considered at any of these stations/sites.

Figure 4: Station I23K: Inside hut enclosure: Battery system, sensors, data cables, etc.

Power and data cables from the seismometer to the enclosure will be run through conduit and either placed in trenches or anchored to rock surface. The trenches will be backfilled after all cables have been secured and tested (Figure 5).

Figure 5: Typical trenching (left image: at soft sediment location) or anchoring (right image: at hard rock location) of sensor cable conduit

Data from the stations will be transmitted to the Internet via cell modem, radio links or through a satellite link and received at the USArray Network Facility at UC San Diego Super Computing Center for processing, and archived at the IRIS Data Management Center in Seattle, Washington. All data are freely available to the public and to scientific researchers (http://usarray.seis.sc.edu/index.html). Data will not be transmitted within the licensed frequency spectrum.

C) Physical Specifications

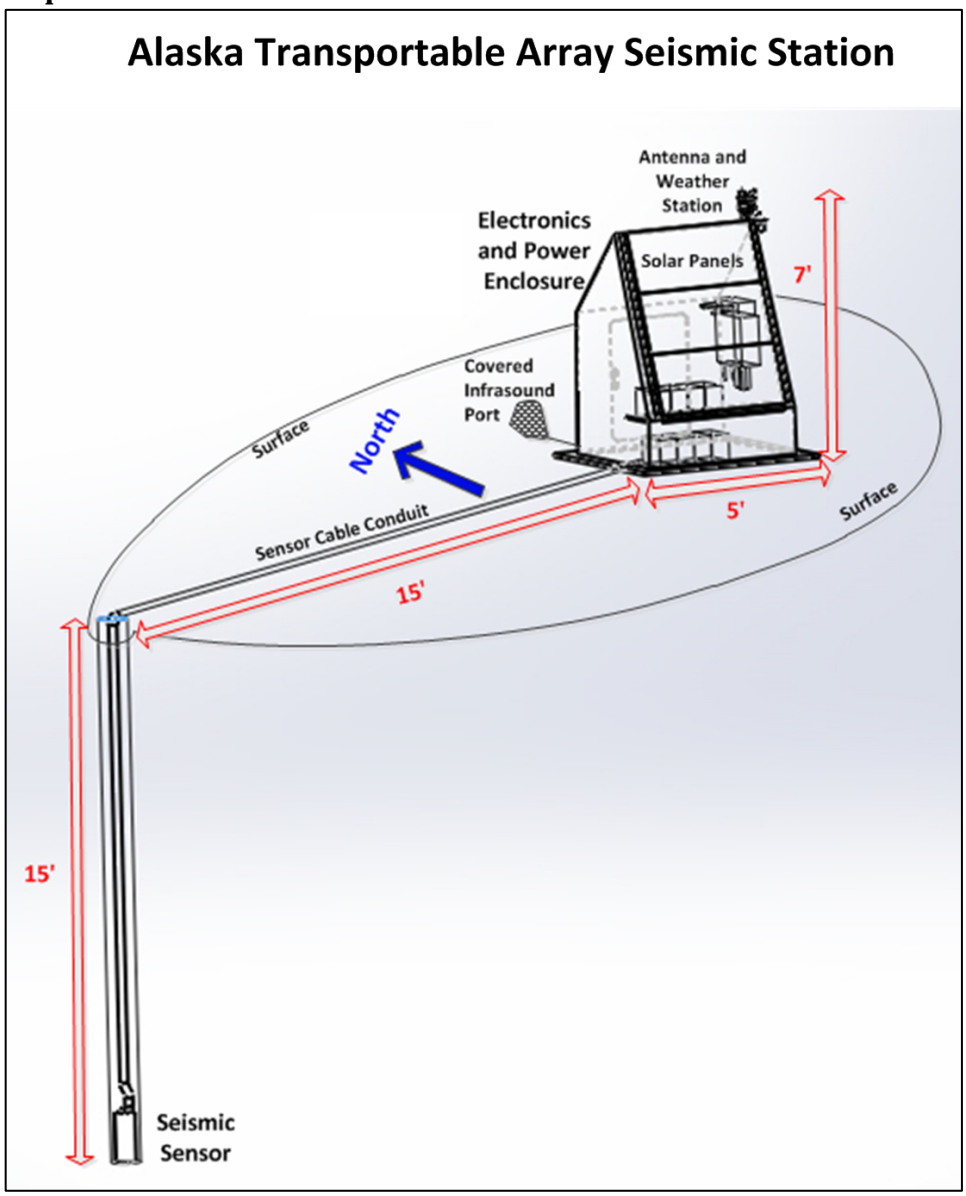


Figure 6: Specification of a USArray seismic station with borehole senor connected to hut enclose via sensor cable conduit.

D) Term of Years Needed

In 2011, roughly 294 initial sites were identified within predetermined 20km areas. 2013 and 2014 field reconnaissance efforts refined these locations to within a few meters of the actual site location, and in some cases provided several alternate locations. With the actual sites located, efforts have moved to permitting and install logistics. As of fall 2014, 25 stations have been installed and/or incorporated into the array. The general proposed schedule for all future station installations over the next few years is depicted in Figure 7. For specific station installation schedules refer to "Attachment B".

Stations will be installed between mid-May and mid-October, as weather permits. Once a station has been installed it will operate continuously for ~5 years. After this time period

stations will be decommissioned/removed. As mentioned, there is a possibility that partnering networks would seek the take over a few of these stations.

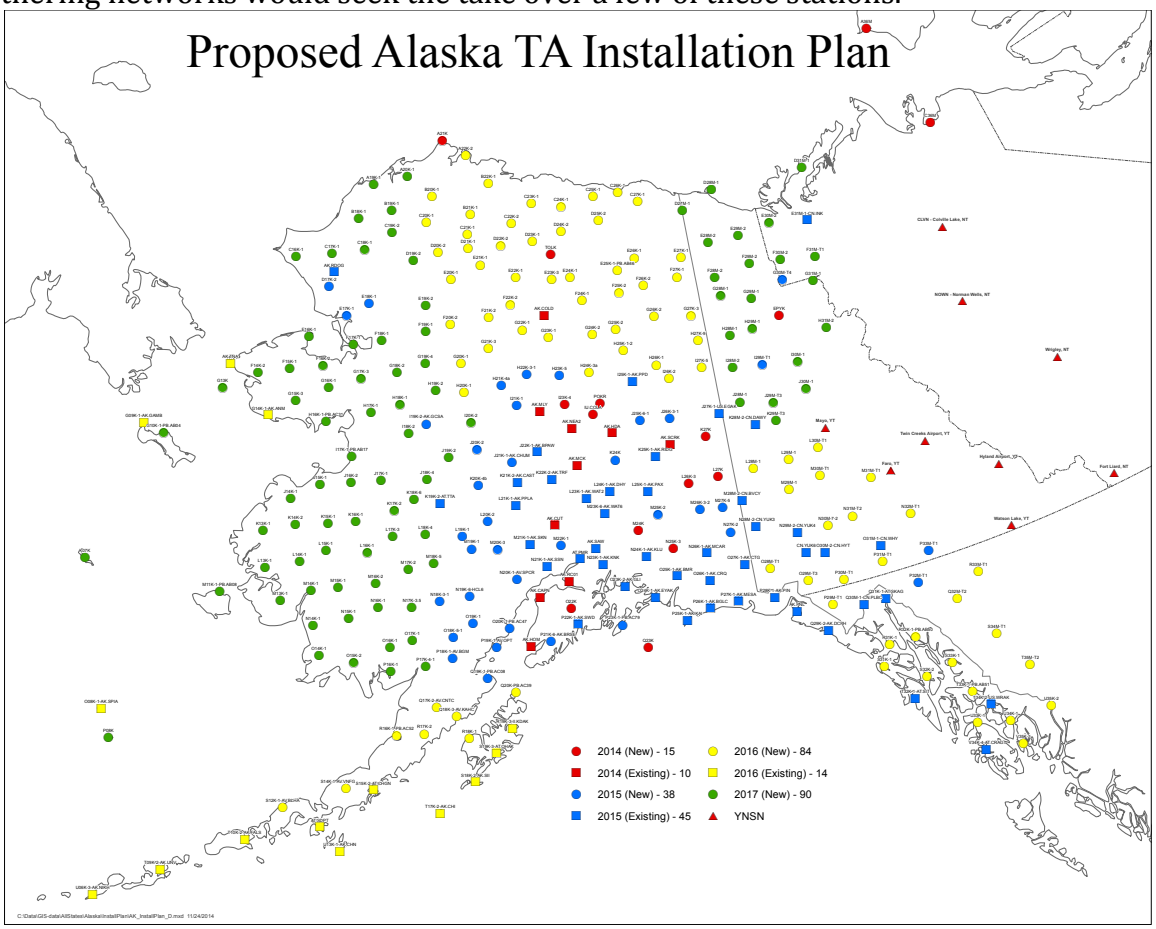


Figure 7: Location of sites based on 2013 and 2014 field reconnaissance work. Sites in red are installed seismic stations. Sites with square symbols are existing seismic stations that we anticipate being incorporated into the array. All other sites follow the installation plan. Note: Install plan has not been finalized.

E) Time of Year of Use or Operation

As mentioned above, stations will be installed between mid-May and mid-October, as weather permits. Once a station has been installed it will operate continuously until 2018-2019. Although, stations run continuously, the equipment does not produce any noise or motion.

F) Volume or Amount of Product to be Transported

Installation Equipment	Description and Purpose
Helicopter Portable Drill	-Lightweight multipurpose (V1), or single purpose (V2) drill -Uses auger or downhole hammer drill bits -Creates 6 inch wide, 3 to 15 feet deep borehole -Weight = 1050 lbs machine, 250 lbs casing, tools, grout Or 1300lbs total (480kg+110kg supplies)

Installation Equipment	Description and Purpose
Air Compressor	-Lightweight, helicopter portable, required for downhole hammer drilling with the V1 drill -Compressor included with the V2 drill -Weight = 600 lbs (270 Kg)
Electronics Enclosure	-4' L x 5' W x 7' H enclosure hut with 3, 90w solar panels installed for battery charging -May include external mast that will extend 2-3' beyond the roofline of the hut for data telemetry antennas and/or meteorological instrumentation
AGM Batteries	-Each site will have ~4, 100ah non-hazardous AGM batteries for augmenting station power. -Weight = 70 lbs each (30 Kg)
Lithium Iron Phosphate Batteries	-Each site will have 6 or 8, 180ah Lithium Iron Phosphate batteries for powering station electronics. -Weight = 60 lbs each (26 Kg)
Broadband Seismometer	-Each site will have a single 6" diameter broadband seismometer installed downhole.
Other miscellaneous station equipment	-2" diameter liquitite conduit. -Sensor cable will be installed in steel lined liquitite conduit to protect it from environmental damage. -Collaboratory science soil temperature probe is contingent on their funding

Table 1: List of installation equipment: Note: See section *"B) Related Structures and Facilities"* for the description, purpose, and amount/volume related to the station equipment.

G) Duration and Timing of Construction

Installation: As mentioned above, stations will be installed between mid-May and mid-October, as weather permits. The installation team will require access to each site for ~2 days which may not be contiguous due to weather. A lightweight auger/drilling machine with the ability to both auger and drill holes will be transported via fixed wing or helicopter to sites that cannot be accessed by road. The mode of transportation to each proposed site can be found in "Attachment B", while Table 2 describes the rough details, average number of trips, and average fuel requirement for a single station installation, and Figure 8 depicts a typical station installation scenario. Two to three field staff will create the hole (~6 inch diameter and 3-15 feet deep) and install 6" PVC or steel casing. Water required for grout will be transported to remote sites by aircraft, or by truck to sites near a road. Care will be taken to minimize ground disturbance at the site. Construction of a station will take ~4-6 hours. Installation of the electronics may proceed immediately, but is often performed on a separate day within a week of construction and subject to weather conditions.

Mode of Transport	Details	Estimated # of Trips/ Landings per Site	Estimated Fuel Storage per Site
Helicopter	-Eurocopter Astar B2: External Load -Robinson R44: Personnel Transport	-Eurocopter: 3 trips/1 landing -R44: 2 trips/ 2 landings	-Eurocopter: <100 gal -R44: <50 gals
Fixed Wing/ Sky Van	-Skyvan will mobilize drill rig and supplies to site or staging airports	2	No cache required
Road	-1-2 vehicles will mobilize drill rig, supplies, and field staff to site or staging area	1-3	No cache required

Table 2: Estimated details, requirements, trips, and fuel usage for each mode of transportation associated with an average, single station installation. Mode of transportation associated with individual stations is noted in "Attachment B".

Figure 8: Typical station installation. Left Image: Drill rig with downhole drill attachment. Left Image: Securing of PVC pipe casing and lowering of borehole sensor.

Maintenance: The seismometer and other equipment will operate continuously. Routine maintenance will be performed remotely. If the equipment malfunctions, the problem can be identified at the data processing center. On rare occasion maintenance trips may be necessary to correct the problem and in such cases the landowner/agency would be contacted. Most often maintenance issues are related to power (blocked panels or dead batteries) or radio antennas.

Removal: Removal of stations would occur in 1 day, and involves the removal of the hut enclosure (and contents), sensor cable conduit, and borehole seismic sensor. The PVC or steel casing would be left in place, but cut about ~1 foot below the surface and buried/covered with local sediments/native materials. It is common practice for USArray to provide the landowner/agency with a Station Removal Report.

General Information:
Installation, maintenance, and removal of a station require 30 feet of workspace in all directions around the borehole and hut enclosure assemblies.

EarthScope: Transportable Array recognizes their responsibility to respect the property and privacy of landowners, the obligation to operate all stations safely and securely, while assuming full liability if the equipment is damaged or stolen. The landowner/agency will be held harmless for any loss or injury involved with the EarthScope project. Additionally, EarthScope will adhere to all site-specific stipulations issued by the landowner/agency concerning the construction and timeframe related to the installation, maintenance, and removal of stations.

H) Temporary Work Areas Needed for Construction

Field Camps: The establishment of field camps is not expected at this time. Field crews will be staying overnight in local communities.

Staging Areas/Hubs: Wherever possible staging areas/hubs will be established in local communities and are tentatively denoted in Attachment B.

Flight Paths: Flights will be planned to conform to all local flight restrictions and will be as direct as possible (between hubs and site locations), without compromising safety. When taking off and climbing out of airports or site locations, climbing to cruise will be completed as quickly as possible to minimize disturbance in the surrounding areas. In general, and when possible, cross country flights will be made at high cruise altitudes to minimize disturbance to areas below the flight path.

Fire Safety SOP: These procedures cover fire prevention and response for USArray employees completing site installations for the EarthScope: Transportable Array project.

- Sites located in the vicinity of active wildfires will not be completed until the Field Operations Manager has evaluated the site area for the safety of the crews and equipment. Excessive smoke, low visibility, or the potential for active wildfire will cause the site installation to be postponed.
- Prior to welding, grinding, or other "hot work" activities, the site must be cleared of all flammable material, including vegetation. If clearing is not possible, station equipment will be returned to a hub community or other safe location for "hot work" before being returned to the installation site.
- A fire extinguisher will be stored in each helicopter supporting field operations, and a fire extinguisher and shovel will be stored in the drill rig tool kit.
- On discovery of fire at the installation site, the site will be immediately evaluated for personnel safety. If possible, the fire should be safely extinguished using the on-site fire fighting equipment.
- If the fire cannot be safely extinguished using on-site equipment, crews must vacate the area and inform the Field Operations Manager via radio or sat phone immediately.
- Wildfires and potential wildfires will be immediately reported to Alaska Fire Service at the Alaska Interagency Coordination Center at 1-800-237-3633.

Fuel Storage SOP: During the process of site construction and installation, fuel for helicopters and drill rigs may be temporarily placed on the installation sites. Helicopter

fuel will be limited to 110 gal or less at each site and be stored in either:

- A purpose built 110 gal capacity double-wall aluminum tank, specifically designed for helicopter transport; or
- 55 gal fuel drums placed in secondary containment of no less than 66 gal (110%) capacity.

Fuel for drill rigs will be transported and stored in OSHA approved 5 gal storage containers. A spill kit of appropriate size will be on site during any fueling operations."

Fuel Management and Spill Response SOP: These procedures cover fuel handling and transfer procedures and emergency response actions for USArray employees

- Fueling**:** Vehicles fueled by project personnel will include aircraft, drill rigs, and highway vehicles.
    - Whenever possible, vehicle fueling and fuel transfers will not occur within annual floodplains or tidelands or within 150 feet of any body of water.
    - Smoking is not allowed at any time during fueling operations.
    - Fuel transfer locations will be equipped with emergency spill response equipment adequate to handle small releases.
- Spill Prevention: Spills include any unintentional discharge of fuel or other hydrocarbon into the environment.
    - All outlying tanks and drums will either:
        - Be placed in secondary containment, or
        - Be of double-walled construction.
- Spill Response:
    - Spill response materials will be stored near all fuel transfer and storage locations.
    - Safety is the first priority. Before responding to any spill, personnel will evaluate the situation for danger.
    - If safe to act, personnel will:
        - Isolate and stop the source of the spill.
        - Call for help from additional personnel if needed.
        - Contain the flow of the spill using absorbent pads, lined earth berms, or anything else that may be available.
        - Decontaminate the spill site as much as possible by collecting the spilled material and any contaminated soil, absorbents, or other material.
    - All contaminated materials must be isolated and removed from the field for disposal at an appropriate facility (see Waste Disposal SOP).
    - In the event that a spill cannot be handled by personnel using on-site resources, personnel will contact the Department of Environmental Conservation (DEC) for assistance at (907) 269-3063 or outside of normal business hours at 1 (800) 478-9300.
- Spill Reporting: Alaska state law requires all oil and hazardous substance releases to be reported to the Department of Environmental Conservation (DEC) at 907-269-3063, or at 1-800-478-9300 outside normal business hours.
    - *HAZARDOUS SUBSTANCES:*

        - *Any* release of a hazardous substance *must be reported* as soon as the person has knowledge of the discharge.
    - OIL/PETROLEUM RELEASES:
        - TO WATER: Any release of oil to water must be reported as soon as the person has knowledge of the discharge.
        - TO LAND: Any release of oil in excess of 55 gallons must be reported as soon as the person has knowledge of the discharge. Any release of oil in excess of 10 gallons but less than 55 gallons must be reported within 48 hours after the person has knowledge of the discharge. A person in charge of a facility or operation shall maintain, and provide to the Department on a monthly basis, a written record of any discharge of oil from 1 to 10 gallons.
        - TO IMPERMEABLE SECONDARY CONTAINMENT AREAS: Any release of oil in excess of 55 gallons must be reported within 48 hours after the person has knowledge of the discharge.

Waste Disposal SOP: In the event that public facilities are available for the disposal of any waste mentioned herein, e.g. waste transfer stations, recycling centers, sewer/septic systems, gray water systems, etc., USArray crew members will adhere to local laws regarding disposal of waste. In the event that public facilities are not available at or near the work site, disposal will be conducted as described in this SOP.

- Human Waste – Human waste will be disposed of in typical backcountry "catholes" dug at least 6 inches deep and at least 200 feet away from any body of water.
- Food Scraps – Food scraps will be limited at the work site, but any waste of this type will be collected in plastic bags or containers at the work site. These waste items may be stored at an active work site in bear-proof containers and will be removed to a public waste transfer station at the earliest opportunity.
- Non-Hazardous Waste – All trash, construction debris, and other non-hazardous solid waste will be collected in plastic bags or containers at the work site. These waste items may be stored at an active work site and will be removed to a public waste transfer station at the earliest opportunity.
- Universal Hazardous Waste – Batteries or lamps/bulbs considered to be hazardous will be collected as individual units or in plastic bags or containers, depending on size, at the work site. These waste items will be removed to processing facilities in Anchorage or Fairbanks at the earliest opportunity.
- Oily Waste – Fuel, oil, or related waste items will be collected in designated oily waste bags at the work site. These waste items may be stored at an active work site in bear-proof containers and will be removed to processing facilities in Anchorage or Fairbanks at the earliest opportunity.
- No waste items of any type will be stored at any inactive or completed work site.

Emergency Response Plan SOP: See Attachment C

Additional Attachments:

- *Attachment B:* Site list with coordinates, legal descriptions, install information, notes and correlating site map
- *Attachment C:* Emergency Response Plan
- *Attachment D:* NEPA considerations
- *Attachment E:* List of previous ROW applications related to project
- *Attachment F:* Individual site recon reports and maps

Information and Outreach:

A significant portion of the funding for this project is dedicated to public outreach. EarthScope and its partners have developed activities, lesson plans, map tools, visualizations - and much more - to help students and teachers work with EarthScope data and scientific results. EarthScope materials include teachable moments, research summaries, links to research projects, and interactions with EarthScope scientists and staff. For more information on the EarthScope project, please review the links below:

http://www.usarray.org/researchers/obs/transportable

http://www.nature.com/news/us-seismic-array-eyes-its-final-frontier-1.14099

www.popsci.com/science/gallery/2011-07/big-science-universes-ten-most-epic-projects?image=9

www.earthscope.org

http://www.earthscope.org/science/observatories

http://www.earthscope.org/resources

www.nature.nps.gov/geology/earthscope

Appendix B: Proposed Sites

(Includes Table and FWS maps. Site Reconnaissance Information Included by Reference)

Table 2: Locations of Proposed Sites

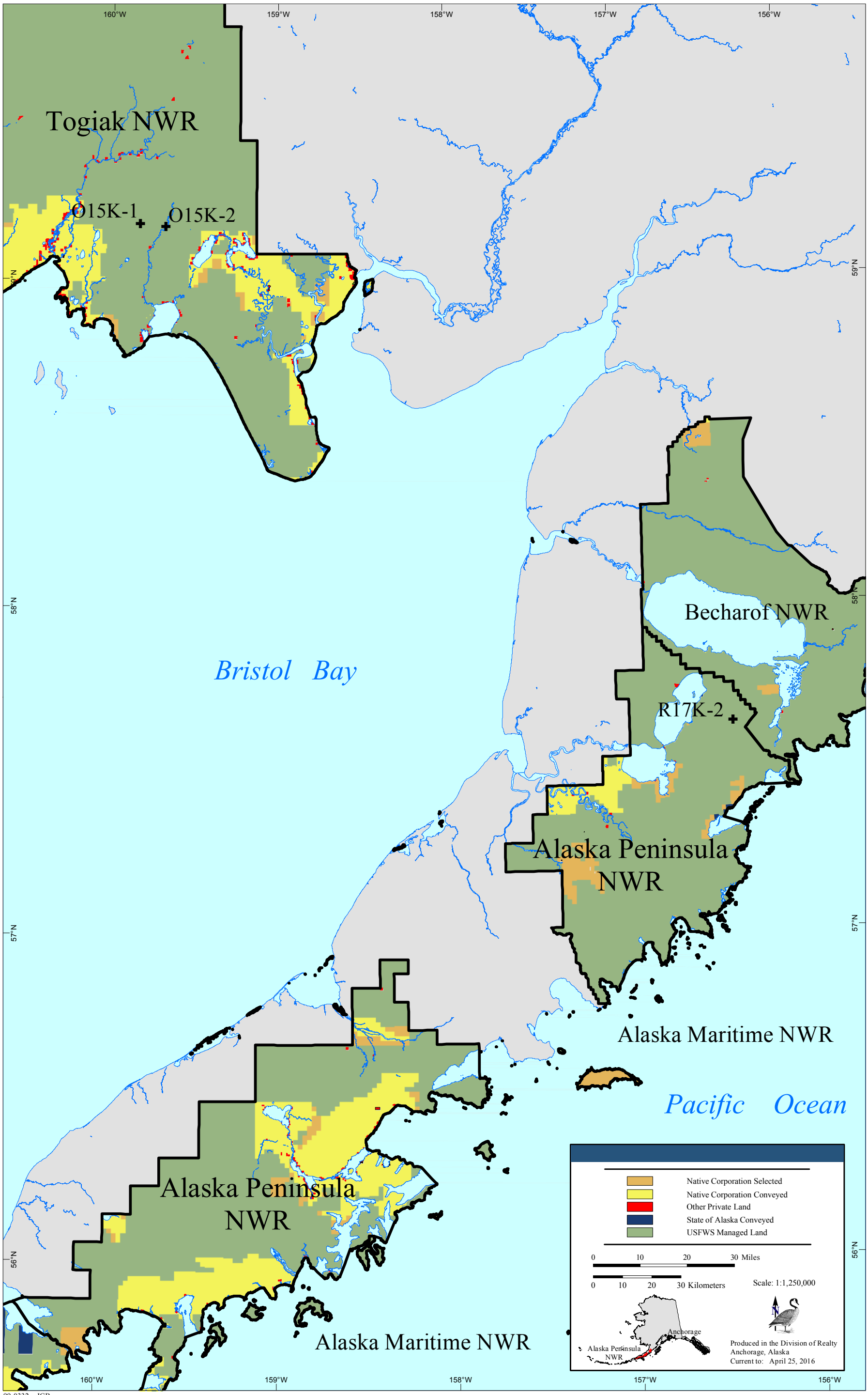
Map_ID	Latitude	Longitude	Legal Description	Install Plan	Wildlife Refuge	Notes
R17K-2	57.63981	-156.38708	Sec. 35, T29S R44WSM	5/17/16	AK Peninsula	Surface estate owner: U.S. (FWS manages); Subsurface estate owner of oil & gas & sand & gravel - Koniag Inc. The site Is in Ugashik Unit of AK Peninsula NWR. USArray has approval/non-objection from Koniag Corp.
O15K-1	59.17672	-159.82437	Sec. 36, T11S, R63W, SM	5/20/16	Togiak	Alternate, do not need permit if primary site is approved
O15K-2	59.16808	-159.67269	Sec. 2, T12S, R62WSM	5/20/16	Togiak	
G26K-2	66.94923	-143.78672	Sec 33, T25N R18E FM	6/3/16	Yukon Flats	
G25K-2	66.76534	-146.10143	Sec. 6, T22N R8E FM	6/4/16	Yukon Flats	
G24K-2	66.70098	-147.47465	Sec 26, T22N R1E FM	6/5/16	Yukon Flats	
G24K-3	66.76943	-147.74187	Sec 34 T23N R1WFM	6/5/16	Yukon Flats	Alternate, do not need permit if primary site is approved
F26K-2	67.69624	-144.13603	Sec 9. T33N R16E, FM	6/20/16	ANWR	
E27K-1	68.1862	-141.59575	Sec 31, T14S R46E UM	6/22/16	ANWR	
F27K-1	67.75181	-142.05283	Sec 22. T34N R25E, FM	6/23/16	ANWR	DESCOPE, do not need permit if it will quicken the process
F27K-2	67.62226	-141.98925	Sec 5, T32N R26E FM	6/23/16	ANWR	Alternate, do not need permit if primary site is approved
E26K-1	68.3454	-144.44919	Sec 2, T13S R33E UM	7/1/16	ANWR	DESCOPE, do not need permit if it will quicken the process
C27K-1	69.62636	-143.71142	Sec 11, T3N R34E UM	7/2/16	ANWR	
C26K-1	69.91748	-144.91224	Sec. 33, T7N R29E UM	7/3/16	ANWR	
H19K-3	65.36948	-156.58625	Sec 27, T1S R11E KM	0/0/2017	Koyukuk	Alternate, the Primary site was permitted through Doyon, no longer need FWS permit
I20K-2	64.79643	-154.4779	Sec. 18, T9S R23E KM	0/0/2017	Nowitna	
I20K-3	64.67338	-154.33911	Sec 30, T9S R23E KM	0/0/2017	Nowitna	Alternate, do not need permit if primary site is approved
J17K-1	63.39661	-159.07765	Sec 21, T24S R2WKM	0/0/2017	Innoko	

U.S. Fish & Wildlife Service

EarthScope Proposed Sites for Installation

Alaska Peninsula / Togiak National Wildlife Refuge

Alaska



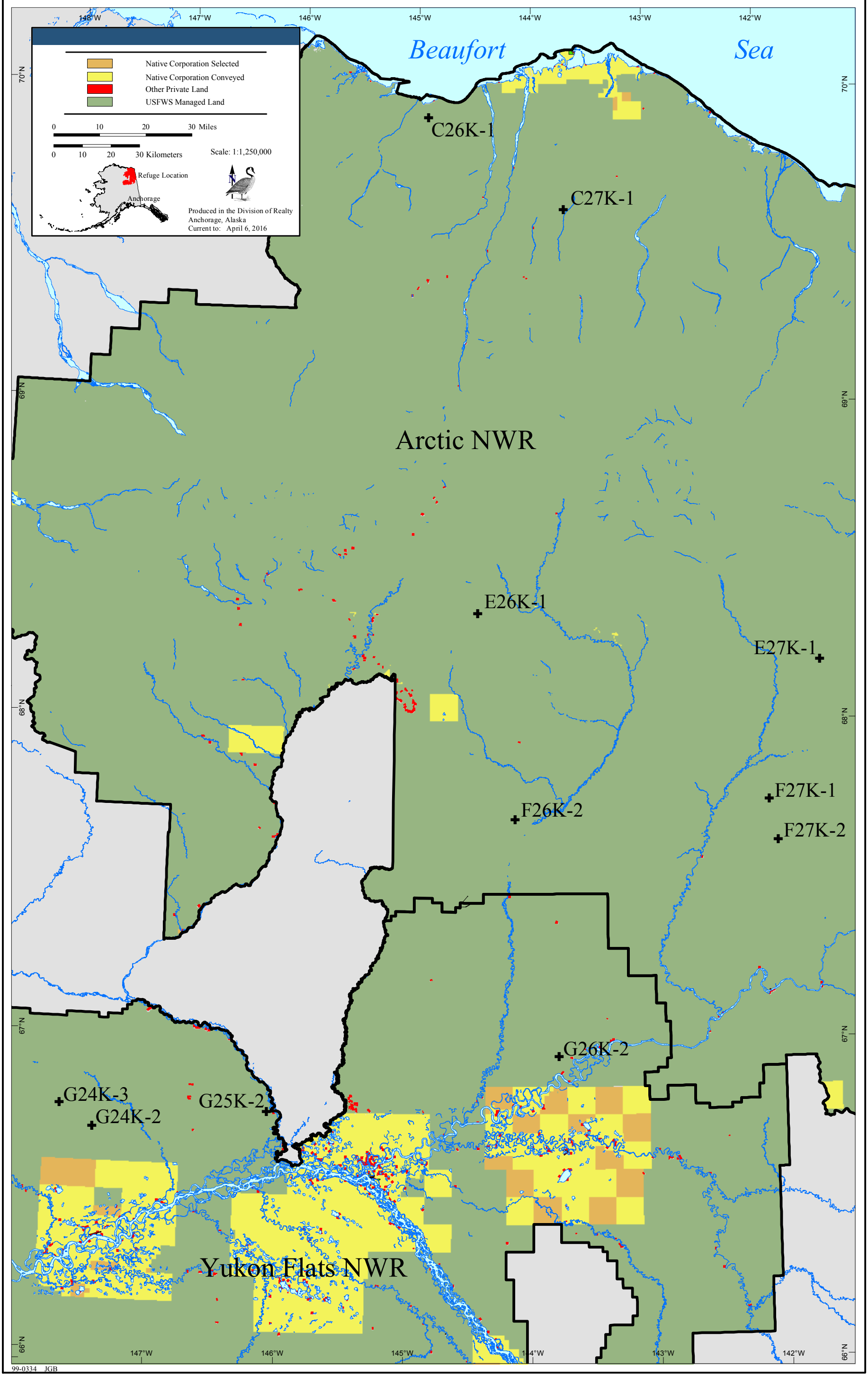
99-0332 JGB

U.S. Fish & Wildlife Service

EarthScope Proposed Sites for Installation

Arctic / Yukon Flats National Wildlife Refuge

Alaska



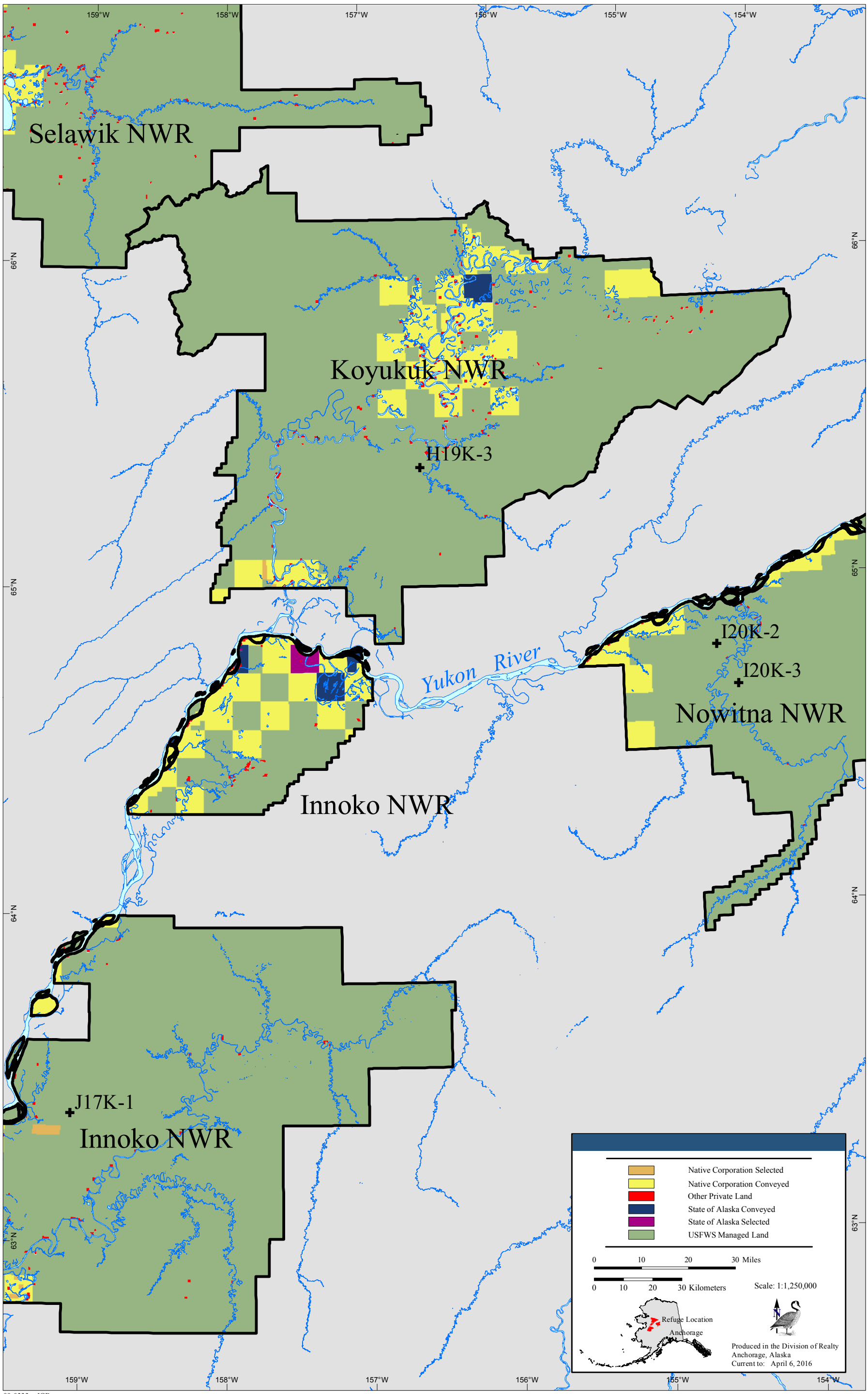
99-0334 JGB

U.S. Fish & Wildlife Service

EarthScope Proposed Sites for Installation

Koyukuk / Innoko / Nowitna National Wildlife Refuge

Alaska



99-0333 JGB

Appendix C: FONSI

U.S. Department of the Interior
Fish and Wildlife Service
Region 7, Alaska

FINDING OF NO SIGNIFICANT IMPACT

Environmental Assessment:
Installation of Temporary Seismometer Stations on Multiple Wildlife Refuges in Alaska (EarthScope)

The Department of the Interior, U.S. Fish and Wildlife Service (Service) is considering an application from the Incorporated Research Institutions for Seismology (IRIS) to install infrastructure as part of a project to collect data on seismic activity. These seismograph stations would contribute as a part of the nationwide EarthScope Transportable Array (USArray). The installations would be for a term of 5 years.

Eleven (11) seismograph stations are proposed for installation on seven (7) National Wildlife Refuges (NWRs) across Alaska. These would complement the existing network of seismic stations in Alaska, approximately 294 other stations now being installed across Alaska and northwestern Canada, and a system operating in the contiguous United States and Canada.

The USArray is one segment of EarthScope, an extensive earth science research project funded by the National Science Foundation and operated by IRIS, a nonprofit 503(c) corporation comprised of a consortium of over 100 US universities dedicated to the operation of science facilities for the acquisition, management, and distribution of seismological data. The USArray is a temporary seismic monitoring network that collects and analyzes seismic data for use in improving the understanding of active tectonics, and geologic history of the North American continent. Data collected will provide new insights into earthquake processes and improve earthquake and tsunami warning systems for hazard mitigation. The array images the deep structure of the earth and records earthquakes. The resulting data is made immediately available to Federal agencies and researchers worldwide. The USArray has installed over 1,700 seismometer stations across the contiguous United States and Canada in an array with approximately 42-mile grid spacing. The seismometers in Alaska will remain in place for up to 5 years at which time the equipment will be removed and the sites restored to their original states.

Refuges with Proposed Installations	Number of Sites
Alaska Peninsula - Becharof NWR	1
Arctic NWR	4
Koyukuk-Nowitna-Innoko NWR	2
Togiak NWR	1
Yukon Flats NWR	3
Total	11

Alternatives Considered

Two alternatives were considered for analysis.

Alternative A – No Action

Under Alternative A, the No Action Alternative, the Service would not grant a right-of-way (ROW) permit. The project would not go forward on refuge lands.

Alternative B – Proposed Action

Under Alternative B, the Service would issue the requested ROW permit for the temporary installation of 11 new seismic monitoring stations on 7 NWRs in Alaska.

Access to each site would be by helicopter and would require approximately 4 to 6 trips over 2 to 3 days to transport and install each monitoring station. A helicopter would also be needed for access to perform occasional routine maintenance at the sites and for removal of all equipment at the end of the project.

Footprints of the seismic monitoring stations would be approximately 120 square feet. A fiberglass hut would house an antenna, electronic equipment, and lithium ion batteries that are charged by a solar panel array attached to the hut. The huts would be gel-coated to blend with surrounding areas to reduce visible impacts. A seismometer would be inserted into a borehole approximately 15 feet from the equipment hut. The seismometer would be housed in a 6-inch diameter PVC pipe buried to approximately 15 feet or bedrock. A cable, placed in a shallow cut in the tundra mat to prevent disruption from animals and other natural phenomena, would connect the seismometer to the equipment hut.

Analysis of Impacts

The Environmental Assessment (EA) analyzed direct and indirect impacts on refuge resources including the natural sound environment, vegetation, visual characteristics, and wildlife and habitat. Issues considered but not evaluated in depth include effects on cultural resources, threatened and endangered species, wetlands, minority and low-income populations, and subsistence users.

The Refuges with proposed installations have reviewed the proposal and contributed stipulations which would minimize potential for adverse impacts. Those stipulations are included in the EA and will be included in any ROW.

Noise/Soundscape

NWRs can provide outstanding opportunities for solitude - places to retreat from the sights, sounds, and presence of others, and from the developments and evidence of man. There is a concern that helicopters can be an intrusion on a visitor's opportunity for solitude or enjoyment of a primitive recreational experience. Drilling operations and human activity will generate localized noise.

Noise impacts would be short-term and transitory since flights would occur during installation, occasional maintenance visits, and during removal of the equipment at the termination of the ROW. However, during periods of helicopter activity, there could be an irretrievable loss of solitude.

To reduce noise levels, helicopters will be required to fly at a minimum altitude of 2,000 feet. Additionally, noise impacts will be reduced or eliminated by scheduling flights during periods when there are few users in the area.

Impacts on the soundscape from the proposed project would be anticipated to be minimal.

Vegetation

The footprint for the equipment housing is small, and the proposed installation sites would generally be located on areas where vegetation is thin and interspersed with bare rock and gravel.

Control of non-native plants will be required. Minor crushing and trampling effects can be expected in the areas where the huts and bore holes will be placed.

Impacts on vegetation would be anticipated to be short term and minimal.

Visual Characteristics

Equipment huts will modify the visual characteristics the areas. Visual impacts will be minimized by requiring that equipment huts be designed to blend with the natural summer surroundings.

Impacts on the visual characteristics from the proposed project would be anticipated to be minimal.

Wildlife and Habitat

Most of the equipment would be installed at elevations that receive little use by wildlife. There is, however, the potential for visual and noise disturbance to some wildlife populations, such as peregrine falcons, resulting from helicopter use and human activity.

Helicopters will be required to maintain a minimum altitude and to avoid areas identified by the refuges.

Impacts to wildlife from the proposed project are anticipated to be minimal.

Anticipated Impacts of Alternatives		
Category	**Alternative A (No Action)**	**Alternative B (Proposed Action)**
Noise/Soundscape	No new impacts on the natural sounds of the areas.	Minor transitory adverse impacts on the natural sounds of the areas. Helicopter flights can disturb wildlife. Helicopter noise may detract from visitor solitude or primitive recreational experiences. Drilling operations and human activity will generate localized noise. Minimum altitude of 2,000 feet AGL will be required. Date restrictions will minimize impacts.
Vegetation	No new impacts on vegetation	Minor crushing and trampling effects in the areas where the huts and bore holes will be placed. Control of non-native plants will be equired.

Visual Characteristics	No new impacts on the visual characteristics of the areas.	Minor effects on the visual characteristics of the areas. Visual impacts would be minimized by designing equipment huts to blend with the natural summer setting.
Wildlife and Habitat	No new impacts on wildlife or habitats	Potential temporary displacement of wildlife. Helicopter flights can disturb game and disrupt hunting activities. Potential for disturbance to ground nesting birds. Potential for entrapment of wildlife in bore holes. Minimum altitude will be required. Known sensitive areas will be avoided. Boreholes and casings will be covered to prevent entrapment.

Public Review

The EA and Finding of No Significant Impact (FONSI) will be made available to the public on the Region 7 website http://www.fws.gov/alaska/nwr/planning/nepa.htm

Conclusions

Based on review and evaluation of the information contained in the EA (included by reference) and other supporting documentation, I have determined that the proposed action is similar to other projects which have taken place on refuges in Alaska and will not cause significant individual or cumulative impacts to the human environment, within the meaning of section 102(2)(c) of the National Environmental Policy Act of 1969, as amended, and that the activities described in the EA are not major Federal actions. Accordingly, the Service is not required to prepare an Environmental Impact Statement.

Mitch Ellis 5/18/16

Mitch Ellis Date

Chief of Refuges, Alaska Region
U.S. Fish and Wildlife Service

Appendix D: Right of Way Permit

U.S. Fish & Wildlife Service
Region 7
1011 East Tudor Road, MS 211
Anchorage, AK 99503