Environmental Assessment

Plate Boundary Observatory Global Positioning System Network Installation and Maintenance on the Alaska Maritime National Wildlife Refuge

Photo taken on Akutan Volcano by Andre Basset (UNAVCO) on July 2005

U.S. Department of the Interior
U.S. Fish and Wildlife Service
Alaska Maritime National Wildlife Refuge

Applicant
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Chapter 1: PURPOSE OF AND NEED FOR ACTION

1.1 Introduction

The U.S. Fish and Wildlife Service (USFWS) is considering a proposal by the University NAVSTAR Consortium, Inc. (UNAVCO), a non-profit corporation funded by the National Science Foundation, to install high-precision geodetic monitoring stations on U.S. Department of the Interior, USFWS-administered lands in the Alaska Maritime National Wildlife Refuge (AMNWR or Refuge) to monitor shifts in the earth's surface due to the physical processes that control earthquakes and volcanic eruptions. The proposal is part of larger monitoring network known as the Plate Boundary Observatory (PBO). The network consists of about 1,000 continuously-operating global positioning system (GPS) stations in the continental western United States and Alaska (Figure 1).

The PBO Project is a collaborative effort between UNAVCO and numerous research universities and government agencies to increase the density and reliability of their geophysical monitoring networks. By joining together to meet their scientific demands, the research entities may incur fewer environmental impacts and lower costs than if each entity developed an individual network. The goal of the PBO Project is to provide the participating research entities with a multipurpose geophysical monitoring network.

There are 142 new GPS stations planned for installation in Alaska (Figure 2). Four GPS stations and one seismometer are being proposed for installation on USFWS-administered lands in the AMNWR and are described in this Environmental Assessment.[1] The locations of the proposed GPS stations are illustrated in Figure 3.

This Environmental Assessment (EA) was prepared by a third-party consultant under the direction of the USFWS pursuant to the National Environmental Policy Act of 1969 (NEPA), the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR 1500 – 1508), and all other associated regulations. This EA is intended to be a concise analysis of the potential impacts to the environment from UNAVCO's Proposed Action (the Project) and the No-Action Alternatives.

1.2 Purpose of and Need for the Action

The Project consists of the construction and operation of a geodetic observatory for the purpose of studying the Earth's surface deformation. Currently, there is a very sparse geodetic network in the western United States and Alaska. In Alaska, increased observation is needed across the active boundary zone between the Pacific and North American plates. The limited geographic

[1] Other PBO stations have been installed or are being planned (by UNAVCO in conjunction with its collaborating partners) on USFWS-administered lands. There are 21 stations on USFWS-administered lands (17 in Izembek National Wildlife Refuge and 4 in AMNWR) that are part of the Alaska Volcano Observatory (AVO). The AVO's mission is to provide an early warning system for volcanic eruptions that have the potential to jeopardize both local populations and passing aircraft.

coverage of the existing geodetic network contributes to a lack of understanding of basic Earth processes, and this lack of understanding increases the risk that the public could be harmed by geologic hazards or events.

The Project would increase the accuracy of the existing network by adding four GPS stations and one seismometer where none currently exist. The network would provide observational data that describes the geophysical condition of Alaska, and in particular the Aleutian Arc.

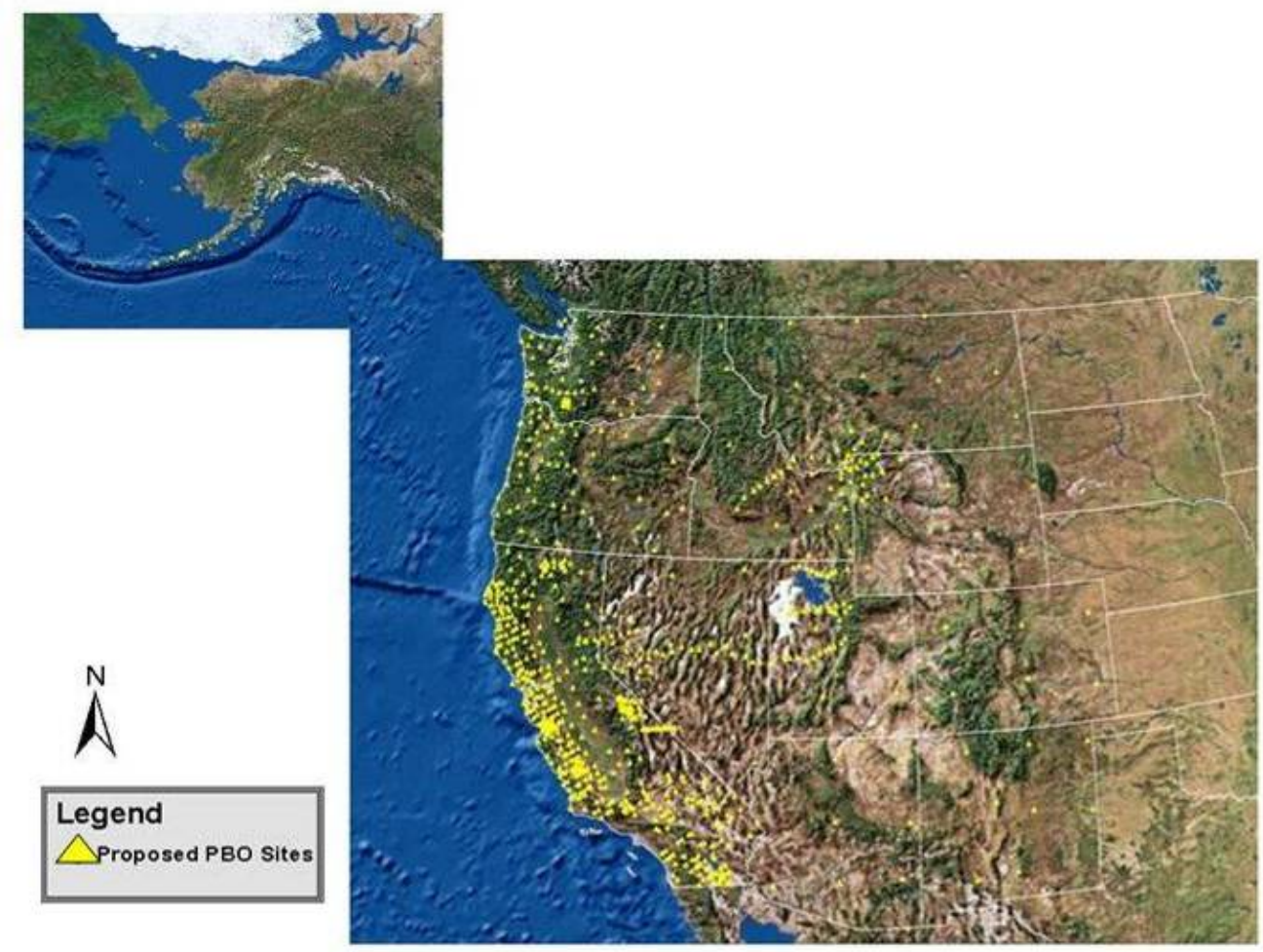

Figure 1: PBO GPS stations proposed for the western United States and Alaska

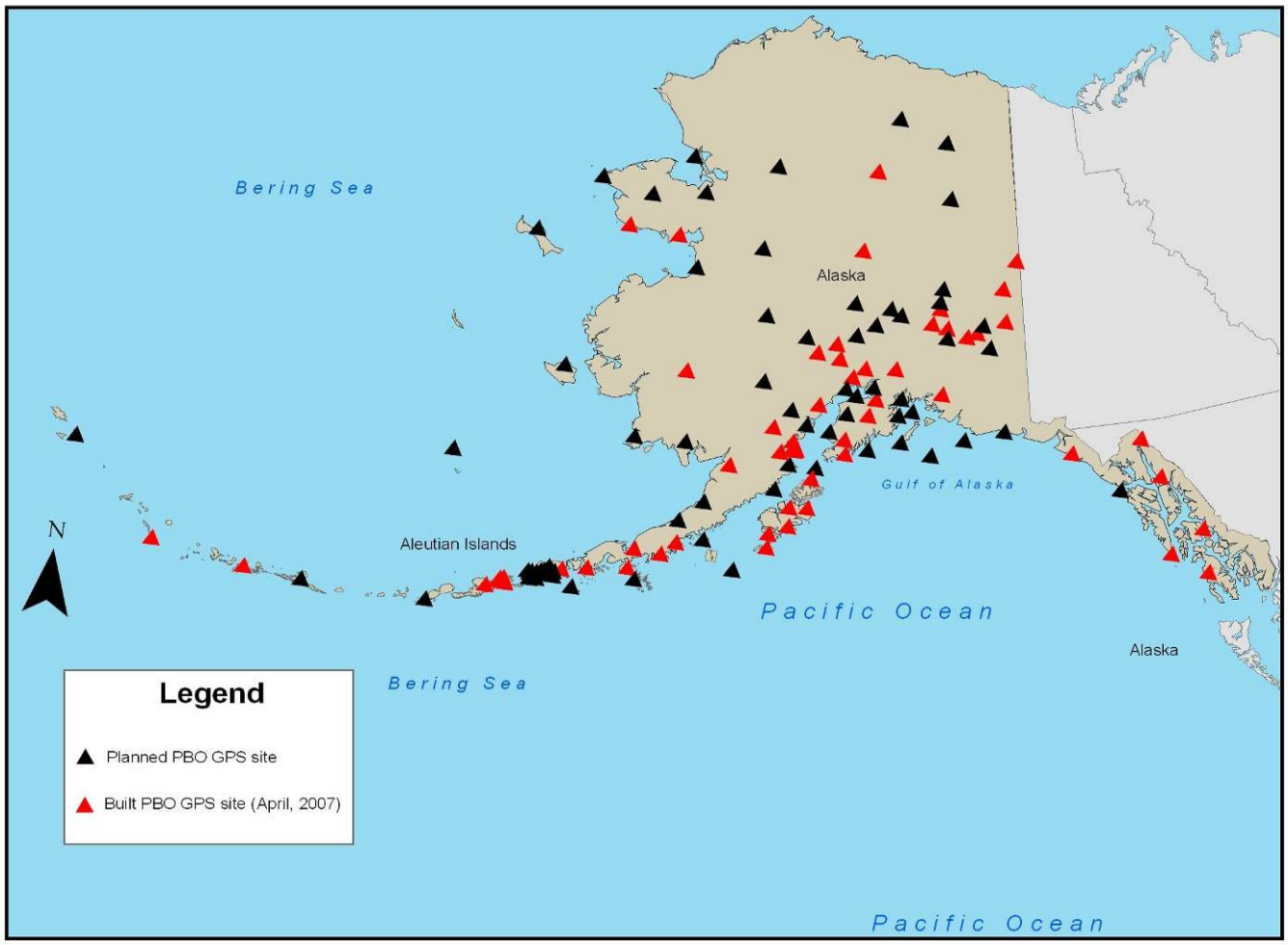

Figure 2: PBO GPS stations proposed and built in Alaska

The Aleutian Arc is part of the very active Aleutian subduction zone, where the Pacific plate is sliding beneath the North American plate. The Aleutian subduction zone has a history of strong earthquakes. Ten large earthquakes have occurred in this area since 1900, including the 1965 magnitude (M) 8.7 Rat Island earthquake, the 1957 M 9.1 Andreanof earthquake, the 1938 M 8.2 earthquake that occurred off the Alaska Peninsula, and the 1964 M 9.2 Gulf of Alaska earthquake that caused $311 million in property damage and took 125 lives (Wyss and others, 2000 and USGS 2003).

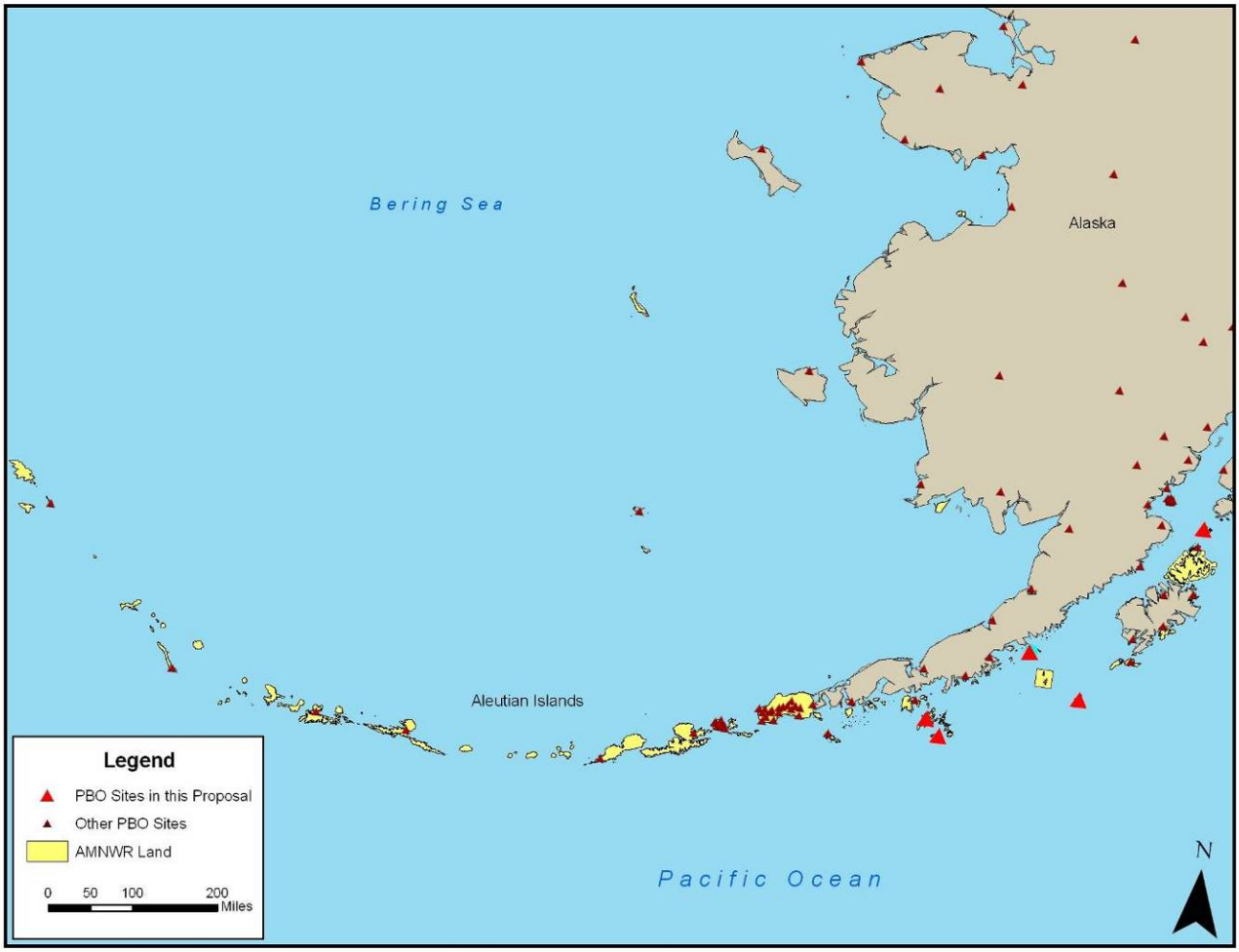

Figure 3: PBO GPS stations proposed for lands administered by the USFWS

In a recent evaluation of the seismic potential in Alaska, researchers reported that several Aleutian subduction zone segments may be ready to rupture soon. The Yakataga gap and the region between Kodiak Island and the Shumagin Islands are areas where M8 or greater events are expected (AEIC 2006). The last great earthquake known to have occurred near the Shumagin Islands (according to Russian records) was in 1848. Because this area has not experienced an earthquake for 159 years, it is very likely that the area will see a strong earthquake in the foreseeable future (Gedney 1983). However, smaller M6.8 to 8.0 earthquakes occur at more frequent intervals in many regions of central and south central Alaska. On average, Alaska has a M7.0 or larger earthquake about every two years, which could cause major damage if it occurred in a populated or strategically sensitive area (AEIC 2006).

The islands along the Aleutian Arc are sparsely populated but face earthquake hazards, volcanic eruptions, and tsunamis resulting from movement along the Aleutian subduction zone. Tsunamis are the primary hazard for the local populations on the Aleutians. The effects of the tsunamis, however, could be damaging as far away as Hawaii (Gedney 1983). In addition to the populated areas, the country's largest fishing industry, sensitive fish populations, and the off-shore rigs could be affected (AEIC 2006 and Gedney 1983).

The proposed GPS stations in the AMNWR would provide continuous observational data to aid scientists in understanding the interface between the North American and Pacific plates, including what areas of the Aleutian subduction zone are locked, which areas are creeping, and how the segments change from locked to creeping over time. It is believed that the shift between locked and creeping segments is related to release in strain that occurs during an earthquake. To measure movement along the subduction zone, the monitoring equipment must be placed on land, which means the measurement must be taken from the islands. To get perpendicular measurements at varying distances from the Aleutian trench, it is not possible to locate the GPS stations off of the AMNWR.

The proposed GPS stations were sited in their current locations to monitor the area of seismic interest between Kodiak Island and the Shumagin Islands. To get a complete picture of what areas along the Aleutian subduction zone are locked and which areas are experiencing creep, the GPS stations need to be perpendicular to the Aleutian trench at varying distances from the trench. The GPS stations were sited to avoid wilderness areas, avoid sensitive resources, and to provide adequate telemetry for relaying data from the GPS stations to the PBO Operations Center in Boulder, Colorado. These data can then be used by the collaborating research institutions and agencies. See Section 2.1 for more information about the siting process used for the GPS stations.

Three islands in the Shumagins (Popof, Chernabura, and Nagai) were selected to obtain measurements of varying distances along the Aleutian trench. The GPS station on Chernabura would be located on lands administered by AMNWR. The GPS stations on Popof and Nagai Islands are located on private land. The measurements will help scientists understand the extent of the locked segment near the Shumagins, which is one of the largest locked segments in the subduction zone (Freymueller, personal communication, 2007). This is important to better predict when an earthquake might occur near the Shumagin Islands.

The proposed GPS stations on Sutwik and Chirikof would provide perpendicular measurements at varying distances along the Aleutian trench in the area between the Shumagin Islands and Kodiak Island. Ideally, a GPS station would have been placed on one of the Semidi Islands, but these islands were avoided because they are designated wilderness areas. The GPS station on Chirikof is particularly important because it is located the farthest distance offshore of the Alaska Peninsula of any of the proposed and existing GPS stations. At Chirikof a seismometer vault is also proposed to provide additional measurements that can not be achieved by the GPS station

alone. Strong-motion and broad-band units would be collocated with the GPS station to obtain acceleration and velocity movements that cannot be measured with the GPS station.

Among the Barren Islands, Ushagat Island was selected for a GPS station because it provides a perpendicular measurement to the Aleutian trench near Kodiak Island, has easy access, and contains fewer seabirds colonies than do most of the other islands in the group. With fewer seabird colonies, disturbance to birds, and the hazards to helicopters concentrations of birds can present, would be reduced.

The four proposed GPS stations and one proposed seismometer vault would contribute to an overall better understanding of the geophysical hazards that are experienced along the Aleutian subduction zone. This real time information can be used by public officials and land managers in preparing and implementing their safety and hazards plans. For example, the data can be used to warn AMNWR and populated areas along the Aleutian Islands of localized tsunamis resulting from earthquakes. These data would be available to the tsunami warning center as discussed below.

The GPS stations are stable, permanent points of reference that could be used as survey control to define AMNWR boundaries and map all types of resources such as biological or archeological resources to a high degree of accuracy and repeatability. The use of these sites as survey control points could be done in real time with Real Time Kinematic (RTK) or in an office using the 24-hour data files available from the EarthScope data portal at http://www.earthscope.org/index.php/es_data.

1.3 Land Status

Four proposed GPS stations and one proposed seismometer would be located near areas of seismic and volcanic activity on AMNWR, Alaska Peninsula Unit and Gulf of Alaska Unit. Three GPS stations would be located in the Alaska Peninsula Unit on the islands of Chernabura, Sutwik and Chirikof. One GPS station would be located on Ushagat Island, which is located in the Gulf of Alaska Unit. The GPS stations would be located on refuge lands, which became part of AMNWR in 1980 with the passage of the Alaska National Interest Lands Conservation Act (ANILCA).

1.3.1 Sutwik Island

Lands have been selected on Sutwik Island by the Koniag Corporation, and a small conveyance has been made to the Koniag Corporation (Figure 14 in Section 3.2). The proposed GPS station on Sutwik Island would not be on the land conveyed to the Koniag Corporation. The Koniag Corporation does not object to UNAVCO's proposed use of Sutwik Island, provided all efforts are made to avoid Koniag's conveyance (Reft, written communication, 2006). See Section 5 for more information about the Koniag Corporation.

1.3.2 Chernabura, Chirikof, and Ushagat Islands

Chernabura, Chirikof and Ushagat Islands are administered by AMNWR. These islands have no selected or conveyed lands.

1.3.3 Wilderness

None of the proposed GPS stations would be located on lands that have been designated wilderness or are being considered for wilderness designation.

1.4 Related NEPA Documents

Any permits issued by the USFWS for use and occupancy of refuge lands must be consistent with current refuge management plans. Refuge management in Alaska is guided by individual Environmental Conservation Plans and Environmental Impact Statements (EIS) prepared for each refuge. AMNWR is managed according to a Record of Decision based on the *1987 Final Comprehensive Conservation Plan, Wilderness Review and Environmental Impact Statement.* This EIS document describes and evaluates the effects of implementing different management alternatives.

Actions similar to the GPS stations proposed on AMNWR have occurred on USFWS- and National Park Service (NPS)- administered lands and are described in more detail. In 1989, the NPS at Katmai National Park and Preserve prepared an EA and Finding of No Significant Impact (FONSI) in response to a request for a special use permit for geophysical investigations, including the installation of seismic monitoring equipment, within the Valley of Ten Thousand Smokes, a designated Wilderness area.

An EA was prepared and FONSI issued in September 2007 for Denali National Park and Preserve, Lake Clark National Park and Preserve, and Katmai National Park and Preserve for installation of six GPS stations (two in each Park) in response to UNAVCO's request for a research permit.

U.S. Forest Service (USFS) issued special use permits for one site in Tongass National Forest and five sites in Chugach National Forest. The sites were categorically excluded from preparing an EA or EIS.

USFWS prepared two EAs for placement of seismic monitoring stations by the Alaska Volcano Observatory (AVO) on the Izembek National Wildlife Refuge and within the AMNWR on Great Sitkin and Kanaga volcanoes in 1998 and 1999. In 2001, the USFWS prepared an EA and FONSI in response to a request from the AVO for a right-of-way permit for installation of seismic monitoring equipment around 20 volcanoes within the Aleutian Island Unit of the AMNWR.

1.5 Permits or Authorizations Required

1.5.1 Right-of-Way Permit

A right-of-way permit would be needed for long-term use and occupancy of Refuge lands by the proposed GPS stations. The right-of-way permit would be issued by USFWS if a FONSI is issued. The right-of-way permit would be issued for 20 years.

1.5.2 Coastal Consistency Review

Section 307(c) of the Coastal Zone Management Act of 1972, as amended (PL 92-583), states that "each Federal agency conducting or supporting activities directly affecting the coastal zone shall conduct or support those activities in a manner which is, to the maximum extent practicable, consistent with approved State coastal management programs." Federal agency consistency requirements are addressed in 15 CFR 930.

The Alaska Coastal Management Act (ACMP) of 1977, as amended, and the Alaska Coastal Management Program set forth general policies to be used for the review of projects. For coastal management purposes, the Proposed Action would occur within the boundaries of the Aleutians East, Kodiak Island, and Lake and Peninsula Boroughs. These boroughs do not currently have approved Coastal Management Plans.

USFWS finds the installation of four GPS stations on AMNWR to be fully consistent with policies of the Alaska Coastal Management Program. See Appendix A for more information.

1.5.3 Compatibility Determination

USFWS will determine whether the proposed activity constitutes an appropriate use of a National Wildlife Refuge and, if the answer is yes, prepare a compatibility determination. The National Wildlife Refuge System Improvement Act of 1997 requires refuge managers to 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 purposes for which the AMNWR (ANILCA 303(1)(B)) were established and shall be managed include those listed below.

> …(i) to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to marine mammals, marine birds and other migratory birds, the marine resources upon which they rely, bears, caribou and other mammals;
>
> (ii) to fulfill the international treaty obligations of habitats; 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;

(iv) to provide, in a manner consistent with subparagraphs (i) and (ii), a program of national and international scientific research on marine resources; and

(v) 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.

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. USFWS will make the compatibility determination available for public review and comment following the public availability of the EA.

1.5.4 Subsistence Analysis

Subsistence activities are allowed on AMNWR. USFWS will prepare a subsistence analysis to comply with Title VIII, Section 810 of the ANILCA. The analysis will evaluate the potential loss of subsistence opportunity that could result from the installation of GPS stations on AMNWR.

1.6 Decisions to be Made

The decisions that must be made about this proposal are: (1) whether the Proposed Action would have a significant impact on the Refuge and require an EIS; (2) whether to issue or deny the right-of-way permit to UNAVCO; 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.

1.7 Relevant Issues

The following issues of concern were identified and explored in this EA:

1.7.1 Wildlife Impacts

Numerous seabird colonies exist throughout the islands along the Alaska Peninsula and Gulf of Alaska. Marine mammals inhabit the waters surrounding the islands. Steller sea lions use many of the islands as haul outs and rookeries. Helicopter use for construction and maintenance of the GPS stations could disrupt some wildlife species' behavior. Depending on the placement, the GPS stations could disrupt a small number of nesting burrows or crevices of seabirds.

1.7.2 Vegetation Impacts

Small plots of vegetation would be removed at the GPS station locations. The vegetative mat on the coastal islands is thin and not well anchored at many locations. It is subject to erosion and sloughing. Disturbed vegetation is extremely slow to recover because of persistent winds and harsh weather. In addition, rare plants occur in the Aleutian Islands and on the Alaska Peninsula. Several of these endemic species grow at elevations where they might be encountered by UNAVCO during installations.

1.7.3 Threatened and Endangered Species

Several listed terrestrial and marine threatened or endangered species are found in Alaska. Nine of these species inhabit the AMNWR including Steller sea lion, northern sea otter, short-tailed albatross, Steller's eider, three species of whales, and the Aleutian shield fern. Due to the location of the GPS stations, method of installation, and short-duration of construction, impacts to these species are minimized.

1.7.4 Hazardous Waste/Solid Waste Generation

No hazardous materials would be produced at the proposed GPS station sites. Solid waste (cuttings) generated during the installation process would be collected in containers and removed from the sites. The old batteries would be removed and recycled when replacement occurs. Used batteries would not be stockpiled at any of the GPS sites. Four over-pack fuel drums would be stored on Chirikof during installation of the GPS station and seismometer.

1.7.5 Human Life-Safety and Geo-Hazard Monitoring

Currently, a very sparse geodetic network exists in the western United States. The limited geographic coverage of this network contributes to a lack of understanding of basic Earth processes resulting in public safety risks attributable to geologic hazards. The proposed GPS stations would be located along the Aleutian subduction zone between the Pacific plate and the North American plate. This is an area of high seismic and volcanic activity that is not well understood. Monitoring these processes provides information to researchers, land managers, and communities that help them increase public safety measures.

1.7.6 Cumulative Impacts

The installation and maintenance of the proposed PBO stations would cause an incremental increase in helicopter activity and the number of long-term research facilities on the ground.

1.8 Issues Considered and Dismissed from Further Analysis

1.8.1 Wetlands or Floodplains

Wetlands, riparian areas, and floodplains were avoided when locating the proposed GPS stations; so no wetlands, riparian zones, or floodplains would be impacted.

1.8.2 Water Quality (Drinking Water, Groundwater)

The proposed GPS stations were not located near surface waters. On AMNWR, only short drill-braced monuments (SDBM) would be used (See Section 2.2.1 for equipment description). The GPS stations would be placed only in bedrock. No groundwater sources would be encountered.

1.8.3 Environmental Justice

The Project would not result in any significant changes in the socioeconomic environment of the area. Therefore, it is not expected to have a direct or indirect impact to minority or low-income populations or communities.

1.8.4 Visual Quality

The GPS stations would be visible to subsistence users and the limited number of visitors that recreate on the islands. Some overhead flights may see the equipment, however, the small scale of the equipment limits its visibility. As noted in Section 2.2.5, the equipment would be painted to blend with the surrounding landscape.

1.8.5 Subsistence

Subsistence activities are allowed on AMNWR. The GPS stations would be installed and maintained in a manner that would not restrict subsistence uses. As noted in Section 1.5.4, a subsistence analysis is being prepared by USFWS.

1.8.6 Wilderness

The proposed GPS stations have been sited so that they would be located in non wilderness areas. No wilderness areas would be impacted.

1.8.7 Invasive Non-native Species

As noted in Section 2.2.5, bags, boxes, and equipment will be checked for seeds, insects, and rodents prior to transport to each island to prevent transmission of invasive species. Drilling equipment would be washed before and after each site is drilled to prevent transmission of non-native plant material and seeds.

1.8.8 Land Use

The USFWS manages approximately 4.9 million acres of public land along the Alaska coast. The Refuge contains more than 2,500 islands, islets, spires, headlands, and reefs, within the North Pacific or Arctic oceans, and was established to conserve marine mammals, marine birds and other migratory birds, and the marine resources upon which they depend (USFWS 2003). The Project -would not conflict with, or have any impact on, the land use plan for or management of the Refuge. The compatibility determination being prepared by USFWS will provide more information on land use and its relationship to the project.

1.8.9 Air Quality Impacts

The proposed GPS stations would have no operational air emissions and the construction areas would be rehabilitated to pre-construction conditions, therefore, no long-term air quality impacts would occur from site operation. A small amount of surface disturbance would occur during construction that could generate particulate matter. Helicopter use would generate mobile source

emissions during construction and maintenance visits. Section 2.2.3 provides information about the number and timing of helicopter visits.

1.8.10 Paleontological Resources

A review of the Alaska Paleontological Database did not identify any known locations of paleontological resources near the proposed GPS station sites. No paleontological resources are expected to be impacted (Alaska Paleontological Database 2007).

1.8.11 Tribal Consultation

No known archeological sites or sites of Native American Religious concern are located within the areas identified for placement of the GPS stations. The elevations and locations, which are away from the coast or inland waters make it unlikely that cultural resources would be disturbed. No tribes were consulted.

1.8.12 Soils

Small holes would be drilled into the Earth to install each proposed GPS station. Although small areas of soil would be compacted where equipment upgrades and maintenance activities would occur, impacts are expected to be negligible.

Chapter 2: ALTERNATIVES

2.1 Introduction

This chapter describes the range of alternatives being considered and the recommended mitigation measures for offsetting potential adverse impacts. Only two alternatives are being considered. The Proposed Action Alternative would involve issuing a right-of-way permit that would allow UNAVCO to install four GPS monitoring stations on AMNWR. The No-Action Alternative would maintain the status quo by denying the permit application.

As part of the development of the Proposed Action Alternative, individual GPS station locations were selected using a systematic siting process to maximize operational capability while minimizing adverse environmental impacts of the seismic network in Alaska and the western United States. The siting process consisted of three phases that progressively eliminated from consideration infeasible and less desirable sites. The three phases were network definition, regional screening, and individual site evaluation. Most potential environmental impacts were minimized by siting the GPS stations so that they would avoid sensitive areas and resources. The remaining potential siting areas were assessed using the network's technical constraints and capabilities, geographic and environmental constraints, and other considerations such as the concerns of government agencies or local officials.

The four proposed GPS stations would be located on land at sites that are perpendicular to the Aleutian trench, have surficial bedrock, and are outside of wilderness areas.

2.2 Alternative 1: Proposed Action (Issue Right-of-Way Permit to Install Four GPS Stations)

UNAVCO would install four GPS stations on AMNWR. One site would be located on each of the following islands: Sutwik Island, Chernabura Island, Chirikof Island, and Ushagat Island. These stations would be part of the larger network of 142 GPS stations being planned and installed in Alaska. The station locations proposed on AMNWR are described in Table 1 and shown in Figures 4 through 7. At Chirikof, a seismometer vault would be collocated with the GPS station. The footprint for the additional station would be no larger than for the GPS station.

Table 1: Proposed GPS stations in Alaska Maritime National Wildlife Refuge

Site	Latitude*	Longitude	Legal Description	Site Elevation m (ft)	Name	Island Group
AC01	56.53299 N	157.27263 W	Alaska, Seward Meridian T42S, R51W, Section 24	55 m (180 ft)	Sutwik	Alaska Peninsula
AC12	54.83094 N	159.58961 W	Alaska, Seward Meridian T62S, R68W, Section 7	52 m (172 ft)	Chernabura	Shumagin Islands
AC13	55.82179 N	155.61938 W	Alaska, Seward Meridian T50S, R41W	183 m (600 ft)	Chirikof	Offshore from Semidi Islands
AC18	58.92581 N	152.24921 W	Alaska, Seward Meridian T14S, R18W, Section 35	151 m (497 ft)	Ushagat	Barren Islands

*Latitude and Longitude Coordinates are in WGS 84

2.2.1 GPS Station Components

The GPS stations are composed of a monument assembly, equipment enclosure, and solar panel support structure. SDBMs would be installed on the AMNWR because they are hand-drilled geodetic devices that can be installed quickly. They are well-suited for environmentally sensitive areas or extremely remote locations. This type of monument would be acceptable only where bedrock is within 0.3 meter (m) (1 feet [ft]) of the surface. Figure 8 is a schematic drawing of a typical SDBM installation. Figure 9 is a site plan layout of a typical SDBM installation. Figure 10 is a photograph of a completed GPS station.

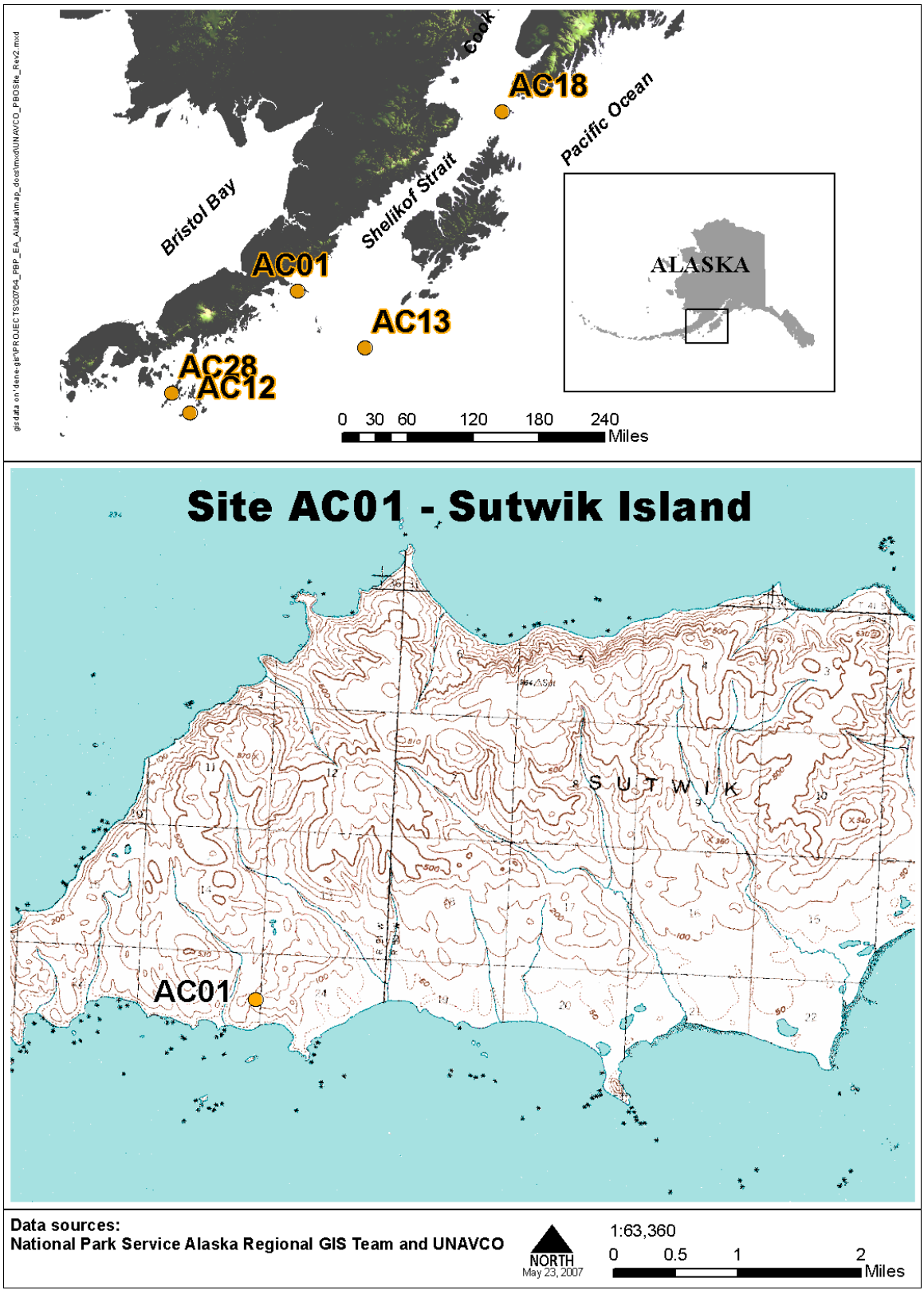

Figure 4: Location of proposed GPS station AC01 on Sutwik Island

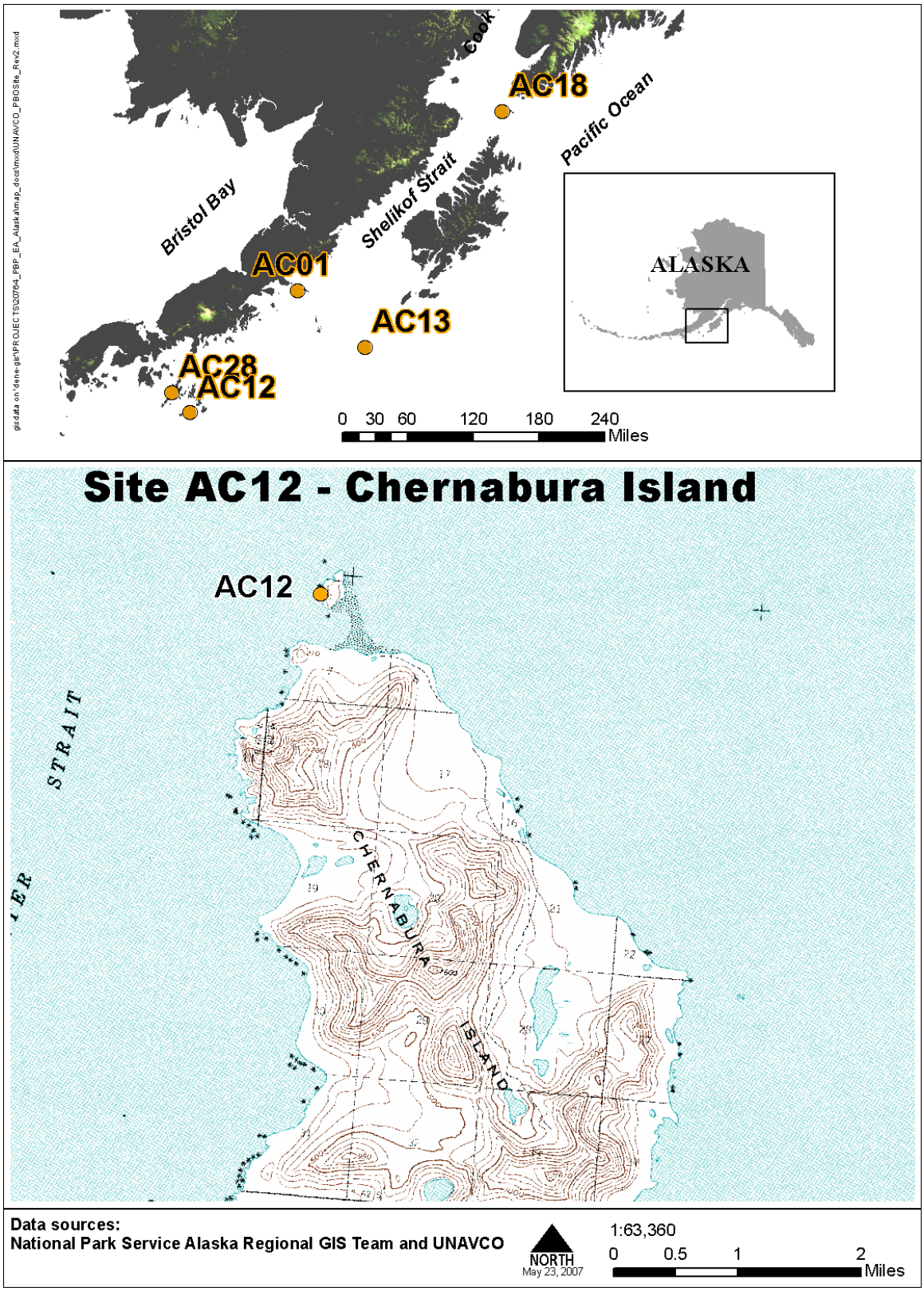

Figure 5: Location of proposed GPS station AC12 on Chernabura Island

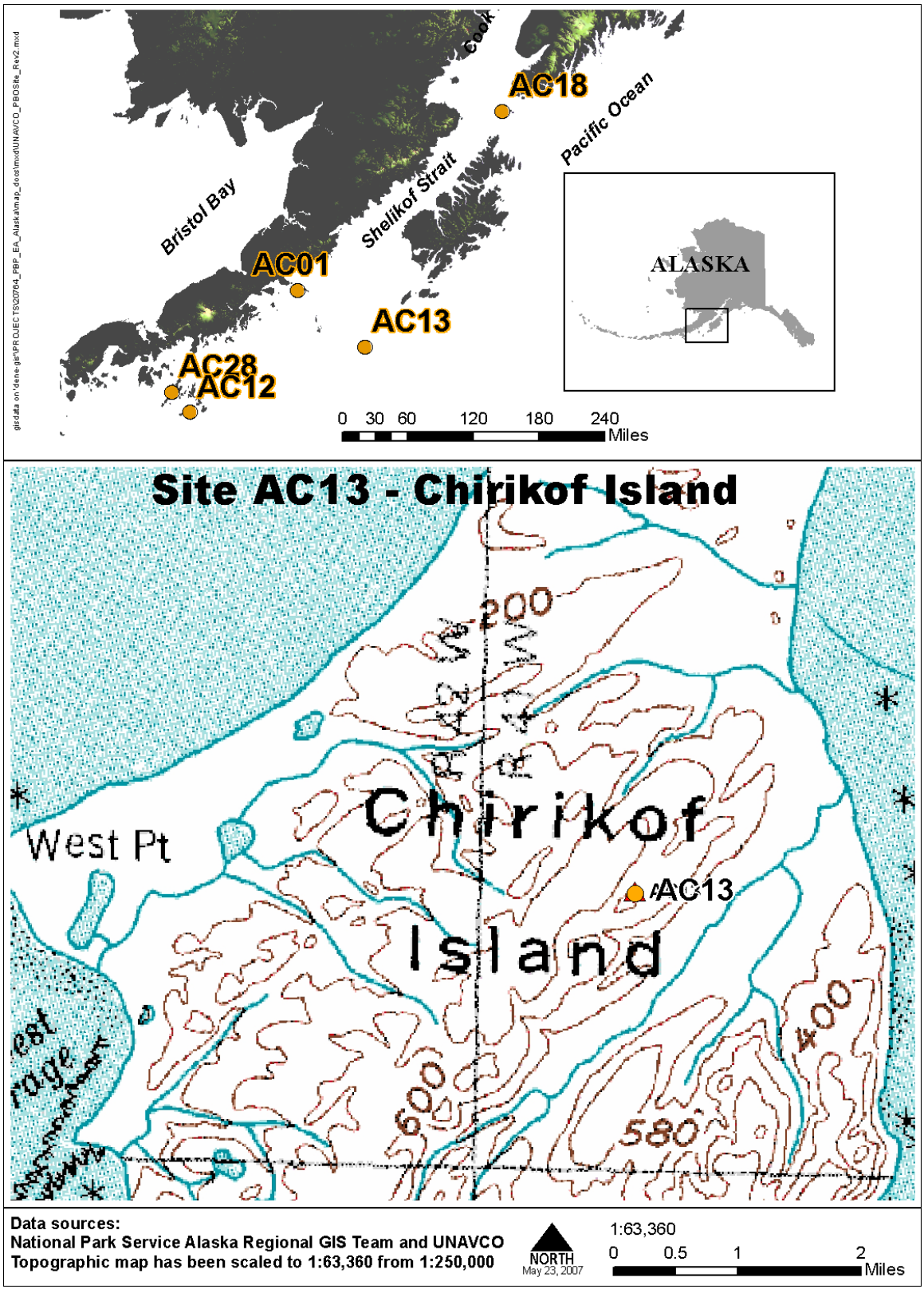

Figure 6: Location of proposed GPS station AC13 on Chirikof Island

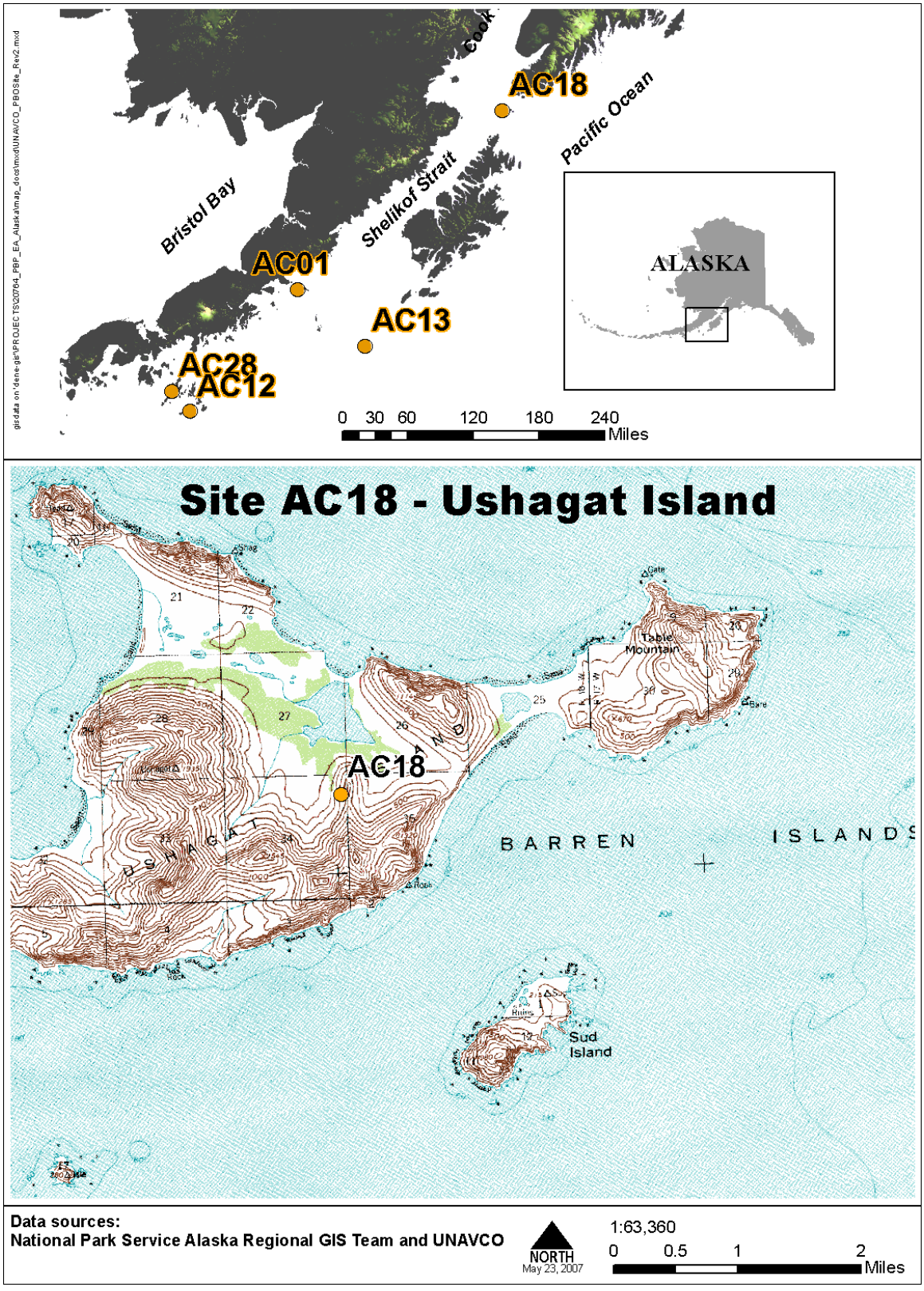

Figure 7: Location of proposed GPS station AC18 on Ushagat Island

2.2.1.1 *GPS Monument*

A center hole and four perimeter holes are drilled at approximately a 55 degree angle 1.5–1.8 m [5 to 6 ft] into bedrock (Figure 8) using a hand held, generator-powered rotary hammer. Five, 2.5 centimeter (cm) [1 inch (in)] diameter stainless steel rods that extend 1–1.4 m (3.3 to 4.5 ft) above the ground surface are inserted into the drilled holes to support the unit. A leveling adapter, geodetic grade GPS antenna and radome [40 cm (16 in.) diameter] are attached to the threaded top of the vertical leg. The total height of the monument is approximately 2 m (6.6 ft) including the GPS antenna and radome.

2.2.1.2 *Equipment Enclosure*

All electronic equipment would be placed in weatherproof equipment enclosures (Figure 8 and Figure 9). Communications devices would be mounted to the top of the equipment enclosure. As shown in Figure 8, a very small aperture terminal (VSAT) dish or a Yagi antenna would be used to transmit data, which would be downloaded and processed daily by the PBO Operations Center in Boulder, Colorado.

The equipment enclosure houses the power and communications equipment. The fiberglass hut also supports two solar panels. The equipment enclosure is pre-fabricated and can be delivered to the site by helicopter. The 1.8 m x 1.2 m x 1.4 m (70 in. x 48 in. x 55 in.) enclosure is anchored into the ground at each corner by a "J" bolt set in concrete. The equipment enclosure would be connected to the GPS monument by cable. Because these sites are located at high elevations and on rocky outcrops, trenching is difficult. The cable would be placed in conduit that would lie on the ground surface and be covered with small rocks.

2.2.1.3 *Solar Panels*

Two solar panels would be mounted on the electronics hut (Figure 8 and Figure 9). Two additional solar panels would be mounted on a swing set structure that would be placed next to the electronics hut. The equipment enclosure would be connected to the GPS monument by cable in conduit. The cable conduit would lie on the ground surface and be covered with small rocks. The solar panel support structure consists of triangular aluminum pipe frame that resembles a child's swing set (Figures 8 and 9). The frame consists of a rectangular aluminum pipe base. Two rectangular side supports are attached to the bottom support at 45 degree angles to form the sides of the triangular structure. Two solar panels are mounted on one of the side supports. The solar panels would be installed to a height that allows for expected snow accumulation levels at a given site. The base of the solar panel support structure would be secured to the ground surface via wires. The base measures 2.4 m x 1.5 m (8 ft x 4.8 ft or 96 in. x 58 in.) and the entire structure would be approximately 2.4 m (8 ft or 96 in.) high.

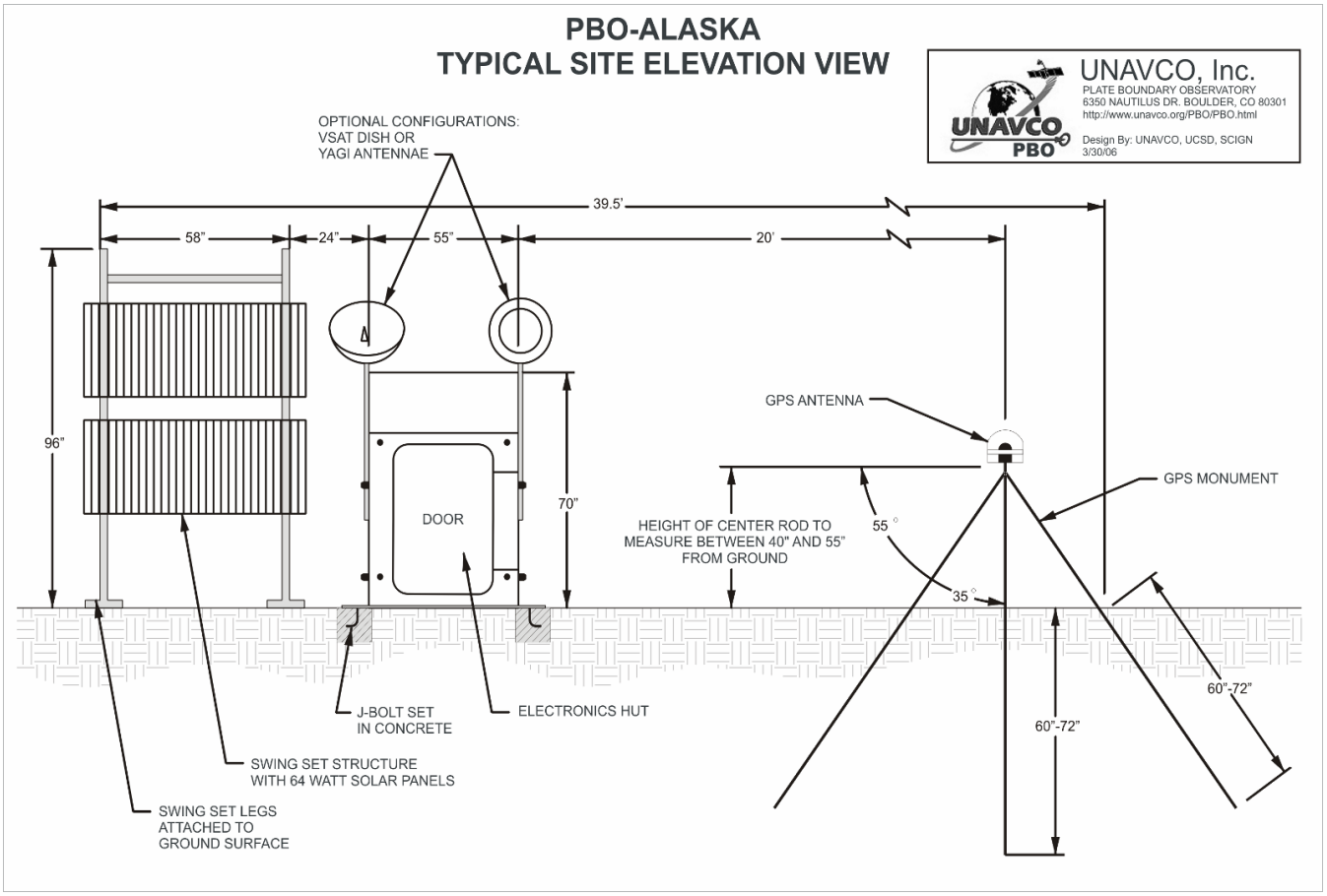

Figure 8: Typical drawing of a short drill-braced monument, equipment enclosure and solar panel support structure

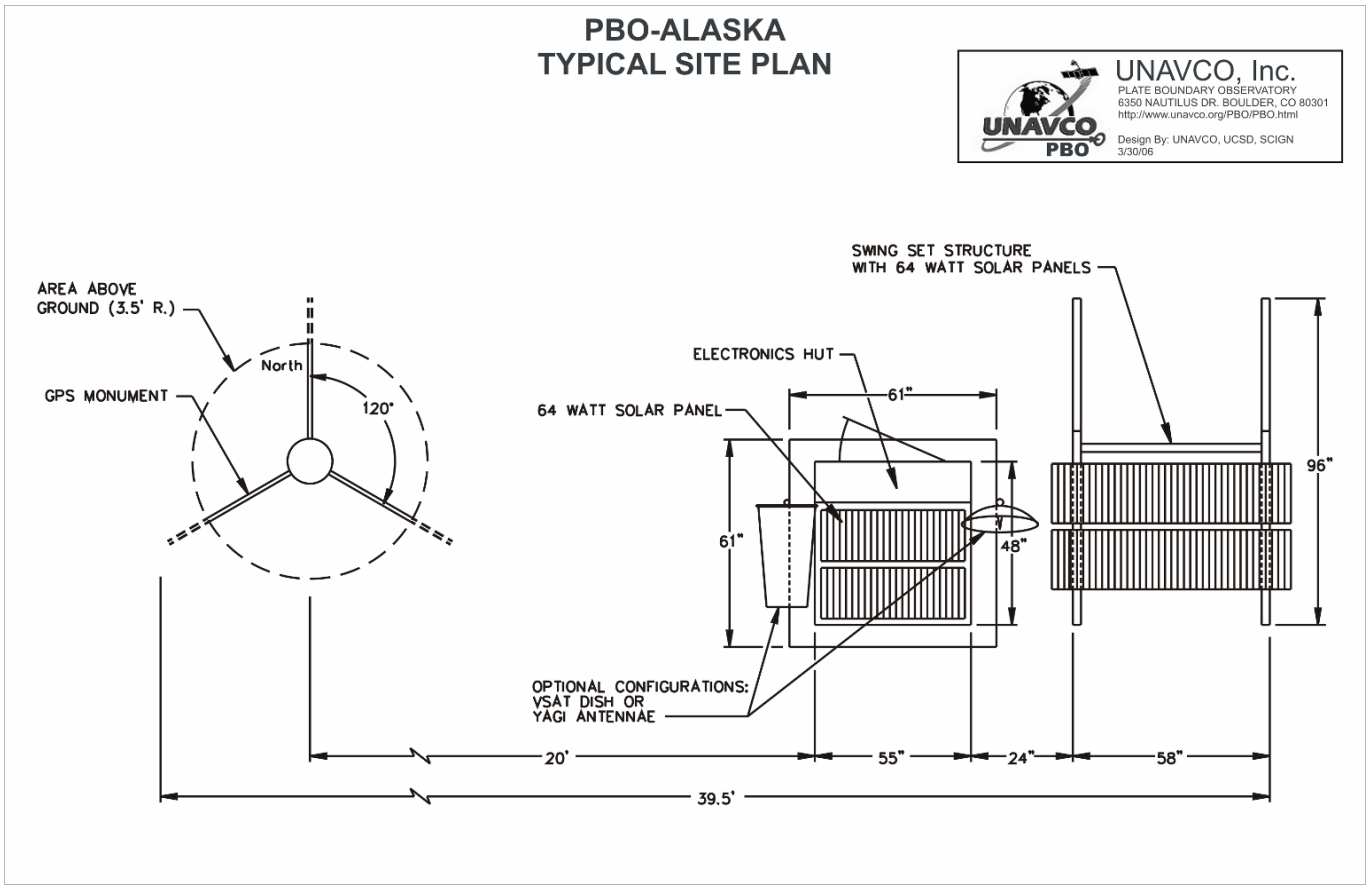

Figure 9: Typical plan view of a short drill-braced monument, equipment enclosure and solar panel support structure

Figure 10: Photo of a finished short drill-braced monument, equipment enclosure and solar panel support structure

2.2.2 Seismometer

The seismometer installation consists of the measuring equipment (seismometer) and the storage vault where the measuring equipment is located. Two types of seismometers would be installed in the vault on Chirikof – a broad-band and a strong-motion seismometer. Both the broad-band and strong-motion seismometer are placed in a single vault as shown in Figure 11. The seismometer vault would be co-located with the GPS station and would utilize the power and communication systems of the GPS station as shown in Figure 12 and Figure 13. Figure 12 is a schematic drawing of a co-located seismometer and GPS station. Figure 13 is a site plan layout of co-located seismometer and GPS station.

2.2.2.1 *Seismometer Equipment*

At Chirikof, a broad-band and a strong-motion seismometer would be placed in a single vault as described in Section 2.2.2.2. The strong-motion seismometer is bolted to the concrete base of the vault; it measures ground acceleration. The broad-band seismometer sits on the concrete base of the vault. The broad-band seismometer measures ground velocity.

2.2.2.2 *Vault*

The seismometers would be placed inside of a 95-gallon ENPAC over-pack salvage drum (Figure 11). The drum is placed on bedrock, typically 4.5 m to 30.5 m (15 ft to 100 ft) from the GPS equipment enclosure that houses the solar panels and communication system. The seismometers would use the GPS station solar panels and communication systems. The bottom of the over-pack drum is cut off and the drum buried to a depth of 3 ft. The bottom of the drum lid is at ground level; approximately 10.2 cm (4 in) of the lid would be above ground. The inside walls are sprayed with non toxic insulating foam (7.6 cm [3 in]) and styrofoam is placed (10.1 cm [4 in] thick) under the lid for insulation. The installation is sprayed into the drum before it is transported to the island. A chain over the top with a lock can be added for security.

A 50-50 sand-cement mixture is placed at the bottom of the drum to make a level pad for the seismometers. The strong-motion seismometer is bolted to the concrete. The broad-band seismometer sits on top of the concrete pad. Both instruments are leveled during installation. Conduit containing the data and power cables would connect the seismometers to the solar panels and communication systems of the GPS equipment enclosure. The conduit would be buried to a depth of up to 61 cm (24 in), if site conditions allow, between the vault and equipment enclosure. The trench is dug using hand tools. If site conditions do not allow burying the conduit, it would be left on the surface and covered with rocks.

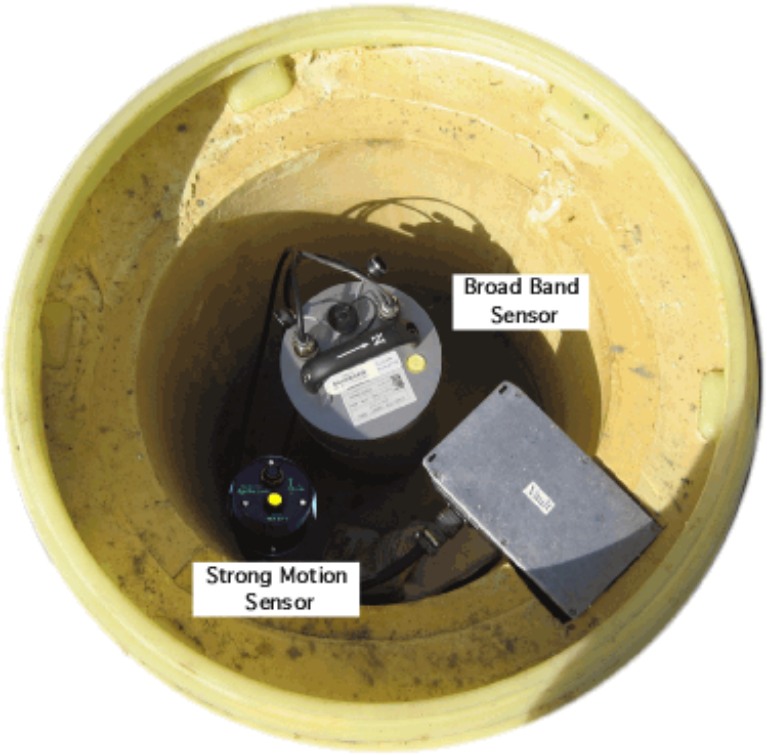

Figure 11: Photo of a seismometer

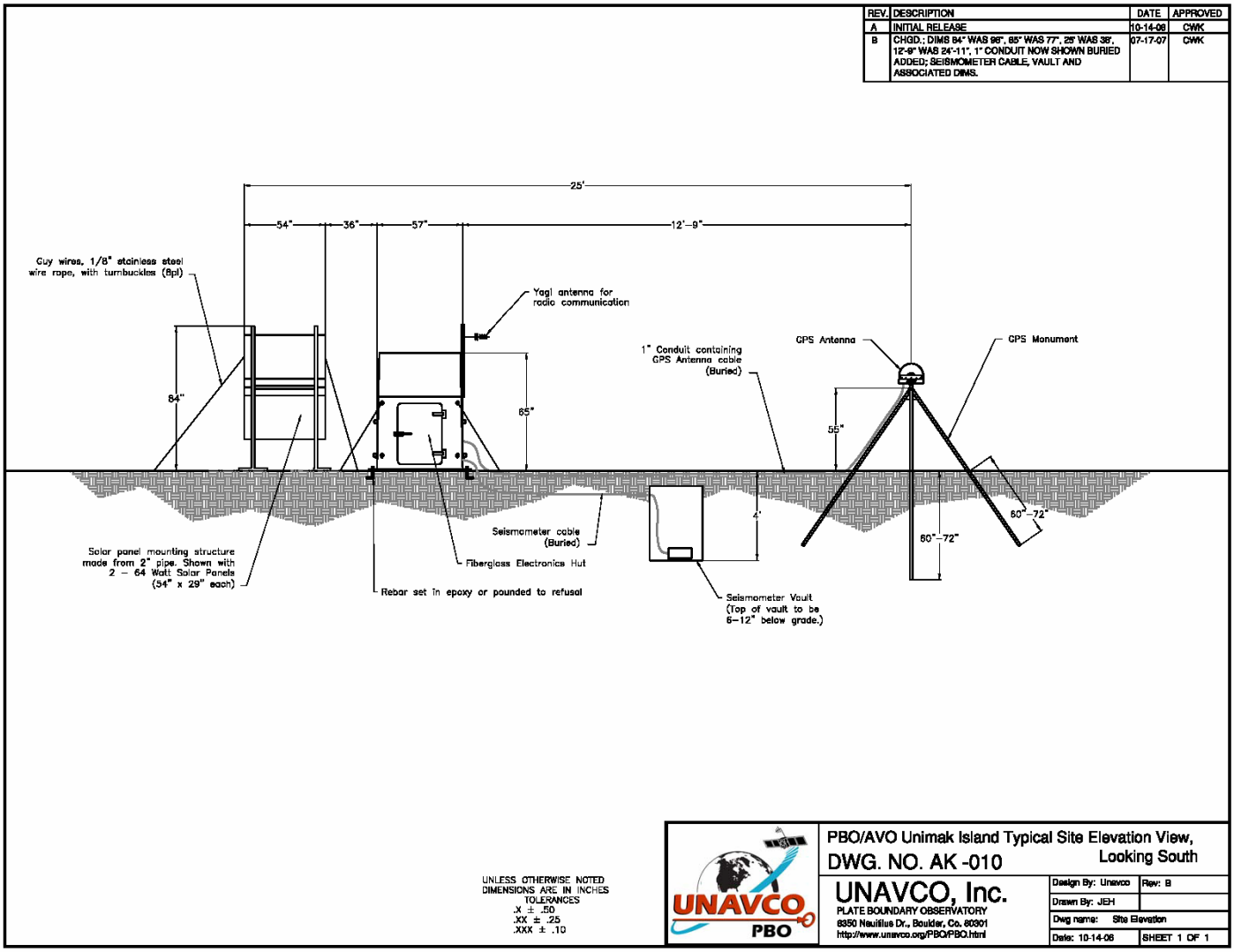

Figure 12: Typical drawing of a short drill-braced monument, equipment enclosure, solar panel support structure and seismometer

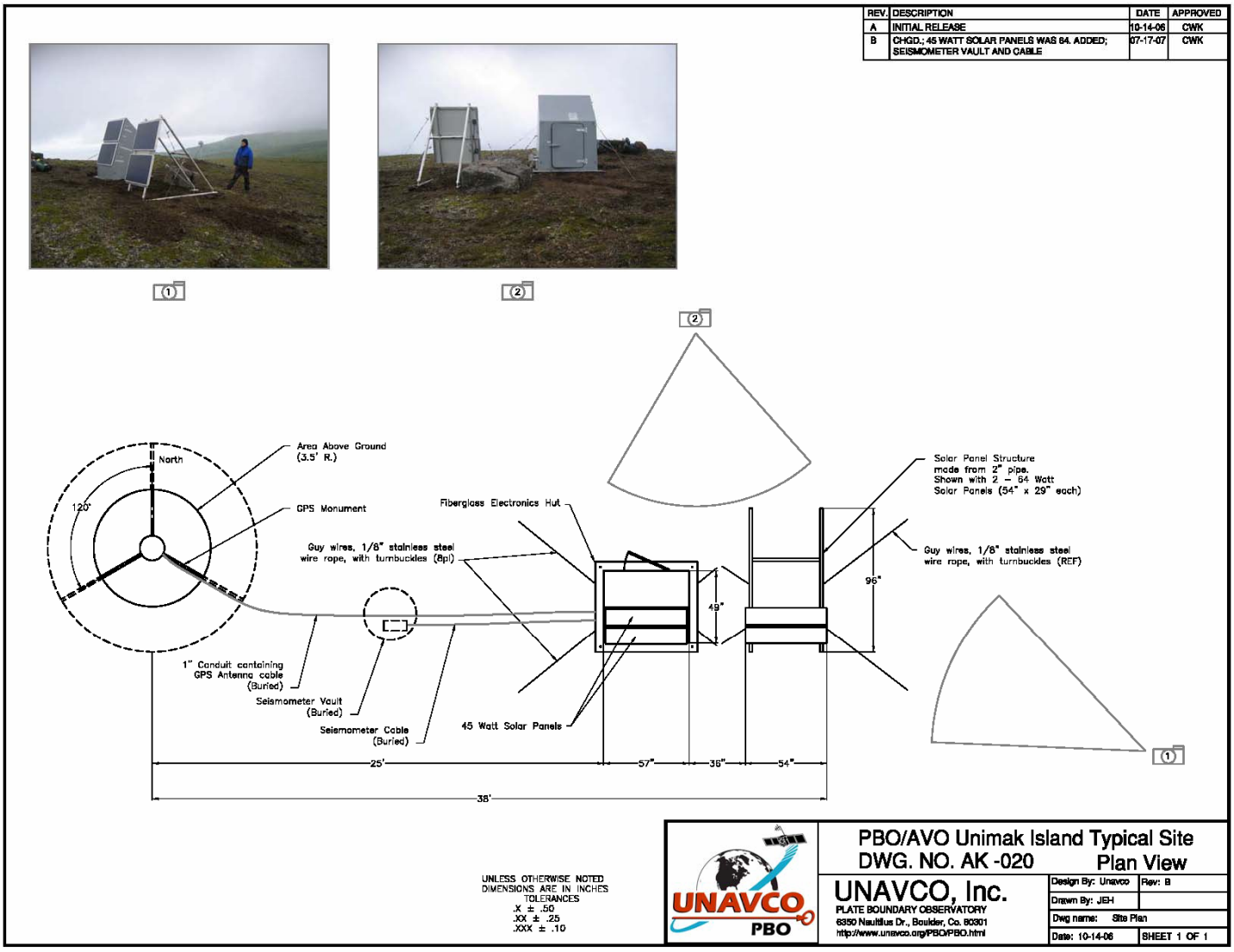

Figure 13: Typical plan view of a short drill-braced monument, equipment enclosure, solar panel support structure, and seismometer

2.2.3 Helicopter Use

Under the Proposed Action Alternative, UNAVCO would use a combination of boats and helicopters to gain access to all of the proposed GPS stations. Transport of heavy equipment and supplies such as seismic monitors, deep cycle batteries, equipment shelters, solar panels, and supporting frames is not feasible with land vehicles. Boats would transport the equipment to a location near the islands. The weight of the equipment, approximately 1,500 pounds, precludes loading and unloading between boats and land (UNAVCO and USFWS 2005). Helicopters would transport the equipment from the boat to the islands. These sites are remote and inaccessible by land vehicles and unsuitable for landing fixed-wing airplanes. UNAVCO is attempting to coordinate the AMNWR installations with other installations on non USFWS–administered lands to limit the number of helicopter trips.

After the stations are operational, UNAVCO would conduct site visits only to replace back-up batteries and conduct routine maintenance. Helicopters would make these visits because the batteries are too cumbersome to be hand-carried to the sites. Site visits would occur approximately once every three years for each station unless the equipment malfunctions, which would require a visit to make repairs outside of the scheduled maintenance visits.

Other than during landing and takeoff, and when visibility and conditions allow, helicopters would maintain a minimum altitude of 2,000 ft above ground surface pursuant to Federal Aviation Administration (FAA) Advisory Circular (AC) 91-36C, “Visual Flight Rules (VFR) Near Noise Sensitive Areas.” Maintaining this altitude from the ground surface is expected to reduce adverse impacts to wildlife and recreational visitors to the islands. All flight plans would be designed to avoid marine mammal haul outs. UNAVCO personnel would consult with the Refuge each season so that flight paths would accommodate Refuge resource and management needs.

UNAVCO would use different flight/boat paths for the various installations. Table 2 lists the takeoff location for each GPS station installation and proposed helicopter approach direction to the proposed GPS station. Although flights would be restricted between May 15th and September 15th, the Refuge may, on a case-by-case basis, authorize flights during that time period. UNAVCO would coordinate with USFWS on installation schedule and flight paths. Helicopters would not fly over any sea lion sites during installation and maintenance of the GPS stations. As specified in 50 CFR 223.202, rookeries would not be approached on land within one-half statutory mile or within sight of a rookery. Boats used to approach the islands would not approach rookies within three nautical miles of a rookery site listed 50 CFR 223.202.

Table 2: Helicopter flight paths for proposed GPS stations

Site	Site Location	Takeoff Location	Island Approach
AC01	Sutwik	Kodiak or Homer	West
AC12	Chernabura	Kodiak or Sand Point	North
AC13	Chirikof	Kodiak or Homer	East
AC18	Ushagat	Homer	North*

* Helicopters would approach Ushagat high and descend straight down to the installation. The helicopters would stay at least one mile from Nord Island because of its concentration of nesting seabirds and marine mammals.

In some instances, the monitoring equipment would be left in the field for a few days before installation is completed. The equipment would be tagged to identify the applicant as UNAVCO, provide contact information, the purpose of the equipment, and the USFWS right-of-way permit number.

2.2.4 Schedule for Construction and Maintenance

Installation of the proposed AMNWR GPS stations would begin in 2008. Construction would not occur between May 15th and September 15th. UNAVCO would operate the facilities for 20 years with the expectation that individual consortium members would assume operation and maintenance of the GPS stations and obtain a new right-of-way permit after that period.

Once constructed, the GPS stations would not require operational support other than a maintenance visit to check the condition and functionality of the equipment and replace batteries. The old batteries would be removed from the station site when replacement occurs. Used batteries would not be stockpiled at any of the GPS sites. Each GPS station would be visited on a rotating three-year schedule. Maintenance visits would not occur between May 15th and September 15th, unless otherwise authorized by USFWS. Maintenance personnel would access the sites using helicopters. Maintenance visits would require minor foot traffic around the installation. Unless the equipment is damaged, no other site support would be required.

2.2.5 Impacts

2.2.5.1 *Construction*

Construction would take approximately one to two days, but could require up to one week depending on site conditions, weather, and the material to be drilled. On the coastal islands, with the greater possibility of poor weather conditions, construction would more typically take two to five days.

SDBM stations can usually be constructed within a 74 square meter (m^2) [800 square feet (ft^2) or 0.02 acre (ac)] construction area. However, the proposed GPS stations are located in remote areas and some stations would be located in extremely rugged terrain. To be constructed in these conditions the GPS stations must include additional solar panels and equipment enclosures as described in Section 2.2.1.2 and must be placed on relatively level terrain. In areas of rugged terrain, the SDBM monument and equipment support structures may need to be placed greater than 9 m (30 ft) apart. For these sites, two separate construction zones would be utilized—one for construction of the SDBM and one for construction of the equipment support structures. Each zone would consist of a 9 m (30 ft) radius circle around the equipment. Some overlap in the construction areas may occur. The total construction area for each SDBM at AMNWR would be 525 m^2 (5,655 ft^2 or 0.05 hectare [ha] or 0.1 ac)

Prior to construction, bags, boxes, and equipment will be checked for seeds, insects, and small rodents prior to traveling to each island to prevent transmission of invasive species to the islands.

2.2.5.2 *Operation*

Immediately following GPS construction, the site will be rehabilitated to pre-construction conditions as much as possible. The completed GPS stations occupy a relatively small footprint of 64 ft^2 (6 m^2) or 0.001 ac (0.0006 ha). The equipment, except the radome and solar panels will be painted to blend in with the surroundings. UNAVCO will coordinate with USFWS on color selection for the equipment. The equipment on Chirikof will be surrounded by a fence. UNAVCO will coordinate with USFWS on fence type. Appendix B contains photographs of a site being constructed and the installed GPS equipment.

2.2.6 Restoration Plan for Equipment Removal

Once the project is discontinued, a UNAVCO crew would visit each GPS station site to disassemble and remove the equipment. The monument bracelegs would be cut off at or below ground level. The monument, electronics hut, solar panel swing set structure, and associated conduit would be removed. The removal would be completed by helicopter. See Section 2.2.3 for more information on helicopter use. The sites will be revegetated as necessary and in coordination with USFWS. Each site will be left in as natural a state as possible when the equipment is removed. It will take one day to remove the equipment from each GPS station site.

2.3 Alternative 2: No-Action

Under the No-Action Alternative no GPS stations would be installed on islands within the AMNWR. There would be no improvement of seismic data collection and interpretation. Implementation of this alternative would not meet the stated purpose and need for the Proposed Action. This alternative represents a continuation of the existing situation and provides a baseline for evaluating the changes and impacts of the Proposed Action.

2.4 Summary Comparison of Environmental Consequences

Table 3 provides a summary comparison of Alternative 1 (Proposed Action—Issue right-of-way permit to install four GPS stations) and Alternative 2 (No-Action). The environments within which the proposed GPS stations would be installed are discussed in detail in Chapter 3 and potential impacts to the environment are discussed in detail in Chapter 4.

Table 3: Summary comparison of Alternative 1 and Alternative 2

Resources	ALTERNATIVE 1: Proposed Action (Install Four GPS Stations)	ALTERNATIVE 2: No-Action
Wildlife Impacts	Negligible impacts to wildlife habitat or populations from helicopter activity because of remote locations of seismic stations and limited periods of helicopter use.	No impact
Vegetation Impacts	Minor impacts on vegetation	No impact
Threatened and Endangered Species	No impacts to threatened or endangered species.	No impact
Human Life-Safety	Improved safety by providing additional information and warnings about geophysical hazards.	Improved geophysical hazards monitoring would not occur, therefore additional information about geophysical hazards would not be available to land managers for safety planning.
Hazardous Waste	Fuel will be stored on Chirikof during installation. There is a potential for minor fuel leaks during refueling. Secondary containment will be used to minimize leaks reaching the ground.	No impact
Cultural Resources	No impacts to cultural resources expected.	No impact
Cumulative Impacts	No significant cumulative impacts expected	No impact

Chapter 3: AFFECTED ENVIRONMENT

This chapter describes the relevant resource components of the existing environment (baseline conditions) that could affect, or could be affected by, the Proposed and No-Action alternatives. In addition, important resources that may occasionally be found in the project area (such as endangered species) are briefly discussed, regardless of whether or not they would be affected by the Project.

3.1 Physical Environment

The Project is located along the Alaska Peninsula and extends into the Gulf of Alaska. Over 800 islands, islets and rocks are off the southern side of the Alaska Peninsula. They have a maritime climate characterized by high winds, persistently overcast skies, and frequent precipitation. The marine waters are highly productive because of the warm currents flowing in a clockwise direction across the northern Pacific Ocean. Island topography varies but generally the islands have steep mountainous terrain with some elevations exceeding 2,000 ft (USFWS 1987).

The Gulf region has a more moderate climate with mild winters, cool summers, and heavy precipitation. The area does not experience the frequent high winds of the Alaska Peninsula (USFWS 1987).

Many geologic forces are eroding and uplifting the landscape. Volcanic and seismic activities (plate deformation) result from the Pacific plate descending northwest under the North American plate along the Aleutian Trench. This trench parallels the Aleutian Islands off the south shore of the Alaska Peninsula. The subduction movement of one plate beneath another results in earthquakes, and long faults from Kodiak Island to the Kenai Peninsula. The area is one of the most seismically active areas in the world (USFWS 1987 and USFWS 2001).

3.2 Wildlife

3.2.1 Birds

The AMNWR protects and provides habitat for seabirds, marine mammals and other wildlife, including unique species not found elsewhere. Approximately 40 million seabirds, 80 percent of all seabirds in Alaska,, nest on AMNWR. The seabird populations are of national and international significance (USFWS, not dated a). All of the islands are used by migrating shorebirds, raptors, upland birds, and passerine birds. The Shumagin Islands, which include Chernabura, have the largest seabird congregation west of the Semidis and east of the Aleutians. Excluding nocturnal species, the group hosts roughly a million seabirds of 18 species (Renner 2007). Additionally, a review of birds by Alaska Natural Heritage Program (AKNHP) (2007) reveals winter or breeding ranges for state ranked, Bureau of Land Management (BLM) sensitive species, or Audubon “Watch List Species” on the all of the islands except Chirikof.

3.2.2 Marine Mammals

Marine mammals commonly found around the islands include sea otters, Steller sea lions, harbor seals, northern fur seals, Pacific walruses, and several species of whales and porpoises (USFWS 1987). Federally-protected whales and Steller sea lions are discussed in Section 3.4.

3.2.3 Terrestrial Mammals

Terrestrial mammals include river otters, shrews, voles, and ground squirrels. A population of feral cattle lives on Chirikof (USFWS 1987 and MacNeil et al. 2007).

3.3 Vegetation

Vegetation on the coastal islands near the proposed GPS stations can generally be characterized as maritime or alpine tundra, depending on the elevation. The uplands support a variety of lichens, moss, and low-growing alpine plants. Tall herbaceous meadows dominate the lowlands (USFWS 2001). The Shumagin Islands (Chernabura) support crowberry, blueberry, lingonberry, and bearberry in mountainous elevations above 305 m (1,000 ft). Grasses and sedges dominate slopes and rocky islands that are devoid of shrubs. Alpine and moist tundra make up the vegetation on Sutwik and Ushagat Islands; crowberry dominates higher elevations, and grasslands are found in well-drained sites. Chirikof Island can be characterized as maritime tundra (USFWS 1987).

3.3.1 Rare Plants

Rare vascular plants may occur at elevations where the GPS stations are proposed and may be encountered by UNAVCO during installation and maintenance of the GPS stations. None of the proposed locations has been specifically surveyed for rare plants. However, the elevation and lack of habitat of Chirikof make it unlikely that any rare plants would be found (Talbot, personal communication, 2007 and AKNHP 2007). Most of the rare plants that could occur are narrow endemic species that are found only at a few clustered sites or are regional endemics that are also known from a few sites in Russia (USFWS 2001).

The following are rare species that could be encountered by UNAVCO (Lipkin and Murray 1997):

- **Aleutian wormwood** (*Artemisia aleutica*) occurs in windswept, gravelly fell fields from elevations of 231 m to 366 m (700 ft to 1,200 ft). It is endemic to Kiska and Rat Islands in the western Aleutian Islands.
- **Aleutian whitlow-grass** (*Draba aleutica*) habitat includes gravely alpine sites and areas in the mountains where soil underlain by frozen ground is slowly moving downhill. It is endemic to the Aleutian and Pribilof Islands in Alaska.
- **Aleutian saxifrage** (*Saxifraga aleutica*) is found on windswept ridges and summits in fine and coarse screes to an elevation of at least 2,000 ft. It is endemic to the central and western Aleutian Islands.

- **Calder's lovage** (*Ligusticum caldera)* is found on limestone in wet to moist sites in rocky habitats in the alpine and subalpine communities.
- **Aleutian Shield Fern** (*Polystichum aleuticum*) is listed as endangered under the Endangered Species Act and is discussed in Section 3.4.

3.4 Threatened and Endangered Species

Several listed terrestrial and marine threatened or endangered species are found in Alaska. Nine of these species inhabit the AMNWR including Steller sea lion, northern sea otter, short-tailed albatross, Steller's eider, three species of whales, and the Aleutian shield fern. These species are described in the sections below.

3.4.1 Steller sea lion

The Stellar sea lion (*Eumetopias jubatus*) was listed as endangered (62 FR 86) under the Endangered Species Act in response to declines of nearly 70 percent of the population in the Gulf of Alaska and the Aleutian Islands. Table 1 of 50 CFR 223.202 lists federally-protected Steller sea lion rookeries in Alaska. Federally-protected rookies are on Chernabura and Chirikof Islands. Figures 14 to 17 show the sea lion sites (rookies and haul outs) in relation to the proposed UNAVCO sites.

3.4.2 Northern sea otter

The Northern sea otter (*Enhudra lutris kenyoni*) is one of the smallest marine mammals in the world. Since the mid-1980s, the Northern sea otter population has declined by 55 percent to 67 percent. It was listed as a threatened species in 2005 (50 CFR Part 17). Sea otters generally occur in shallow water areas of less than 100 m (328 ft) in depth. These areas are generally located within 1–2 kilometers (0.62–1.24 miles) from shore. The Northern sea otter has historically been found throughout the Aleutian Islands (USFWS 2001), however, the southwest Alaska distinct population segment has declined by over 50 percent, from an estimated 94,050–128,650 otters in the mid-1970s, to approximately 41,685 at present. The population around the Shumagins has declined approximately 33 percent while the population near Sutwik Island has declined nearly 68 percent (USFWS 2006a).

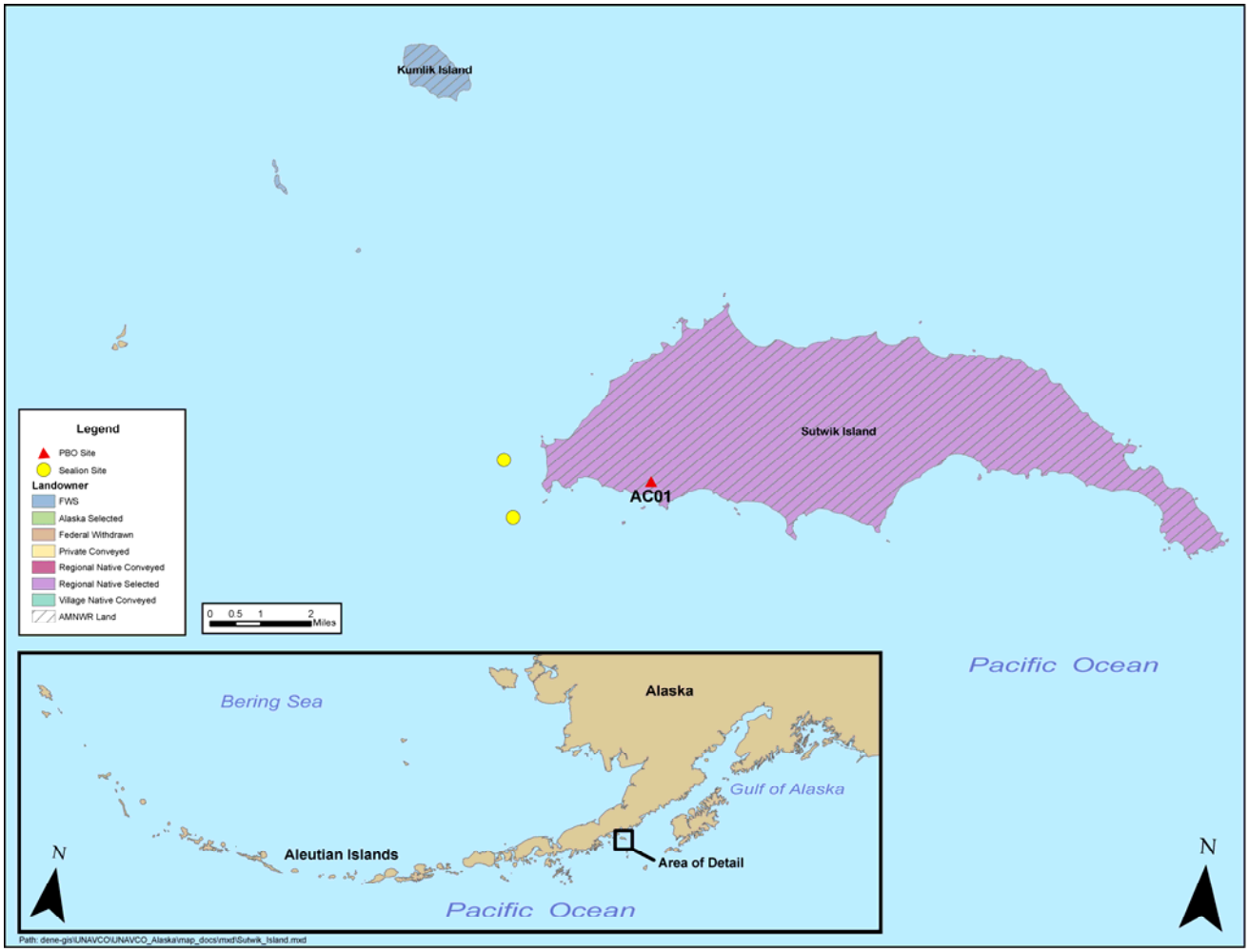

Figure 14: Proposed location of GPS station AC01 on Sutwik Island in relation to sea lion sites and native selections

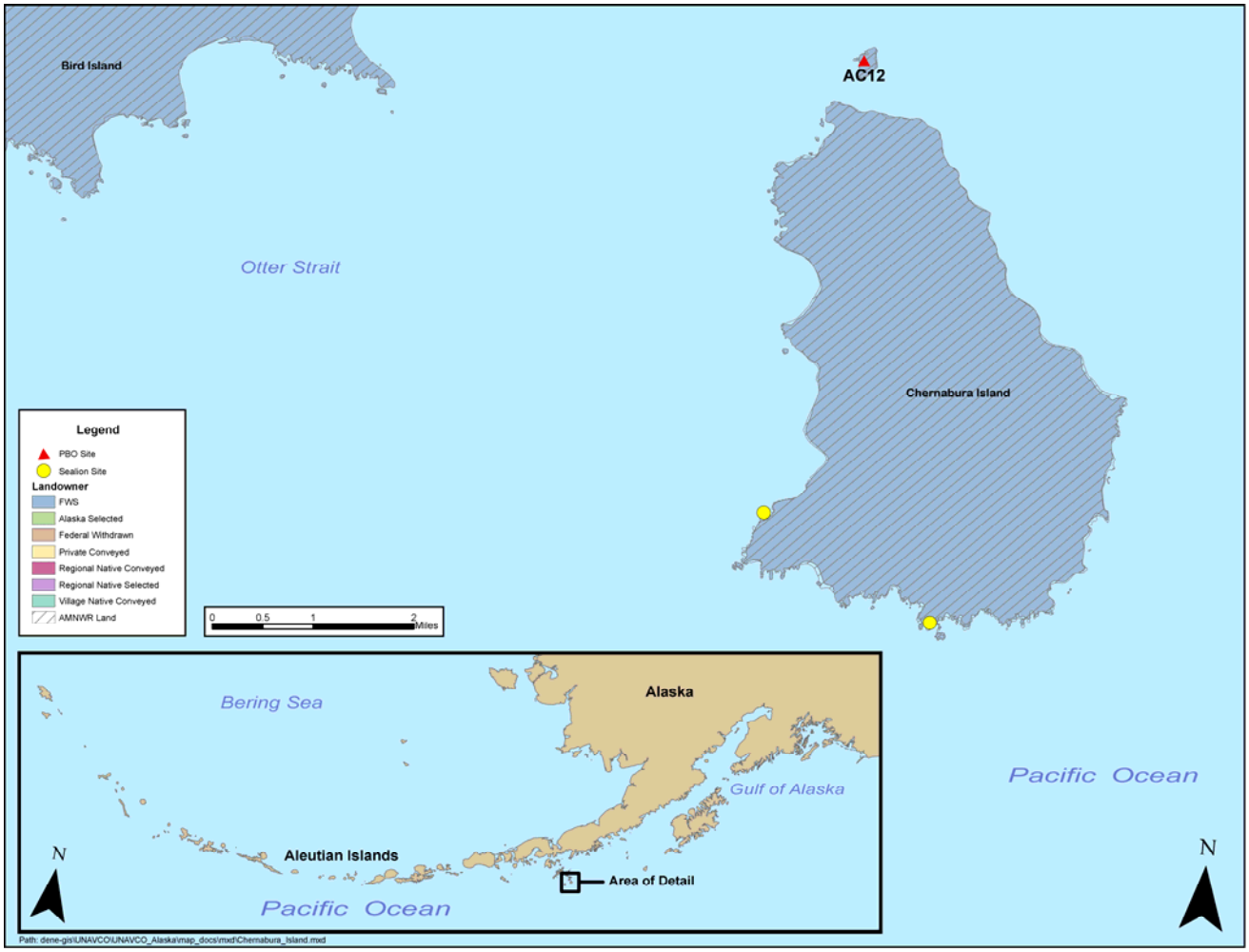

Figure 15: Proposed location of GPS station AC12 on Chernabura Island in relation to sea lion sites and native selections

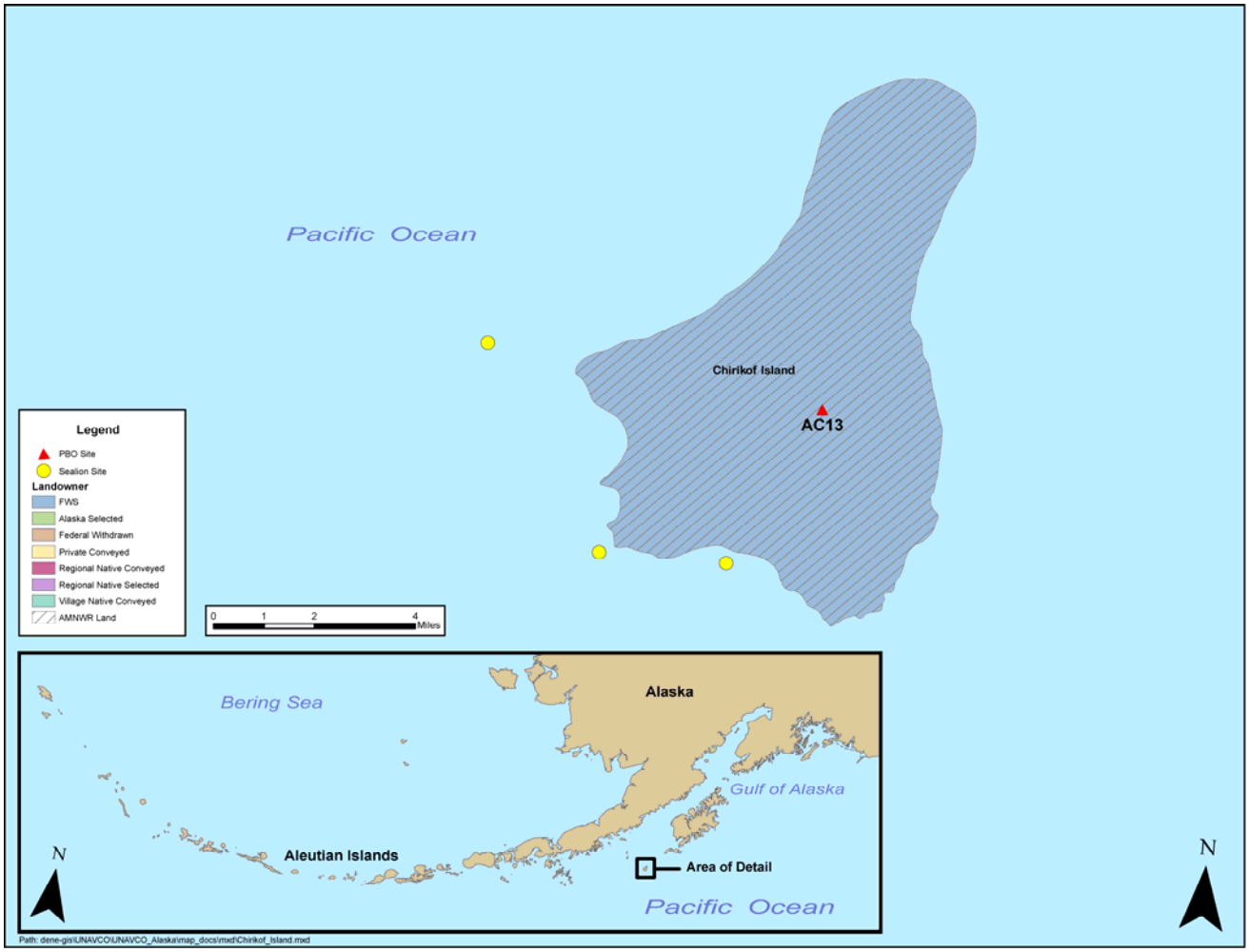

Figure 16: Proposed location of GPS station AC13 on Chirikof Island in relation to sea lion sites and native selections

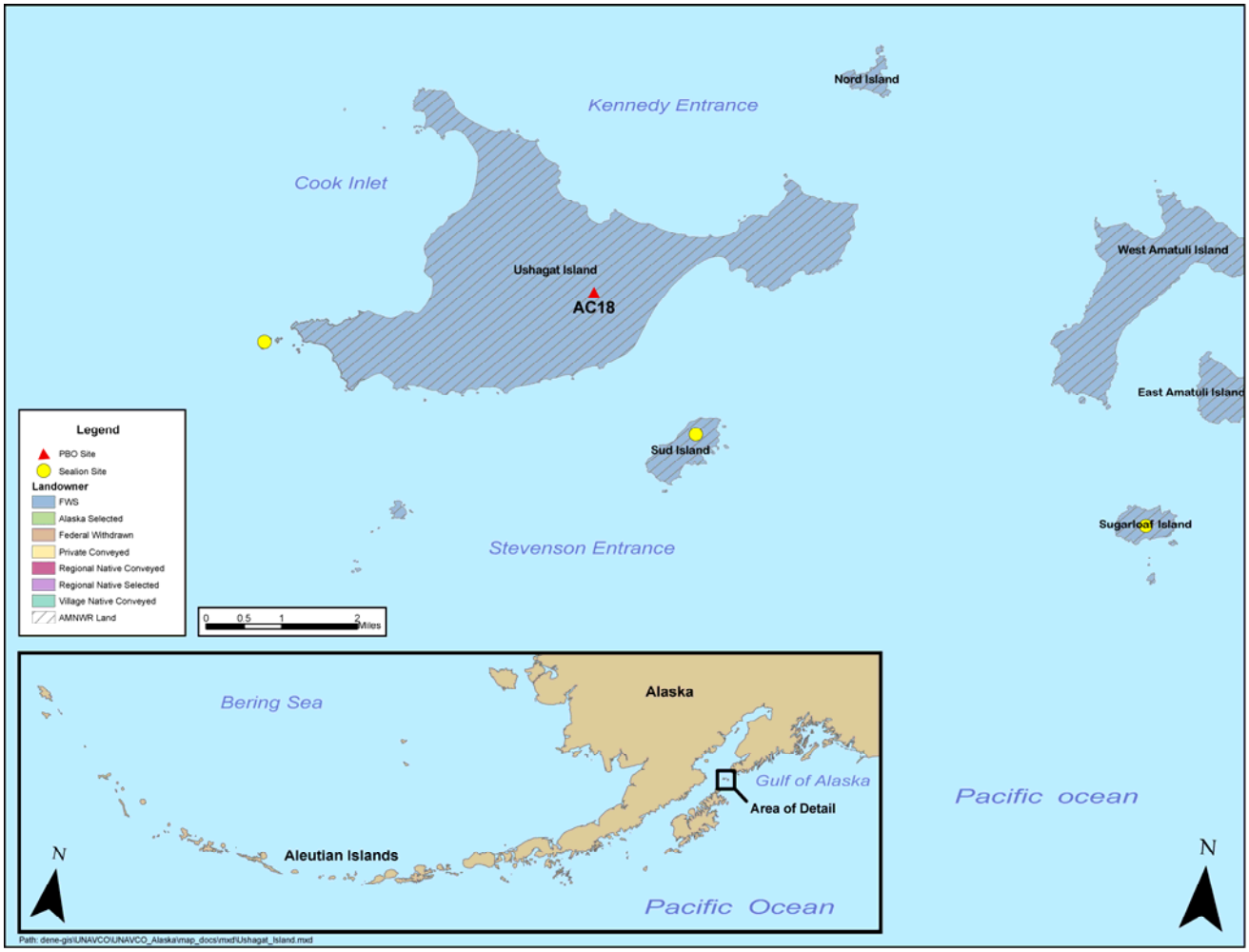

Figure 17: Proposed location of GPS station AC18 on Ushagat Island in relation to sea lion sites and native selections

3.4.3 Short-tailed albatross

The short-tailed albatross (*Phoebastria albatrus*) was listed as endangered throughout its range on July 31, 2000 (65 FR 147). It is a large pelagic seabird that visits land only during nesting and chick rearing. It nests in Japan, but is a regular visitor to Aleutian waters during the summer nonbreeding season. After fledging, juveniles and adults spend the summer at feeding grounds across the north Pacific Ocean. Most summer sightings are in the Aleutian Islands, Bering Sea, or Gulf of Alaska. However, the albatross is not known to occur on any of the islands on AMNWR (USFWS 2001 and USFWS, not dated b).

3.4.4 Steller's eider

The Steller's eider (*Polysticta stellen*) is the smallest of four eider species. It nests on land, but spends a majority of the year in shallow near-shore marine waters. It nests on tundra adjacent to small ponds or within drained lake basins, primarily on the Arctic Coastal Plain with a very small subpopulation remaining on the Yukon-Kuskokwim Delta. After breeding, Steller's eiders move to marine waters where they molt between July and late October. After molting, many Steller's eiders disperse and winter in the Aleutian Islands, on the south side of the Alaska Peninsula, on Kodiak Island, and as far east as Cook Inlet (USFWS 2002). The Steller's eider was listed as threatened on June 11, 1997 (62 FR 112).

3.4.5 Cetaceans

Several species of endangered whales occur in waters off the Aleutian Islands. The humpback whale (*Megaptera novaeangliae*) may occur seasonally and has been documented in near-shore waters. Fin (*Balaenoptera borealis*), blue (*Balaenoptera musculus*) and right (*Balaena glacialis*) whales have been sighted in the northern Gulf of Alaska and the southern Bering Sea (USFWS 2001).

3.4.6 Aleutian Shield Fern

The Aleutian shield fern (*Polystichum aleuticum*) is a narrow endemic species known to exist only on Adak Island. A population was collected on Atka Island in 1932, but has not been observed since the collection. It was listed as endangered on February 17, 1988 (53 FR 462) (USFWS 1992). The habitat for the fern is characterized as cliffs and rock outcrops on east facing volcanic slopes at elevations of 366 m to 526 m (1,200 ft to 1,725 ft). It is found in protected gullies, grottos, and on ledges, and is commonly associated with longawn sedge (*Carex macrochaeta), least willow (Salix rotundifolia)*, narcissus anemone *(Anemone narcissiflora),* and *Arnica unalaschensis* (Lipkin and Murray 1997).

3.4.7 Kittlitz's murrelet

The Kittlitz's murrelet (*Brachyramphus brevirostris*) was designated as a candidate species on May 4, 2004 (69 FR 100). The murrelet is a small diving bird related to puffins, murres, and auklets that migrates between winter offshore and summer inshore regions of Alaska waters. In

the winter, the small seabirds appear to scatter in mid-shelf waters offshore, and occasionally near shore in a few locations in south coastal Alaska. In the summer, the main breeding locations for the Kittlitz's murrelet are rugged mountains near glaciers or in previously glaciated areas in the lower Kenai Peninsula, Prince William Sound, Glacier Bay, and Southeast Alaska (Kuletz 2004). Breeding range and winter range habitats have been identified on Ushagat and Sutwik, respectively (AKNHP 2007). The murrelet is a solitary nester, laying a single egg at the base of large rocks on a steep slope. It relies on camouflage to avoid predation (Kuletz 2004).

3.5 Hazardous Waste/Solid Waste Generation

No known hazardous waste or solid waste materials are known to be present near the proposed GPS stations.

3.6 Cultural Resources

No cultural resources are known to exist near the proposed GPS stations. Due to the location of the proposed GPS stations–away from coastal or inland water–and the high elevations of the proposed GPS stations, it is unlikely that there are cultural resources near the proposed GPS stations. The locations of known cultural resource sites are near coast areas. USFWS requested and received concurrence from the State Historic Preservation Officer (SHPO) that it is unlikely for cultural resources to be present near the proposed GPS stations, and that there would be No Historic Properties Affected by the GPS stations (see Section 4.4.1 and Section 5.1.2) (Corbett 2007). A summary description of cultural resources on the islands proposed for the GPS stations is provided in Table 4.

Table 4: Known cultural resources near the proposed GPS stations

Proposed	Site Location	Description of Cultural Resources
AC01	Sutwik Island	Coastal sites are known to exist on Sutwik, but a dedicated survey of the island has not been conducted.
AC12	Chernabura Island	Shumagin Islands were intensively surveyed by L. Lewis Johnson in the 1980s. A site is located on the main part of Chernabura directly south of the islet proposed for the seismic station. A site was found on the coast of the islet.
AC13	Chirikof Island	This island was surveyed in the 1960s and again in 2005. Of 39 known sites, six have been lost to erosion. All of the sites are on or very near the coast.
AC18	Ushagat Island	Ushagat Island was surveyed following Exxon Valdez oil spill. Five coastal sites were identified.

3.7 Human Life Safety

A limited number of existing seismic and volcanic monitoring stations are located in Alaska. These research devices provide information to land managers and communities that can be used to develop emergency hazard plans. The Aleutian trench, south of the Alaska Peninsula and along the Aleutian Islands has not been well studied for geophysical processes and relatively little information is available.

Chapter 4: ENVIRONMENTAL CONSEQUENCES

This Section describes the probable impacts of each alternative on the resources identified in Section 3.0. A comparison of the likely environmental impacts between the alternatives is summarized below.

4.1 Wildlife

4.1.1 Alternative 1: Proposed Action (Issue Right-of-Way Permit to Install Four GPS Stations)

Impacts to wildlife would be minimal. The proposed GPS stations would be installed at elevations that receive little use by wildlife. All of the sites are located in upland barren alpine areas away from coastal areas, important wildlife habitat, and migration corridors.

4.1.1.1 *Birds*

Noise has the greatest impact on seabirds. Noise would be generated during helicopter overflights for installation and maintenance of the GPS stations. Noise is particularly disruptive during the nesting season. Adult birds could temporarily vacate their nests, which could dislodge eggs or young from cliff edges or expose eggs or young to inclement weather or predators. Losses are typically greater in ledge nesting species.

Impacts would be minimized or eliminated by restricting flights between May 15th and September 15th. When the flights cannot be restricted seasonally, a no-fly zone within one-half mile from seabird colonies would be enforced. UNAVCO would coordinate with USFWS on intended installation times, locations of seabird colonies, and flight paths. USFWS would advise UNAVCO of the locations of noise-sensitive areas to be avoided. These restrictions would comply with Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds.

4.1.1.2 *Marine mammals*

The proposed GPS stations would have no direct impacts on marine mammals because the GPS stations are located in upland areas. The populations may be temporarily disturbed by helicopter noise, but helicopter flight paths on each island would avoid concentrations of haul outs and rookeries. As specified in 50 CFR 223.202, rookeries would not be approached on land within one-half statutory mile or within sight of a rookery. Boats used to bring equipment near the islands would not approach within three nautical miles of a rookery site listed in the CFR. Noise will be minimized by requiring helicopter flights to maintain a minimum altitude of 610 m (2,000 ft), as detailed in the Federal Aviation Administration (FAA) Advisory Circular 91-36C, “Visual Flight Rules (VFR) Flight Near Noise-Sensitive Areas” and described in Section 2.2.3.

4.1.1.3 *Terrestrial mammals*

Small terrestrial mammals might be temporarily disturbed during station construction but would return to the area following installation, which typically lasts two to five days. A small amount of habitat would be disturbed (up to 525 m^2 or 5,655 ft^2 or 0.1 ac) per GPS station during construction. However, the long-term value of the habitat would not be substantially diminished because the small mammals would still be able to use the area around the proposed GPS stations. Because of the cattle on Chirikof the GPS station on this island will be fenced to protect the monitoring equipment. The fence type will be determined in cooperation with USFWS prior to installation.

4.1.2 Alternative 2: No-Action

Because GPS stations would not be installed on AMNWR, no impacts on wildlife would result from the No-Action Alternative.

4.2 Vegetation Impacts

4.2.1 Alternative 1: Proposed Action (Issue Right-of-Way Permit to Install Four GPS Stations)

Minimal impacts to the vegetative cover would result from the GPS stations because the stations are primarily on bedrock with mosses, lichens, and low-growing alpine vegetation present. The proposed locations on Chernabura and Sutwik Islands have the most-dense vegetative cover. Where the vegetative mat is thin, the impact would be greater than in areas of dense vascular plants or grass cover because natural revegetation would be slow. For each GPS station, the maximum construction area would be 525 m^2 (5,655 ft^2 or 0.1 ac). The construction area could be half that amount where the GPS monument and equipment enclosure can be placed less than 0.09 m (30 ft) apart. The total construction impact would be up to 2,100 m^2 (22,6220 ft^2 or 0.4 ac). The long-term impact of the GPS stations from removal of vegetation for GPS station components would be 6 m^2 (64 ft^2 or 0.001 ac) for each GPS station or 24 m^2 (256 ft^2 or 0.004 ac) total. This total is negligible when compared to the 1.98 ha (4.9 million ac) of the AMNWR.

4.2.2 Alternative 2: No-Action

Because GPS stations would not be installed on AMNWR, no impact on vegetation would result from the No-Action Alternative.

4.3 Threatened and Endangered Species

4.3.1 Alternative 1: Proposed Action (Issue Right-of-Way Permit to Install Four GPS Stations)

As noted in Section 3.4, nine endangered species use the AMNWR. The Steller sea lion and the whales are under the jurisdiction of the National Marine Fisheries Service (NMFS).[2] The northern sea otter, short-tailed albatross, Steller's eider, and Aleutian shield fern are under the jurisdiction of the USFWS. See Section 5 for more information on the consultations with these agencies.

4.3.1.1 *Marine Threatened and Endangered Species*

Steller sea lion

Steller sea lion sites are located on Chernabura and Chirikof as shown on Figures 15 and 16. Federally protected rookeries are located on Chernabura and Chirikof. The sea lion sites (haul outs or rookeries) on Chirikof are along the southwest coastline, but the GPS station would be located upland near the center the island. The sea lion sites on Chernabura are located on the southwest coast line, whereas the GPS station would be located on the islet north of the island mainland.

The GPS stations would have no direct impacts to any of the sea lion sites. As discussed in Section 2.2.3, rookeries would not be approached on land within one-half statutory mile or within sight of a rookery. Boats used to bring equipment near the islands would not approach within three nautical miles of a rookery site listed in the CFR. Alternative 1 would have "No Effect" on Steller sea lions. The NMFS concurred with this effect determination on June 8, 2006 (Capron, e-mail communication, 2006).

Cetaceans

Although several species of endangered whales occur in waters off the Aleutian Islands, the installation of a GPS station on Sutwik, Chernabura, Chirikof, and Ushagat Islands would have "No Effect" on the whales because no impact would occur to waters surrounding the islands. NMFS concurred with this effect determination through informal consultation on June 8, 2006 (Capron, e-mail communication, 2006).

4.3.1.2 *Terrestrial Threatened and Endangered Species*

Northern sea otter

The northern sea otter utilizes the shallow coastal areas of the Aleutian Islands and Alaska Peninsula. The GPS stations would have no direct impact to the coastal areas of Sutwik, Chernabura, Chirikof, or Ushagat. The otters may be disturbed by helicopter noise during

[2] Under the Endangered Species Act of 1973, as amended, the NMFS is responsible for listed anadromous and marine fishes and marine mammals other than sea otters, manatees, and dugongs.

installation and maintenance overflights. Helicopters would fly over the coastal areas as discussed in Section 2.2.3, however, overflights would be as high above the coast line (at least 610 m [2,000 ft] above ground level) as possible to minimize noise impacts. Installing the GPS stations is "Not Likely to Adversely Effect" the northern sea otter. The Endangered Species Office of the USFWS concurred with this effect determination through informal consultation on June 26, 2007 (Balogh, written communication, 2007).

Short-tailed albatross

The short-tailed albatross spends its life in open water except to nest. The only known nesting colonies are in Japan and Taiwan. Some sightings have been made around the Aleutian Islands where the albatrosses forage the open water around the islands (USFWS 2006b). Installing the GPS stations would not disrupt foraging and is "Not Likely to Adversely Effect" the short-tailed albatross. The Endangered Species Office of the USFWS concurred with this effect determination through informal consultation on June 26, 2007 (Balogh, written communication, 2007).

Steller's eider

The Steller's eider nests on land, but spends a majority of the year in shallow near-shore marine waters and uses the Aleutian Islands for wintering. Sutwik, Chernabura, Chirikof, and Ushagat are outside of the critical molting, molting/wintering, and nesting habitat for the eider (USFWS 2007). Near-shore marine waters would not be directly impacted because the GPS stations would be installed on the island interiors. Helicopter overflights of the shorelines would be as high above the coastline as possible (at least 610 m [2,000 ft] above ground level). Due to the location of the stations away from near-shore marine waters and out of critical habitat, the Project is "Not Likely to Adversely Effect" the Steller's eider. The Endangered Species Office of the USFWS concurred with this effect determination through informal consultation on June 26, 2007 (Balogh, written communication, 2007).

Aleutian Shield Fern

The Aleutian shield fern is known to exist on Adak Island and possibly on Atka Island. The fern is not believed to exist on Sutwik, Chernabura, Chirikof, nor Ushagat where the GPS stations are proposed (Talbot, personal communication, 2007). The Project is "Not Likely to Adversely Effect" the Aleutian shield fern. The Endangered Species Office of the USFWS concurred with this effect determination through informal consultation on June 26, 2007 (Balogh, written communication, 2007).

Kittlitz's murrelet

The Kittlitz's murrelet migrates between the winter offshore and summer inshore regions of Alaska's waters. Although habitat may be present on some of the islands where the GPS stations are proposed, USFWS has no evidence that Kittlitz's murrelets nest in these locations. Helicopter

overflights of the shorelines would be as high above the coastline as possible (at least 610 m [2,000 ft] above ground level). Due to the location of the stations away from near-shore marine waters and out of ideal nesting habitat, the Project is "Not Likely to Adversely Effect" the Kittlitz's murrelet. The Endangered Species Branch of the USFWS concurred with this effect determination on June 26, 2007 (Balogh, written communication, 2007).

4.3.2 Alternative 2: No-Action

Because GPS stations would not be installed on AMNWR, no impact on threatened and endangered species would result from the No-Action Alternative.

4.4 Cultural Resources

4.4.1 Alternative 1: Proposed Action (Issue Right-of-Way Permit to Install Four GPS Stations)

No new impacts would be expected to cultural resources because of the remote locations and high elevations of the proposed GPS stations.

On March 20, 2007, USFWS requested concurrence from State Historic Preservation Officer (SHPO) that there would be No Historic Properties Affected by the GPS stations. SHPO concurred with the finding by not responding within 30 days in compliance with 36 CFR 800.4.

If any archeological resources are discovered during installation of any of the proposed GPS stations, the construction would be halted and the USFWS archaeologist would be notified as soon as practicable. No further action would take place until the USFWS consults with the SHPO and affected Native communities, and gives clearance to proceed.

4.4.2 Alternative 2: No-Action

Because GPS stations would not be installed in AMNWR, no impact to cultural resources would result from the No-Action Alternative.

4.5 Hazardous Waste/Solid Waste Generation

4.5.1 Alternative 1: Proposed Action (Issue Right-of-Way Permit to Install Four GPS Stations)

Solid waste (cuttings) generated during the installation process would be collected in containers and removed from the sites. Potential for solid wastes to be left on the islands, such as batteries, equipment housings, construction materials, and supplies used during equipment installations exists. The potential is very small and any materials left during construction would be removed in subsequent maintenance visits. The old batteries would be removed and recycled when replacement occurs. Used batteries would not be stockpiled at any of the GPS sites. The batteries used to power the instruments are gel cell types with no risk of spillage.

No hazardous materials would be produced at the proposed GPS station sites. During installation of the Chirikof GPS station and seismometer, four over-pack fuel drums containing helicopter fuel would be stored at the GPS site. The helicopter would be re-fueled at the GPS station location. During refueling, a square tub would be placed under the over-pack drum and under the helicopter where the hose connected to the fuel opening of the helicopter. Fuel absorbent rags/pad would be available to catch any fuel leaked during the connection process. Extra care would be taken to ensure good fitting hose connections. A spill response kit will be kept on site.

4.5.2 Alternative 2: No-Action

Because GPS stations would not be installed in AMNWR, no hazardous material impacts would result from the No-Action Alternative.

4.6 Human Life Safety

4.6.1 Alternative 1: Proposed Action (Issue Right-of-Way Permit to Install Four New Seismic Stations)

The GPS stations would provide an improved level of monitoring and understanding of geohazards. Several of the largest earthquakes in the world have occurred in the Aleutian subduction zone. The Aleutian Arc does not have adequate equipment to monitor movement along the North American and Pacific plates. Installing the GPS stations would provide the opportunity to gather data to understand earthquakes and the seismic hazards they pose (Wyss and others, 2000). Improving hazard forecasting and public warning systems would be consistent with USFWS management priorities to protect human life and property.

4.6.2 Alternative 2: No-Action

The existing AVO seismic station array would continue to provide monitoring and geohazards information associated with volcanic activity. GPS stations would not be placed along the seismically active Aleutian trench. Less information related to geohazards such as earthquakes and tsunamis would be available.

4.7 Cumulative Impacts

This section addresses the potential cumulative impacts from installing GPS stations on Sutwik, Chernabura, Chirikof, and Ushagat. The cumulative impacts analysis looks at past, present and reasonably foreseeable actions on the four islands proposed for GPS stations and, as necessary, to AMNWR. A cumulative impact can result from either (1) the combination of two or more individually significant impacts, or (2) the combination of two or more impacts that are individually less than significant, but constitute a significant change in the environment when considered together over a period of time. Cumulative impacts include the direct and indirect effects of proposed projects/actions that result from incremental impacts of the Proposed Action (or Alternatives) added to the impacts of other past, present, and reasonably foreseeable

projects/actions, regardless of what agency or person undertakes such projects or actions (40 CFR 1508.7).

The AMNWR was established to conserve marine mammals, seabirds, and other migratory birds, and the marine resources upon which they rely, thus any future projects or management actions at AMNWR would continue to support or be compatible with wildlife uses. Present projects and management actions support, or are compatible with, these wildlife uses. Some of the current USFWS projects include protection of wildlife resources and eradication of introduced species. Additionally, other geophysical monitoring stations (such as AVO) as described in Section 1.4 have been installed on some refuge islands.

Prior to their inclusion in the AMNWR in 1980 with passage of the Alaska National Interest Lands Conservation Act (ANILCA), Chernabura and Chirikof had radio beacons and weather stations to aid in naval navigation during WWII or other military activities. These sites were decommissioned after World War II and have deteriorated over time. Also prior to inclusion of these islands in the refuge, populations of foxes and cattle were introduced on some islands for economic production of the species as noted in Section 3.2 (Transano 1994 and USFWS 2007b).

The Proposed Action will result in minor physical impacts to the station sites to be located on these islands, but do not constitute a significant cumulative impact. As described in Section 4, none of the proposed stations would individually have significant impacts during construction, operation, or maintenance. Potential impacts at each site would be low in severity and minor in extent due to (1) siting criteria, (2) the small area of disturbance at each site, and (3) flight restrictions imposed during construction and maintenance. Maintenance would occur on a rotating three-year schedule to further limit impacts. Ground disturbance during construction would cause very small, temporary direct impact to vegetation.

Cumulative, long-term disturbance and displacement impacts from these four stations would be negligible. Installation of all four proposed stations would temporarily disturb up to 2,100 m^2 (22,620 ft^2 or 0.4 ac). Completed stations will result in about a 34 m^2 (256 ft^2 or 0.004 ac) footprint in total. When added to past and reasonably foreseeable refuge projects, the effects of these stations do not contribute to any negative impacts on wildlife, vegetation, or threatened and endangered species on land administered by the AMNWR. The four stations may be visible to recreational users, aircraft overhead, or boat traffic in the vicinity. These stations would be painted to blend with the surrounding landscape to limit the overall visual impact.

The GPS stations would have a positive impact by contributing to the understanding of the Earth's processes, geological events, and geohazards. Coupled with other earthquake and volcanic monitoring activity in Alaska and throughout the western United States, the information gained from the GPS stations could be used to protect human life through improved emergency preparedness plans.

The No-Action Alternative would preclude the siting of GPS stations on the AMNWR. Because of the location of the Aleutian trench, these islands are the only land areas where the GPS stations

could provide information about movement along the Aleutian subduction zone. Not allowing the GPS stations would substantially limit the effectiveness of the PBO network and reduce the amount of knowledge of the seismic activity in Alaska, an area with some of the largest earthquakes in the world.

Chapter 5: CONSULTATION AND COORDINATION

5.1 Persons, Groups or Agencies Consulted

5.1.1 Native American Consultation

There are no known archeological sites or sites of Native American Religious concern within the areas identified for placement of the GPS stations.

The high elevations and locations away from the coast or inland waters make it unlikely that cultural resources would be disturbed. Koniag, Incorporated, a Regional Native Corporation with cemetery and historical place selections and conveyances on Sutwik Island, was consulted and provided comments. The proposed GPS site on Sutwik Island is not near their cultural resources of concern.

5.1.2 Agency Consultation

The following agencies were contacted regarding resources under their jurisdiction:

- State Historic Preservation Officer
- National Marine Fisheries Service
- U.S. Fish and Wildlife Service

On March 20, 2007, USFWS submitted information about the location and configurations of the proposed GPS stations to SHPO. USFWS asked for SHPO concurrence that there are "No Historic Properties Affected" by the GPS stations. In compliance with 36 CFR § 800.4, SHPO concurred with the finding by not responding within 30 days.

Shane Capron at NMFS was contacted about threatened and endangered marine species. On June 8, 2006, NMFS indicated that the GPS stations would have "No Effect" on marine species if boats are not landed near and helicopters do not overfly sea lion sites (rookeries and haul outs). NMFS noted that helicopters should stay as high as possible when flying over the shoreline (Capron, e-mail communication, 2006).

Greg Balogh at the Endangered Species Office of the USFWS was contacted about threatened and endangered terrestrial species. On June 26, 2007, USFWS indicated that the GPS stations are "Not Likely to Adversely Affect" the northern sea otter, short-tailed albatross, Steller's eider, Aleutian shield fern, or the Kittlitz's murrelets (Balogh, written communication, 2007).

AMNWR staff and staff from the USFWS Regional Office, Region 7 staff were contacted about specific resources and issues including:

- John Brewer, Chief Cartographer
- Helen Clough, Chief, Division of Conservation Planning Policy
- Debbie Corbett, Archaeologist

- Susan LaKomski, Realty Specialist
- Heather Renner, Wildlife Biologist AMNWR
- Susan Schulmeister, Wildlife Refuge Specialist AMNWR
- Steve Talbot, Regional Refuge Botanist

5.1.3 Public Consultation

USFWS provided the opportunity for known interested parties to participate. The Koniag Corporation was contacted because of land conveyance and selections on Sutwik. The Koniag Corporation responded that they had no objections to the Project if their lands were avoided (Reft, written communication, 2006).

The Public Notice of the EA and the draft Refuge Compatibility Determination will be posted on the U.S. Fish and Wildlife Service - Alaska, Conservation Planning and Policy Web site for public review. Additional notices will be sent to the Conservation Planning and Policy mailing list appropriate to the project area, and to Native corporations, local governments, and newspapers in the Homer, Kodiak, and Alaska Peninsula areas.

5.2 List of Preparers

5.2.1 Preparers

This EA was prepared for USFWS by:

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- Dan Miller, Project Management, Quality Assurance
- Kristine MacKinnon, Author
- Laura Lutz-Zimmerman, Author
- Terri Morrell, Quality Assurance

5.2.2 USFWS Reviewers

The following persons oversaw preparation of this EA:

- John Brewer, Chief, Mapping Science Branch
- Helen Clough, Chief, Division of Conservation Planning Policy
- Arthur Kettle, Wildlife Biologist AMNWR
- Susan LaKomski, Realty Specialist, Division of Realty and Natural Resources
- Will Meeks, Deputy Refuge Manager AMNWR
- Heather Renner, Wildlife Biologist AMNWR
- Susan Schulmeister, Wildlife Refuge Specialist AMNWR

- Gregory Siekaniec, Refuge Manager AMNWR
- Cyndie Wolf, Wildlife Biologist/LCP Planner, Division of Conservation Planning and Policy

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Chapter 6: LIST OF ACRONYMS AND ABREVIATIONS USED IN THIS EA

ac	acres
AEIC	Alaska Earthquake Information Center
AKNHP	Alaska National Heritage Program
ADNR	Alaska Department of Natural Resources Office of Project Management and Permitting
AMNWR	Alaska Maritime National Wildlife Refuge
ANILCA	Alaska National Interest Conservation Act
AVO	Alaska Volcano Observatory
BLM	Bureau of Land Management
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cm	centimeter
EA	Environmental Assessment
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
FONSI	finding of no significant impact
ft	foot
ft^2	square feet
FR	Federal Register
GPS	global positioning system
ha	hectares
in.	inch
M	magnitude
m	meter
m^2	square meters
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic Atmospheric Administration

PBO	Plate Boundary Observatory
Project	The Proposed Action
the Refuge	Alaska Maritime National Wildlife Refuge
RTK	real time kinematic
SDBM	short drill-braced monument
SHPO	State Historic Preservation Officer
UNAVCO	University NAVSTAR Consortium
USFWS	United States Fish and Wildlife Service
VFR	visual flight rules
VSAT	very small aperture terminal

Chapter 7: REFERENCES

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APPENDIX A: Consistency with the Alaska Coastal Management Program

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Negative Determination For
Installation and Maintenance of the UNAVCO GPS Stations
Sutwik, Chernabura, Chirikof, and Ushagat Islands
Alaska Maritime National Wildlife Refuge

USFWS is considering authorization of the UNAVCO Plate Boundary Observatory (PBO) on the Alaska Maritime National Wildlife Refuge (AMNWR). Four sites would be installed as described in Table 1 and the Environmental Assessment (EA) - *Plate Boundary Observatory Global Positioning System Network Installation and Maintenance on the Alaska Maritime National Wildlife Refuge*. The GPS stations would be installed by helicopter in fall of 2008.

Table 1. Proposed GPS Stations in Alaska National Maritime Wildlife Refuge

Site	Latitude*	Longitude	Legal Description	Name
AC01	56.53299 N	157.27263 W	Alaska, Seward Meridian T42S, R51W, Section 24	Sutwik Island
AC12	54.83094 N	159.58961 W	Alaska, Seward Meridian T62S, R68W, Section 7	Chernabura
AC13	55.82179 N	155.61838 W	Alaska, Seward Meridian T50S, R41W	Chirikof Island
AC18	58.92581 N	152.24921 W	Alaska, Seward Meridian T14S, R18W, Section 35	Ushagat Island

***Latitude and Longitude Coordinates are in WGS 84**

A detailed project description for the GPS monument installation and maintenance on AMNWR is provided in the attached environmental assessment. The EA is also available on USFWS – Alaska, Conservation Planning and Policy web site for public review and comments (http://alaska.fws.gov/nwr/planning/compatibility/akmar_UNAVCO_EA.pdf).

The ACMP "Coastal Zone Boundaries of Alaska (Map #59, 70, 74, 75, and 76) shows lands and waters in the project area fall within the coastal zone of the state of Alaska, Kodiak Island Borough, Lake and Peninsula Borough, and Aleutians East Borough. None of these boroughs have an approved Coastal Management Plan (CMP). The previous plans expired on September 1, 2007. The project is located on the AMNWR, administered by the USFWS, and by definition is outside the coastal zone.

The following section details the USFWS analysis by which it was determined that the Project would not affect any coastal use or resource. In determining effects, USFWS followed 15 CFR 930.33(a)(1) and has included an evaluation of the relevant enforceable policies of the ACMP (11 ACC 112). State standards analyzed include: coastal

development; coastal access; subsistence; transportation routes and facilities; habitats; air, land, and water quality; and historic, prehistoric, and archaeological resources. The project facilities would be located on lands under federal jurisdiction, which are outside the coastal zone.

As documented in the EA, there would be negligible to minor environmental impacts which would not extend beyond the AMNWR boundary.

Alaska Coastal Management Program Relevant Policies:

11 AAC 112.200. Coastal development.
Analysis: The installation of the GPS stations to measure earthquake and volcanic activity would result in no new impacts on the ground, expect for negligible, short-term disturbance to vegetation and wildlife during installations and maintenance. These stations are part of a larger geodetic network that measures the volcanic and tectonic structure of the Earth's crust across the western United States and Alaska. Prominent volcanic and tectonic features in Alaska occur along the Aleutian subduction zone and many of the largest earthquakes in Alaska have occurred in this zone. This zone is located along the coastal areas of Aleutian Islands and Alaskan Peninsula. Because strain occurring in this zone can manifest itself at the Earth's surface 10s or 100s of miles away, it is necessary to observe this zone. This project is physically dependent on a coastal location because the location of the Aleutian subduction zone. While the stations are located on the island interiors, the islands are within designated coastal boundary areas. Installation and maintenance would occur on federal refuge land and would have not effect on coastal development uses or resources.

11 AAC 112.220. Coastal access.
Analysis: Public access to, from, and along coastal water will not be affected by the proposed project. The proposed sites will be accessed via helicopter during construction and periodic maintenance visits. Maintenance visits would occur every three years. The GPS stations could improve GPS locations and navigation for mariners, aviators, and the general public with access to the real-time GPS data.

11 AAC 112.270. Subsistence.
Analysis: The GPS stations would be installed on uninhabited islands; all would be located more than 30 miles from the nearest community. The GPS stations would be situated primarily inland on rocky outcrops. There may be disturbance to a small amount of vegetation, but typically the stations are installed in gravelly or rocky alpine areas with sparse vegetation not utilized by concentrations of wildlife, especially the coastal species desired by subsistence users. There would be no reasonably foreseeable adverse impacts to subsistence uses.

11 AAC 112.280. Transportation routes and facilities.
Analysis: Helicopters would be used for access to the proposed sites. No permanent transportation routes or facilities would be constructed. Therefore, no alterations to surface or ground water drainage patterns would occur. No permanent transportation routes or facilities would be constructed. Helicopter use will be limited between May 15th and September 15th according to the direction of USFWS. The restriction would prevent disruption to seabirds that utilize the islands during this time period. No permanent transportation routes or facilities would be constructed. Helicopter use would not block traditional access.

11 AAC 112.300. Habitats.
Analysis: Installation and maintenance of the GPS stations on AMNWR would affect no more than 320 square feet (0.005 acres) of area over the long term and temporarily up to 28,275 square feet (0.5 acres) during installation. The proposed GPS stations would be located on exposed bedrock on the islands away from surface water bodies and wetlands. The project would not affect waves or marine currents and would avoid flows of sediment into water by being situated away from water bodies. Impacts to coastal species would be avoided by limiting the helicopter use between May 15th and September 15th, by maintaining a 2000 ft altitude during helicopter flights, and by avoiding flights over marine mammal haulouts. No species would be introduced to any of the islands as a result to the proposed project. Affected habitat would be confined to refuge lands and would have no effect on coastal habitat uses or resources.

11 AAC 112.310. Air, land, and water quality.
Analysis: No response is necessary as this standard is incorporated into the statutes and regulations of the Department of Environmental Conservation with respect to the protection of air, land, and water quality.

11 AAC 112.320. Historic, prehistoric, and archeological resources.
Analysis: USFWS has reviewed the proposed sites and determined that the proposed GPS stations would not affect historic or prehistoric resources. The State Historic Preservation Officer (SHPO) concurred with this determination. Should historic properties be discovered during project implementation, work in the discovery area will be stopped and procedures would be followed as described in the regulations in 36 CFR 800.13.

District enforceable policies for the Kodiak Island Borough, Lake and Peninsula Borough, and Aleutians East Borough expired on September 1, 2007 so are not included in the analysis.

Conclusion: USFWS has determined that the proposed Plate Boundary Observatory GPS stations installation and maintenance on AMNWR would have no effect on coastal uses or resources. The negligible to minor impacts associated with the project would be confined to federal lands.

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APPENDIX B: Installation Overview

Step 1: Helicopters deliver materials and equipment used to build GPS monument, equipment enclosure, and solar panel support structure.

Step 2: Using a hand-operated drill, four to five holes are drilled into the rock to a depth of three feet to six feet.

Step 3: Steel rods are cut to appropriate length and inserted into the holes. Rods are held in place with epoxy.

Step 4: The rods are welded together to form a tripod.

Step 5: A GPS antenna is attached to the tripod base. To protect the antenna, a dome cover is installed.

Step 6: An equipment enclosure hut is erected near the GPS monument. The enclosure hut houses GPS, communications, and power equipment.

Step 7: Batteries, communication equipment, and other needed components are stored in the enclosure.

Step 8: The finished site, ready to record and transmit data, is activated.