REPORT OF FINDINGS

ALEUTIAN ISLANDS MILITARY CONTAMINANTS
FISCAL YEARS 1988-1990

ATTU ISLAND
LITTLE KISKA ISLAND
GREAT SITKIN ISLAND (Fox Creek Drainage)
TANAGA ISLAND
SEMISOPOCHNOI ISLAND

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EXECUTIVE SUMMARY

This report presents results and findings of contaminant studies performed at abandoned military installations on the following U.S. Fish and Wildlife Service (Service), Alaska Maritime National Wildlife Refuge (NWR) lands: Attu Island, Tanaga Island, Little Kiska Island, Great Sitkin Island (Fox Creek Drainage), Semisopochnoi Island. Study efforts centered on determining what, if any, contaminants [i.e., organochlorines, polynuclear aromatic hydrocarbons (PAHs), inorganics] from military activities may have entered the surrounding environment. The Service's effort to determine the presence or absence of contaminants at the abandoned facilities is necessary because there is a potential for contaminants to be transferred through the food chain to Service trust resources. Identified in the report are: 1) contaminated sites requiring remediation activities and 2) recommendations for additional study and cleanup for use by the Alaska Maritime NWR manager.

From June 1942, until August 1943, Kiska and Little Kiska Island were occupied by the Japanese. After Allied (American and Canadian) forces invaded and reoccupied the islands in August 1943, they established bases in and around Kiska Harbor. During World War II., Great Sitkin Island was used as a fuel depot for the Navy base on Adak Island. Attu Island was occupied by the Japanese Army from June 7, 1942, to May 30, 1943. The battlefield used to reoccupy the island covers 15 square miles on the eastern side of the island. Presently the U.S. Coast Guard occupies 1800 acres and operates a Loran navigation station. A Naval construction battalion of Seabees was sent to Tanaga in September 1943 to maintain U.S. military presence in the Andreanof Islands Group and to assist the Naval Operating Base at Adak. Other possible operations on Tanaga may have included an Army Aircraft Warning Service and a Naval weather station. The Atomic Energy Commission constructed scientific and weather stations on Semisopochnoi Island to monitor their nuclear tests on Amchitka Island. In 1973, all equipment and structures were removed from the island by Navy helicopter and the occupation site cleaned up.

Each project site is known to contain "petroleum, oil, and lubricant products" (POLs), spills and electrical transformers which may contain polychlorinated biphenyls (PCBs); therefore, more than 530 soil/sediment samples and 31 biological samples were collected and analyzed as part of the study. The 89 soil/sediment and 7 biological sample sites included, but were not limited to, POL spill locations, drum disposal areas, power generating facilities, solid waste dumps, waste storage areas, housing facilities, garages, lakes, catch basins and natural and man-made drainage areas.

Data indicate that the most contaminated island investigated is Attu Island and that its numerous petroleum seeps and spills pose a direct threat to the refuge's aquatic and wildlife resources.

Further consultation with the U.S. Environmental Protection Agency might conclude that Coast Guard personnel stationed on Attu Island and recreate around the island may also be at risk, as high levels of PCBs (9000 ppm) occur on the island. It is important to note that are other areas on Attu Island (e.g. Holtz Bay, Alexai Point/Creek, Upper West Massacre Valley) that have not been inspected for contaminants. Conducting such inspections may discover areas more contaminated than those already identified in this report.

Tanaga Island, with its low-level PCB contamination and petroleum seep is ranked as the second most contaminated site. Of less immediate concern is the contamination in Great Sitkin Island's Fox Creek drainage (not to be confused with Great Sitkin Island's highly contaminated Little Fox Creek drainage; see Crayton, 1990), Little Kiska Island and Semisopochnoi Island, as the number and concentrations of hazardous substances and POL constituents were generally less than those found on Attu and Tanaga islands.

Potential biological receptors (i.e., organisms subject to being contaminated) from soil contamination found on each of the islands include vegetation, birds, small mammals and humans. Service trust resources potentially affected include migratory birds and anadromous fish. Major media or pathways of concern for all the sites are dermal contact with soil, sediment, water, or waste; inhalation of contaminated suspended particles; and ingestion of contaminated soil and waste. The main migration pathway of concern is transport of contaminated surface soils via runoff into nearby stream habitat.

Efforts must be initiated to: 1) fully identify the contaminant release pathways, 2) prevent the migration of contaminants at concentrations that pose a threat to wildlife and other natural resources, and 3) confirm cleanup operations during the remediation process. The responsibility for such efforts lies with the U.S. Army Corps of Engineers (Corps), as the Corps administers the Department of Defense's Defense Environmental Restoration Program (Program) which is designed to identify, evaluate, and cleanup hazardous waste sites on abandoned military bases and restore the areas to their near original state by implementing remedial actions. All the islands have been identified by the Corps as low-priority Program sites.

In conclusion, it is recommended that:

1. appropriate Regional Office, Field Office and Refuge staff meet to develop a strategy to facilitate a timely cleanup of the affected sites. At a minimum, a letter from our Regional Director to Colonel John W. Pierce [U.S. Army Corps of Engineers, Alaska District (Corps)] should be sent informing him of our findings, as the Corps has legislative responsibilities under the Defense Environmental Restoration Program to cleanup abandoned military facilities in Alaska.

2. the U.S. Army Corps of Engineers, under the auspices of the Defense Environmental Restoration Program and in consultation with the U.S. Fish and Wildlife Service, conduct detailed site investigation studies on (in priority) Attu Island, Tanaga Island, Great Sitkin Island (Fox Creek Drainage), Little Kiska Island and Semisopochnoi Island to substantiate Service findings and delineate the full extent of contamination. Attu Island investigations should include Holtz Bay, Alexai Point/Creek and upper West Massacre Valley.

3. the U.S. Army Corps of Engineers U.S. Environmental Protection Agency and Service meet to develop a remediation strategy and identify funding sources, to initiate response actions (institutional, containment, treatment and/or disposal) at the following contaminated sites which pose the greatest and immediate threat to wildlife and natural resources:

Attu:	3, 13, 22, 28, 38, 42, 43, 47, 50, 53, 58, 66, 67 and 68.
Tanaga:	5, 8 and 15.
Great Sitkin: (Fox Creek drainage)	3

4. the U.S. Coast Guard on Attu Island and the U.S. Environmental Protection Agency be informed of our findings about Attu Island's PCB contamination so that measures can be initiated, in concert, to investigate potential problems and if appropriate, minimize the exposure of military personnel.

INTRODUCTION

This investigation was conducted in 1988, 1989 and 1990 at abandoned military facilities on Attu, Tanaga, Little Kiska, Great Sitkin, and Semisopochnoi islands - all are located within the Aleutian Islands Subunit of the Alaska Maritime National Wildlife Refuge (Refuge) (Figure 1). The Principal Investigator was Wayne M. Crayton from the Ecological Services Anchorage field office, who was assisted by Nancy Norvell and other staff from the Refuge. In 1987, the U.S. Fish and Wildlife Service (Service) conducted a similar investigation on abandoned and active military facilities on Kiska, Adak, Agattu, and Great Sitkin islands (Crayton, 1990). Both investigations centered on determining what, if any, contaminants (i.e., organochlorines, polynuclear aromatic hydrocarbons, inorganics) from military activities may have entered the surrounding refuge environment.

Organochlorine compounds are normally associated with polychlorinated biphenyls (PCBs), pesticides, herbicides, insecticides, rodenticides and other biological control agents. Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous in nature but it is the anthropogenic-derived compounds (usually petroleum-related) that pose the greatest environmental threat. Inorganics are comprised of biologically essential (e.g. iron, zinc) and non-essential (e.g. mercury, lead) elements which typically are found in concentrations less than 1 part per million (ppm).

Each project site is known to contain "petroleum, oil, and lubricant products" (POLs) and spills and electrical transformers which may contain PCBs. Extensive leaching of POLs and PCBs into the surrounding environment, depending on their chemical make up and concentration, could pose a threat to fish and wildlife resources.

The Service's effort to determine the presence or absence of contaminants at the abandoned facilities is necessary because there is a potential for contaminants to be transferred through the food chain to Service trust resources (migratory birds, anadromous fish).

The Department of Defense has initiated a program [Defense Environmental Restoration Program (Program), P.L. 98-212,97 Stat. 1427, Dec. 8, 1983] designed to identify, evaluate, and cleanup hazardous waste sites on abandoned military bases and restore the areas to their near original state by implementing remedial actions. The Program is administered by the U.S. Army Corps of Engineers (Corps) and complies with the U.S. Environmental Protection Agency Superfund regulations. Of the five abandoned military facilities being investigated by the Service, only Tanaga Island has had a Corps-sponsored site investigation. No Corp-sponsored cleanup has occurred on any of the islands to date.

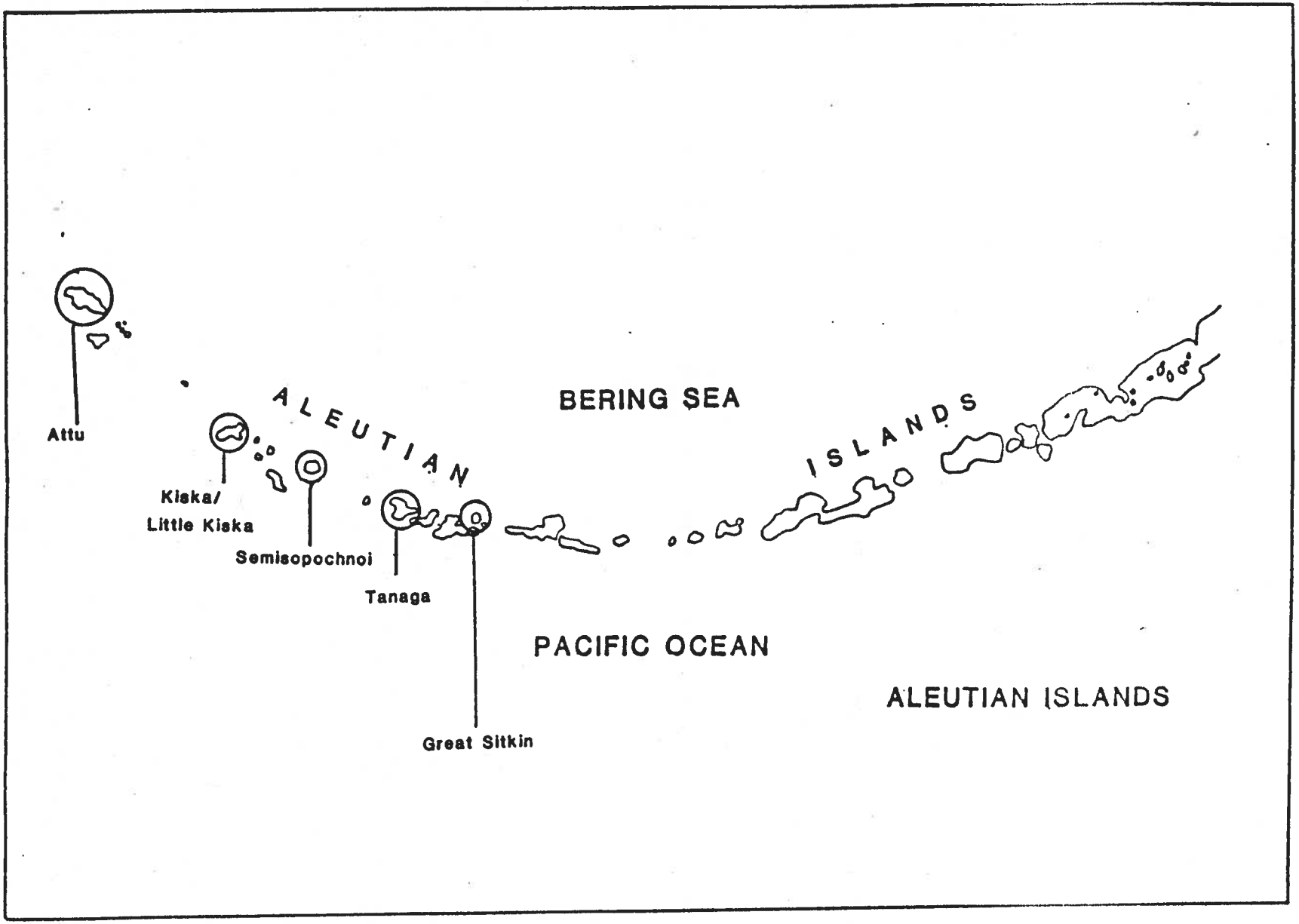

Figure 1. Aleutian Islands military contaminants study locations, Alaska Maritime National Wildlife Refuge, 1988-1990.

Included in this report is a summary of field activities, and an interpretation of analytical data. Contaminated sites requiring remediation activities and recommendations for additional study and cleanup are also identified for use by the Refuge manager in administering the refuge.

STUDY AREAS

For further information about the pilot study's goals, objectives and background, please refer to the study plans located in Appendix A. Also, please refer to the study's sample catalogs (Appendix B) for a more technical discussion of sample collection methods and handling, and analytical costs.

ATTU ISLAND

Attu comprises 223,312 acres and is the western-most island in the Aleutian Chain (Figure 1). Attu was occupied by the Japanese Army from June 7, 1942, to May 30, 1943. A battlefield used to reoccupy the island covers 15 square miles on the eastern side of the island (Figure 2). At present the U.S. Coast Guard occupies 1800 acres and operates a Loran navigation station. World War II debris consists of quonset huts, wood frame buildings, pumphouses for water and fuel, ammunition magazines, concrete foundations, utility poles, steel fuel tanks and miscellaneous debris (U.S. Army 1977). Maps of the area indicate many tank farms were established on Attu, particularly in Navy Town. Records (available upon request) show an elaborate distribution system consisting of underground pipelines and pumping stations. At a minimum, 200,000 barrels of Bunker "C" fuel oil, 28,000 barrels of aviation gasoline and 31,000 barrels of diesel oil were stored in Navy Town. Information is not available about what was stored in the Army's tank farms.

A total of 239 soil, 149 sediment and 19 fish samples were collected from 68 sites (Figure 3). A brief description of each site follows.

Site AT-1 Engineer Hill: Fuel Tank. About 700 feet from the left side of the road is a large square fuel tank. Fuel has spilled out of the tank and is draining over the edge of a small cliff. A sandy, vegetation-laden soil sample was collected.

Site AT-2 Engineer Hill: Cement Foundation. East of the drainage marking the beginning of the East Massacre Valley there is a large cement foundation with 25 spray cans, white piles of powder and milk can-looking containers piled on the floor. Next to the foundation is a large 500-gallon tank with a spigot leaking a viscous yellow liquid draining. Rusty open barrels were strewn about the site. Wooden structures and pieces of wood were scattered throughout the site also. A sediment sample was collect from a stream which collects runoff from this area and drains into East Massacre Valley.

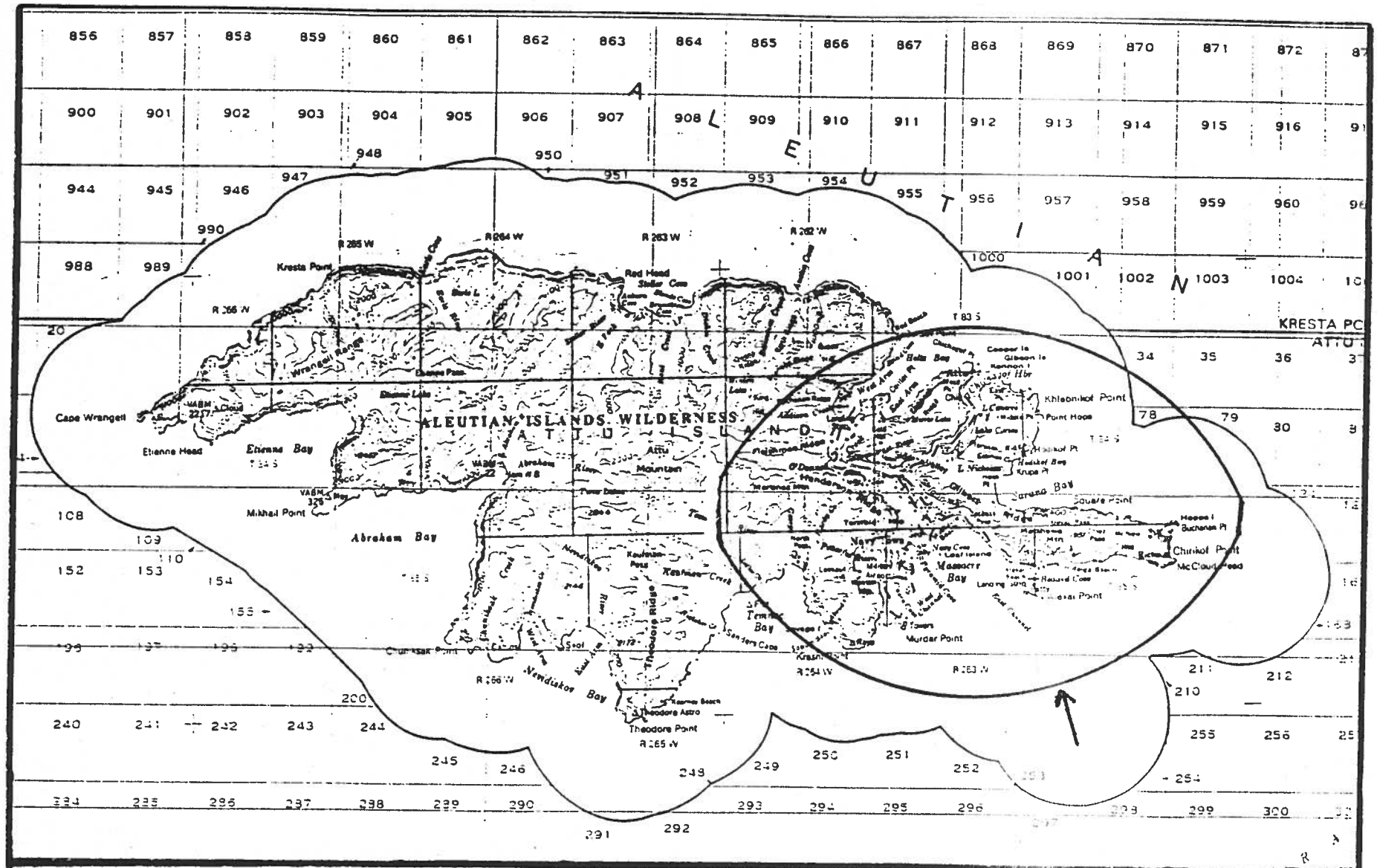

Figure 2. Attu Island study area.


50
T H I R D
D I V I S
FISH VALLEY
SIDDENS
GILBERT
RIDGE
60
T H I R D
V I S I O N
A N D
50

Site AT-3 Jarmin Pass Dump. This site is located at the upper east end of West Massacre Valley and below Jarmin Pass. The site is a combined barrel dump and solid waste dump, located on the side of a cliff and along a stream. Barrels, pieces of plane and bed springs, are among the debris strewn along the cliff. At the bottom of the cliff, there are approximately 100 barrels stacked neatly next to the stream. A viscous yellow liquid is present throughout the area and a strong fuel aroma permeates the air. Water flowing through the site has an oil sheen which drains into West Massacre Valley. Wet, fuel-permeated soil was collected from around the site.

Site AT-4 Hogback Ridge: Church Pond. The site, located near a collapsed church, is a drainage ditch which has widened into a small pond. A sediment sample was taken.

Site AT-5 East Massacre Valley: Dump. This site contains many barrels and jerry cans. A large wooden 20-foot-high platform with a ramp leading up the to the platform, is next to the dump and a small lake. About 75 feet from the barrels and cans exists a small area of spilled asphalt, paint and grease. Soil samples were collected slightly down-slope from spilled asphalt and paint.

Site AT-6 East Massacre Valley: Foundation Ponds. The site contains a cement pad with paint cans strewn about. Orange and yellow flecks were on the cement pad and on the ground surrounding the cement pad. A sediment sample was collected from the small ponds to the east of the foundation.

Site AT-7 East Massacre Valley: Several Sites. This area encompasses several contaminated sites; a large work shed with spray cans, paint cans, batteries, and oil barrels. A large furnace, large square fuel containers, oil heaters and a workshop also exist in the area. The area is bordered by two streams; sediment samples were collected from the stream flowing from the contaminated sites.

Site AT-8 East Massacre Valley: Creek Drainage. This sediment sampling site is located at the confluence of the two streams that surround Site AT-6. One branch of the stream is rust-colored and the other branch was clear. However, up the clear branch an oil-like substance was discovered seeping from the bank into the stream.

Site AT-9 Beach Road: Gymnasium Barrel Dump. This site is a barrel dump located in a small beach-zone drainage, next to the old gymnasium. The dump has discolored the surrounding soil. Sandy, soil samples were collected.

Site AT-10 Beach Road: Transformer. A utility pole, on a beach berm about 100 feet back from Beach Road, contains a rusted-out transformer. Sediment samples were collected in a small pond below the transformer pole. In 1990, soil samples were collected at the base of the utility pole.

Site AT-11 Casco Cove: Barrel Dump. A soil sample was collected from a boulder spit containing a pile of barrels, which is surrounded by a band of green and black-colored soil.

Site AT-12 Navy Town: Stream. This site is near large asphalt tanks east of Navy Town. Sediment was collected at the confluence of two streams behind the asphalt tanks. One of the streams flows through the fuel tank farm and the other stream flows through the asphalt tank-area.

Site AT-13 Navy Town: Pumping Station. Soil samples were collected around the station, which is heavily contaminated with fuel-laden soil. At the lower pumping station there are pipes crossing the stream, one of which was cracked and leaking oil into the stream.

Site AT-14 Navy Town: Upper Drainage. This sediment sampling site is located in a drainage below Coast Artillery Hill, which contains collapsed and intact fuel tanks. Fuel pipelines crisscross the drainage.

Site AT-15 Navy Town: Fuel Tank Basin. Sediment was collected in a small, low wet area below two fuel tanks (among several). Although collapsed, the tanks contained fuel and had oil pooled around its base.

Site AT-16 Navy Town: Unknown Building. Sediment was collected from a low area west of a collapsed wooden building. Utility poles and assorted metal debris litter the area.

Site AT-17 Navy Town: Upper Drainage. This sediment sampling site lies below sites AT-15 and AT-16 in a wetland. The site was sampled to determine if contaminants have drained into the area from the various deteriorated fuel tanks.

Site AT-18 Coast Artillery Hill: Barrel Dump. A sandy soil sample was collected below a pile of barrels, which was leaking asphalt and an unknown POL substance.

Site AT-19 Coast Artillery Hill: Debris Pile. This soil sampling site contains electrical transformers, piles of debris, a large wooden platform (100x75ft) and piles of scrap metal. The potential for drainage from this site (over the cliff) is high, since a stream borders the area and the soil is porous.

Site AT-20 Coast Artillery Hill: Pit Ponds. Sediment was collected from small ponds surrounding a pit which contained a building that may have contained ammunition.

Site AT-21 Coast Artillery Hill: Drainage. Sediment was collected at the mouth of a stream draining the area southwest of Coast Artillery Hill.

Site AT-22 Coast Artillery Hill: Quonset #1. Down from the turnoff to the pass, soil was collected below the fifth quonset hut.

Site AT-23 Coast Artillery Hill: Quonset #2. Down from the turnoff to the pass, soil was collected below of the fourth quonset hut.

Site AT-24 Lake Elwood: Sediment. Located at the base of Coast Artillery Hill, sediment was collected from Lake Elwood. Within the drainage, ten fuel tanks are positioned on the side of Terrible Mountain and about fifty fuel tanks are located on Coast Artillery Hill. The stream leading from the lake was rust-colored.

Site AT-25 Lake Elwood: Fish. Minnow traps were set at Lake Elwood but no fish were caught.

Site AT-26 Lake Nevidiskov: Fish. Control fish samples were collected from this lake on the Cape Wrangell side of the island. Unfortunately the samples were lost.

Site AT-27 East-West Runway Debris Pile. Sediment samples were collected from a ditch which surrounds a debris pile located in one of the runway revetments. The pile contained collapsed building material and barrels.

Site AT-28 Peaceful River Valley: Asphalt Barrel Dump #1. This site is a large (250) barrel dump which was burned to dispose of asphalt. Asphalt flowed from the site towards a stream. Soil was sampled in the center of this area where the asphalt had fractured.

Site AT-29 Peaceful River: Sediment. Sediment was collected where the river flows under the north-south runway. The river receives runoff from all the contaminated sites in the Peaceful River Valley. Dolly Varden (*Salvelinus malma*) were collected from this site in 1990.

Site AT-30 Casco Point: Transformer. Located on the east side of the neck of Casco Point, sediment was collected around a possible electrical transformer. The site has poles that a transformer could have been mounted on. Wooden debris also surrounds the area.

Site AT-31 Murder Point: Utility Pole. This site is located about one quarter of a mile from the Service cabin. Wooden debris and utility poles litter the area. Soil was collected from around the area.

Site AT-32 Lake Nicholas: Fish. Threespine stickleback (*Gasterosteus aculeatus*) were collected from the lake, which is northeast of Massacre Bay. Bassett Creek (Site AT-40) flows into this lake.

Site AT-33 Murder Point: Workshop(?). Soil was collected around a hole in the ground located behind a wooden building. The building may have been a workshop and perhaps something could have been poured into this hole. If there was anything in the building that could have leaked it would have leached towards this hole.

Site AT-34 Murder Point: Quonset Hut Ditch. This site contains a line of collapsed quonset huts alongside the hill that faces Casco Cove. Sediment samples were collected from several drainage ditches leading from the quonset huts. No obvious sources of contamination were discovered.

Site AT-35 Murder Point: Lake #1. Sediment samples were collected from a lake surrounded by many machine gun emplacements, quonset hut pits and debris piles.

Site AT-36 Murder Point: Lake #2. Sediment samples were collected from a lake surrounded by a water tower and two buildings used as a communications center.

Site AT-37 Murder Point: Radio Tower Buildings. Sediment samples were collected in a wet area, down-gradient from four radio towers laying on the ground and two buildings.

Site AT-38 Murder Point: Leaking Barrels. Soil was collected from an area surrounding debris and ten leaking barrels (probably grease). The soil was bare under and around these barrels.

Site AT-39 Jim Fish Valley: Debris Pile. The area smelled of POLs. A kiln-like structure was located alongside wood debris and old barrels. Soil was collected at the base of barrels.

Site AT-40 Bassett Creek. The creek was clear, clean and shallow. Sediment and Dolly Varden samples were collected at the Chichagof Road bridge crossing.

Site AT-41 Siddens Valley: Dump. Dump containing barrels, metal, glass, sheet metal and other debris. No ammunition found. Soil sample collected east of the dump in a drainage ditch leading out from the dump.

Site AT-42 Siddens Valley: Powerhouse. Large metal quonset-like structure. Interior had been gutted. 12-volt batteries litter the concrete floor. Soil sample collected from outside front and back doors.

Site AT-43 Siddens Valley: Powerhouse Fuel Tank. There was evidence of fuel spilled at the base of the tank. Bullet holes pocketed the tank's sides. The tank is about 15 feet tall and 5 feet high. Six inches of fuel remains inside. Soil samples were collected directly below the spout and two feet beyond.

Site AT-44 Storage Tunnel Creek. This creek appears to be a tributary to Bassett Creek. Sediment was collected from a channel whose water appears to have originated from inside the two storage tunnels. The tunnels were constructed to store supplies and house troops.

Site AT-45 Upper Henderson River Bridge. Rust-colored sediment and Dolly Varden were collected upstream of the upper-most bridge.

Site AT-46 Peaceful Valley: Barrel Dump. This barrel dump is located within the Peaceful River floodplain and appears to have been flooded over the years. Hundreds of barrels exist, some partially buried. Wet soil samples were collected from low areas below the dump. No POLs were found, but asphalt was discovered in some barrels.

Site AT-47 Peaceful Valley: Asphalt Barrel Dump #2. This approximately two-acre-area is covered with solidified asphalt. Hundreds of "burned out" barrels lie in the center of the two acres. Berms constructed to contain the asphalt were breached, as a "river of asphalt" was found flowing into the Peaceful River. Soil samples were collected from around the site, as no soil was available within the site.

Site AT-48 Casco Cove Transformer. Soil samples were collected directly below a single transformer, which was mounted on a utility pole. Bullet holes pocketed the transformer and its bottom had rusted away.

Site AT-49 Casco Beach Road Barrel Dump. 500+ drums in various stages of deterioration lie in a low area with a small drainage ditch leading out from the dump. Soil was collected alongside the ditch and from under a few of the barrels.

Site AT-50 Navy Town: Paint Shop. A wooded structure had collapsed onto barrels and buckets of paint. Many of the containers had rusted away. Soil was not available to collect so paint chips were collected instead.

Site AT-51 Navy Town: Concrete Slab. A large wood structure had fallen, exposing a 20-foot by 100-foot concrete slab. On the slab were various appliances, metal debris and a furnace. No soil was available in the site so moss and associated soil was collected by scrapping it off the concrete.

Site AT-52 Navy Town: Utility Pole Platform. A utility pole, from which electrical transformers were hung, had fallen on a wooded structure and was subsequently burned. Soil samples were collected next to the transformer, beneath the wooden floor.

Site AT-53 Navy Town: Lube Oil Drum Spill. A 50-to-100 square foot area has been heavily contaminated with POLs. Drum impressions in the soil indicate that about 10 drums were in the area. Soil samples were collected from around the spoiled area.

Site AT-54 Navy Town: Collapsed Building. A wood structure had collapsed on itself burying hundreds of 10-gallon barrels containing an unknown white crystalline substance. The barrels contents were collected for analyses.

Site AT-55 Navy Town: Garage. Soil was collected in an intact, single car garage. The soil appeared tainted with POLs.

Site AT-56 Coast Guard Pumphouse Pool. Dolly Varden samples were collected from within the pumphouse reservoir and in an adjacent Peaceful River wetland.

Site AT-57 Navy Town: Hall Furnace. Soil samples were collected around the vicinity of a furnace, which was centrally located in a large collapsed wooden structure. There was evidence of POLs throughout.

Site AT-58 Navy Town: Radio Shack (?). Soil samples were collected around, what appeared to be a portable, metal building (6X8X8) containing many electrical sockets and associated wiring. Deteriorated 12-volt batteries were scattered around the base of the structure.

Site AT-59 Sediment Control #1: Peaceful Valley. Clean, fine sediment was collected from Peaceful River (150-foot elevation) above the confluence with Angel and Rucksock creeks.

Site AT-60 Soil Control #1: Peaceful Valley. Soil was collected from a cut bank (200-foot elevation), north of Peaceful Valley Road and north of Site AT-46.

Site AT-61 Sediment Control #2: Kingfisher Creek. Clean, fine sediment was collected from Kingfisher Creek (150-foot elevation) in a ravine above the pumphouse.

Site AT-62 Soil Control #2: West Mountain. Soil was collected from a cut bank (300-foot elevation), southeast of Kingfisher Creek.

Site AT-63 Soil Control #3: West Mountain. Soil was collected from a cut bank (100-foot elevation), southwest of the Fish and Wildlife Service Bunk house.

Site AT-64 Chichagof Point: Unknown Structure. Soil was collected around a fractured underground pipe dripping a petroleum-based liquid. A great deal of power-generating equipment and metal debris littered the area.

Site AT-65 Soil Control #4: Chichagof Point. Soil was collected from a cut bank (175-foot elevation), west of the Power House, towards West Peak.

Site AT-66 Chichagof Point: Radio Shack. Soil was collected from around the burned remnants of a radio shack. The site was littered with radio components, wiring, rubber items and metal debris.

Site AT-67 Beach Road: POL Burn Pit. Soil/sediment was collected from an asphalt-lined pit used to burn POLs and dispose of hazardous wastes. An unknown number of barrels were buried with gravel, some protruded through the surface.

Site AT-68 Navy Town: Tank Farm Utility Pole Transformer. Soil samples were collected around the base of a utility pole, which contained a deteriorated electrical transformer.

TANAGA ISLAND

Of Tanaga's 128,000 acres, 774 acres were used for military purposes. The abandoned facility is located in the southwest corner of the island, on Cape Amagalik (Figure 4). A Naval construction battalion of Seabees was sent to Tanaga in September, 1943 to maintain U.S. military presence in the Andreanof Islands Group and to assist the Naval Operating Base at Adak. Tanaga became a Naval Auxiliary Air Facility for Adak in March 1944 and functioned until October 1945. Other possible operations on Tanaga may have included an Army Aircraft Warning Service and a Naval weather station. Ocean Technology, Ltd., under contract with the Corps, visited Tanaga Island to conduct a site survey of the abandoned military installation (Ocean Technology, 1986). A 1983 demolition team collected and blew up old live ammunition. Only those sites the Service suspects as being contaminated are identified and discussed hereafter.

In total, 48 soil, 36 sediment and 6 fish samples were collected from 15 sites (Figure 5). A brief description of the sites follow.

Site TA-1 Collapsed Building Barrels. This soil sample site is located southeast of the runway, on a sandy knoll next to a collapsed, burned building. Piles of barrels litter the area. The area also contains an open 55-gallon grease barrel, open paint cans and POL-contaminated soil.

Site TA-2 Workshop #1. This soil sample site is located in the corner of a building located along the road nearest a large, rusty crane. The building supports have collapsed and the roof of the building was on the ground (this is a significant

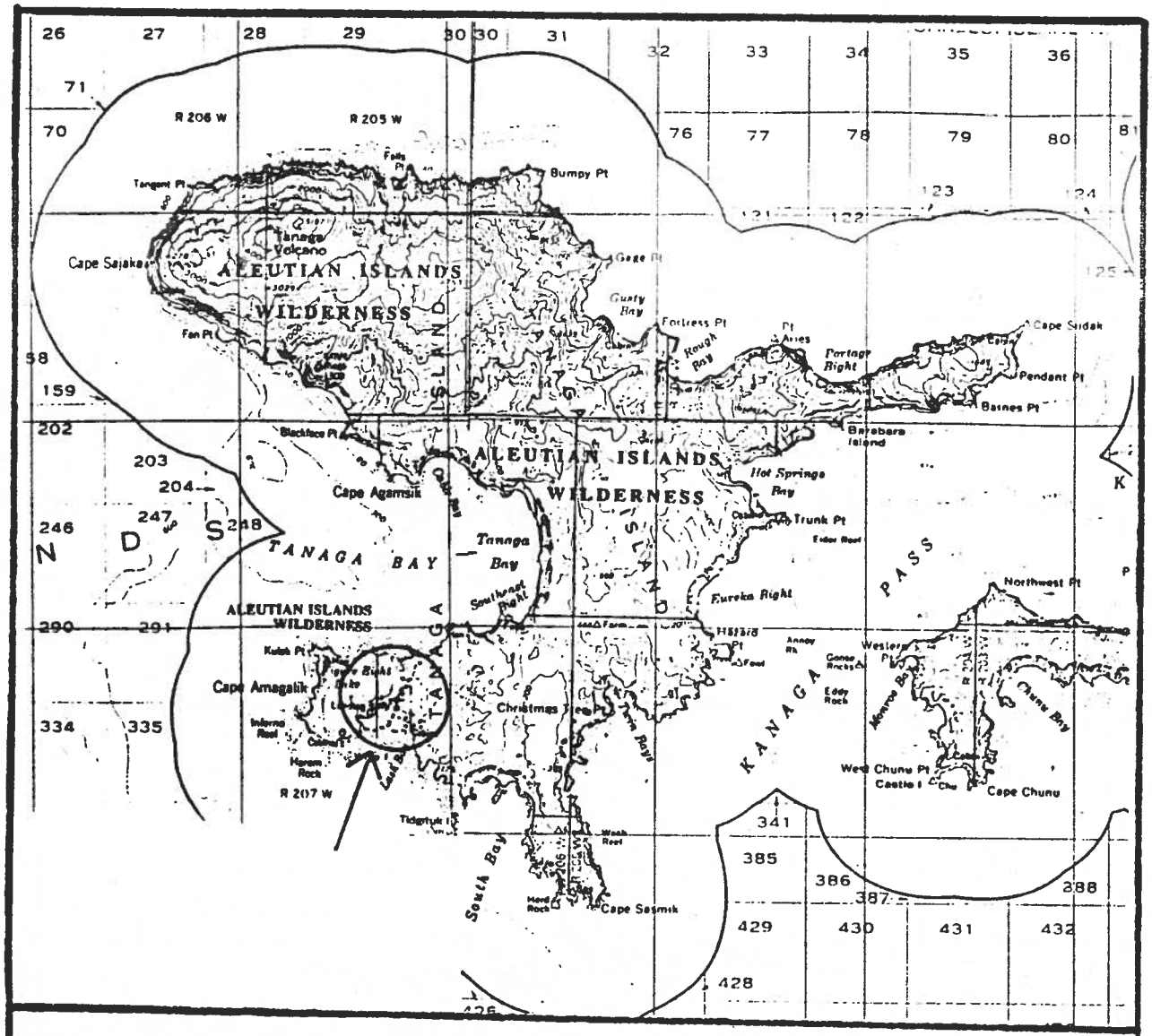

Figure 4. Tanaga Island study area.

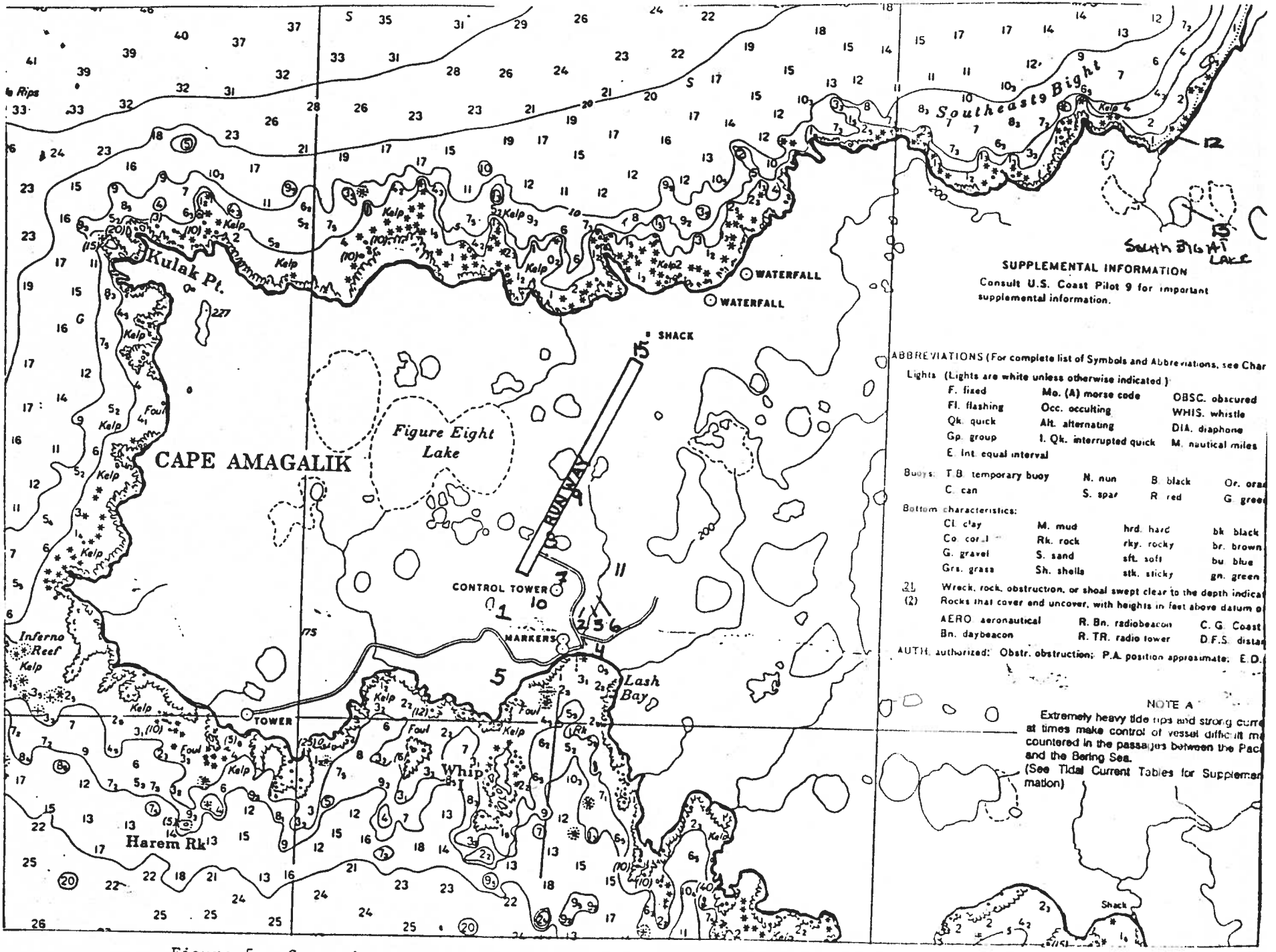

Figure 5. Contaminant sample sites, Tanaga Island.

landmark). The building appeared to be an old workshop, as machine parts were in rows on shelves, cans and barrels were in a corner on a pile of rusted parts and the soil was discolored.

Site TA-3 Workshop #2. This site is located 20 feet down-gradient from Site TA-2. A soil sample was collected to determine if contaminants from Site TA-2 were draining towards the stream.

Site TA-4 Lash Bay Road Fuel Container. A composite soil sample was collected around a large 6-foot by 7-foot square fuel container. The fuel tank had fuel draining from a spigot; the surrounding soil was discolored. Nearby, a stream located next to the road contained 25 barrels: There was no obvious evidence of contamination even though the stream was rust-colored. On the opposite side of the stream is a wetland containing 10 buried barrels: There was no evidence of POL-contamination.

Site TA-5 Lash Bay Barrel Dump. About 500+ barrels (many of them leaking POLs) were discovered in a large sandy depression. The sandy-soil sampling station was in the center of the depression.

Site TA-6 Drainage Ditch. This site is located directly below Site TA-3, at a housing complex between a road and the stream. A series of drainage ditches lead from the buildings towards a stream. A sediment sample was collected from the ditch which contained rust-colored water and corrugated metal.

Site TA-7 Paint Shed. A soil sample was collected from beneath the wooden floor of a collapsed paint shed. Old paint cans and tar paper littered the area.

Site TA-8 Pumping Station. Sediment samples were collected from a water-filled pit next to a concrete pad containing four pump-type objects. A transformer on a utility pole is located 300 feet south of the cement pad. The soil located up-slope of the cement pad was black, but no sources of POL-contamination were present.

Site TA-9 Runway Drainage Ditch: East Side. A sediment sample was collected in a drainage ditch located east of the runway. The ditch has steep sides and is 4 feet deep and two feet wide. All the drainage ditches, running along both sides of the runway, lead to small lakes.

Site TA-10 Runway Barrel Dump. The 20+ barrels are located east of Site TA-1 and is surrounded by bare discolored soil. A composite soil sample was collected from around the dump.

Site TA-11 Unnamed Stream: Fish. Dolly Varden were collected from a stream that flows from a lake near the pumphouse,

past the housing complex and into Lash Bay. The stream bed is rust-colored and contains a great deal of corrugated metal and barrels.

Site TA-12 Soil Control. This soil control site is located near Southeast Bight off Tanaga Bay, in a deep depression 100 yards back from the beach.

Site TA-13 Lake Sediment Control. This sediment control site is located in a lake near Southeast Bight, close to the confluence of 2 streams.

Site TA-14 Fish Control. Minnow traps were set in a stream on the north side of Tanaga Bay; however, no fish were caught.

Site TA-15 Radio Shack. A sediment sample was collected from low areas surrounding a radio shack, located north of the runway. The intact building, which overlooks Southeast Bight, contains electrical generators. This site is surrounded by utility poles.

LITTLE KISKA ISLAND

From June 1942, until August 1943, Little Kiska Island and nearby Kiska Island were occupied by the Japanese. Allied (American and Canadian) invasion forces established bases in and around Kiska Harbor in August 1943, after the Japanese withdrew from the islands. The Secretary of the Interior designated the Japanese Occupation Site as a National Historic Landmark on February 4, 1985.

Little Kiska comprises 1843 acres: The precise acreage impacted by military operations is not known, but it appears most military activities were limited to the South Pass side of the island (Figure 6). The military debris left consists of 5 quonset huts, 1 wood frame building, coastal-gun emplacements, anti-aircraft emplacements, miscellaneous steel and wood debris, roads and approximately 100 petroleum barrels (U.S. Army 1977).

The Service discovered quonset hut pits on the southwestern end of the island. Pits were also located on the neck of land that leads to Little Kiska Head. Gun emplacements (and associated ammunition) were very abundant. Many of the island's lakes contained pump-type structures and nearby streams had clear water with well vegetated banks. A debris pile, consisting of wood from collapsed buildings, is located on the eastern end of the island.

In total, 4 sample sites were established (Figure 7) and 6 soil, 12 sediment and 6 fish samples were collected.

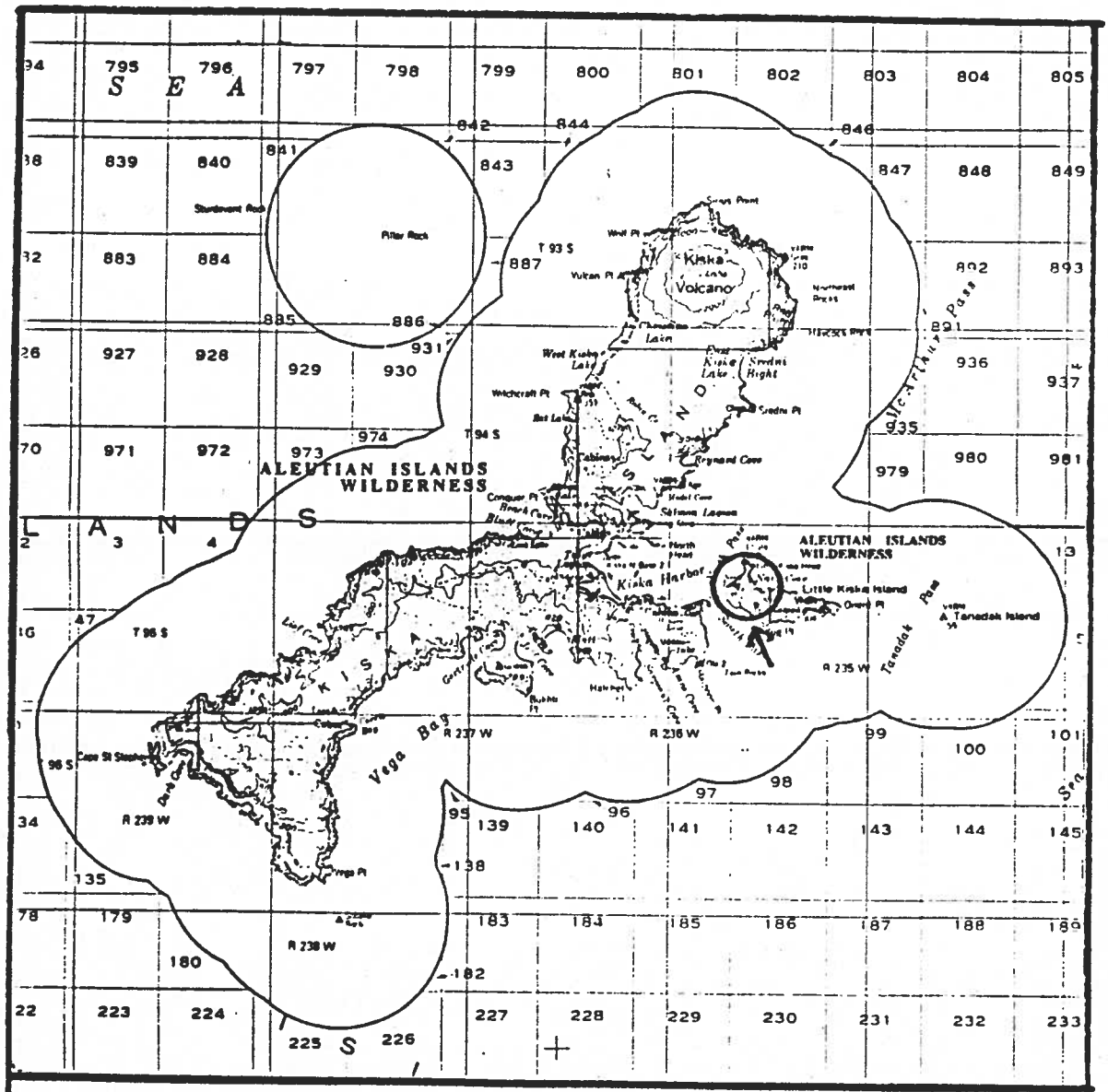

Figure 6. Little Kiska Island study area.

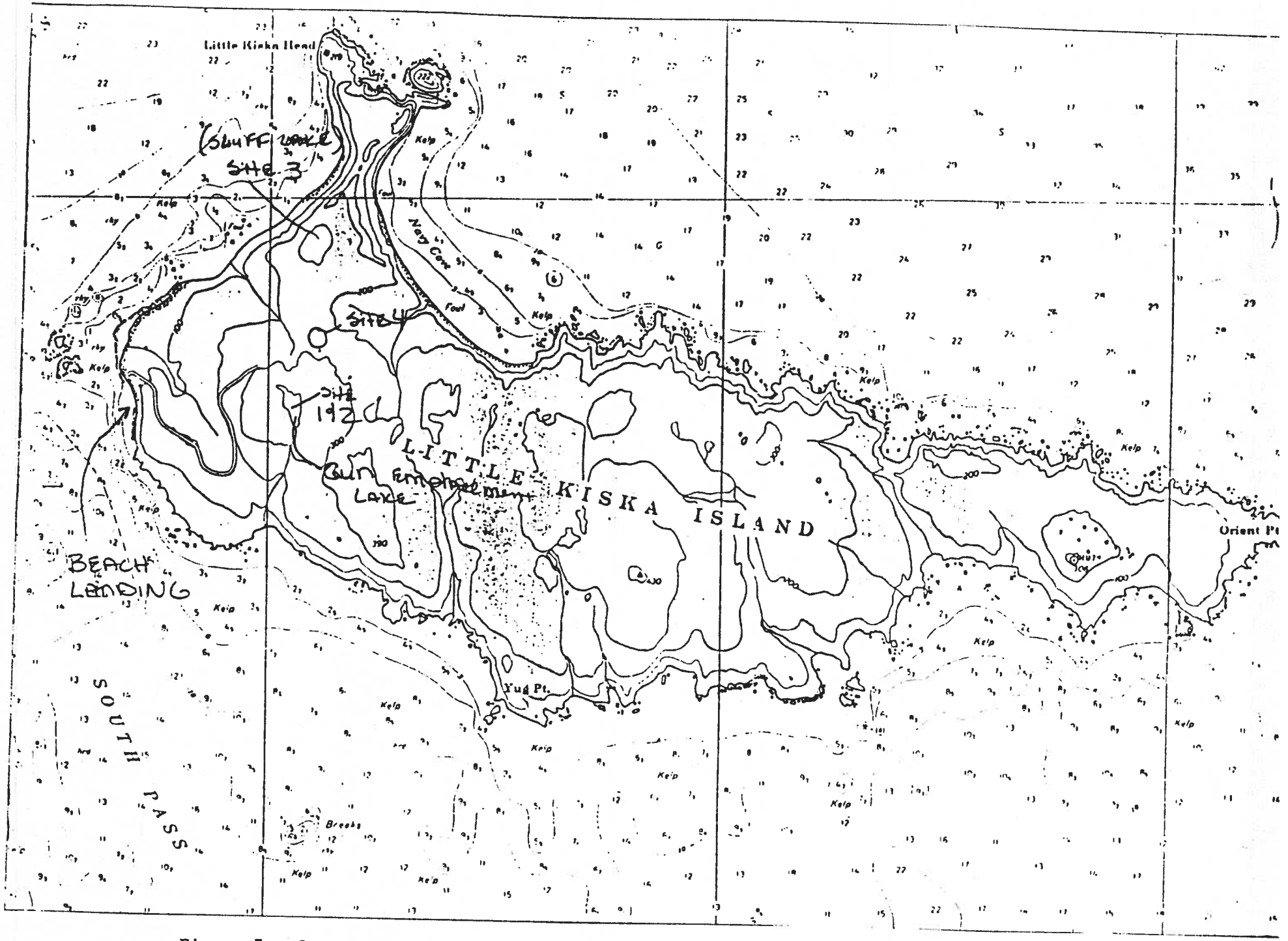

Figure 7. Contaminant sample sites, Little Kiska Island.

Site LK-1 Gun Emplacement Hill Lake. Sediment was collected from a lake located on the west end of the island, below three gun emplacements. Samples were restricted to the lake's bank, as the lake was very steep-sided. Approximately 10, 50-caliber artillery shells were seen resting on the lake bottom. On the shore, above the sample site, another pile of the same kind of artillery shells was discovered.

Site LK-2 Gun Emplacement Hill Lake: Fish. Threespine stickleback were collected from Site LK-1.

Site LK-3 Sluff Lake. Sediment samples were collected from a lake located on the west end of the island. To the west of the lake, six barrels were neatly stacked at the lower end of a sluff-area. Old machinery was found in the middle part of the sluff-area also. There were no signs of POL leakage in the area. Attempts to seine fish in the lake were unsuccessful.

Site LK-4 Machine Gun Mounts. Soil samples were collected around several machine gun mounts and decayed 12-volt battery. This site is a 50-foot oval area located between Site LK-1 and LK-3, in a vegetated area devoid of the usual tundra cover. The lupine in the immediate area had purple leaves as compared to other lupine further away which had green leaves.

GREAT SITKIN ISLAND (Fox Creek Drainage)

Of Great Sitkin's 39,219 acres, approximately 700 acres (located within the Little Fox and Fox creeks' drainage) are affected by military debris (Figure 8). During World War II. the island was used as a fuel station for the Navy base on Adak Island. The site is characterized by 24 large storage tanks which boarder both sides of Little Fox Creek. An additional 12 tanks are scattered throughout the site. Dramatically evident are numerous petroleum spills and seeps from fuel pumping stations and underground pipelines. Many of the storage tanks still contain fuel. Past efforts by the Navy (1970) to properly dispose 600,000 barrels of Bunker "C" fuel oil stored in 26 tanks failed, as burning the tanks resulted in their heating up, collapsing internally, and spilling the unburned fuel onto the ground. That which did not run off immediately into the natural drainage was absorbed into the soil, eventually surfacing elsewhere.

In August 1987, the Service collected soil, sediment and fish samples from seven sites within the Little Fox Creek drainage. Large pools of petroleum products were discovered throughout the drainage. One pool was found draining directly into the Creek. Other pools were found to contain numerous submerged and floating rosy finch carcasses and unidentified bird species. The 1987 results have been summarized in Crayton, 1990.

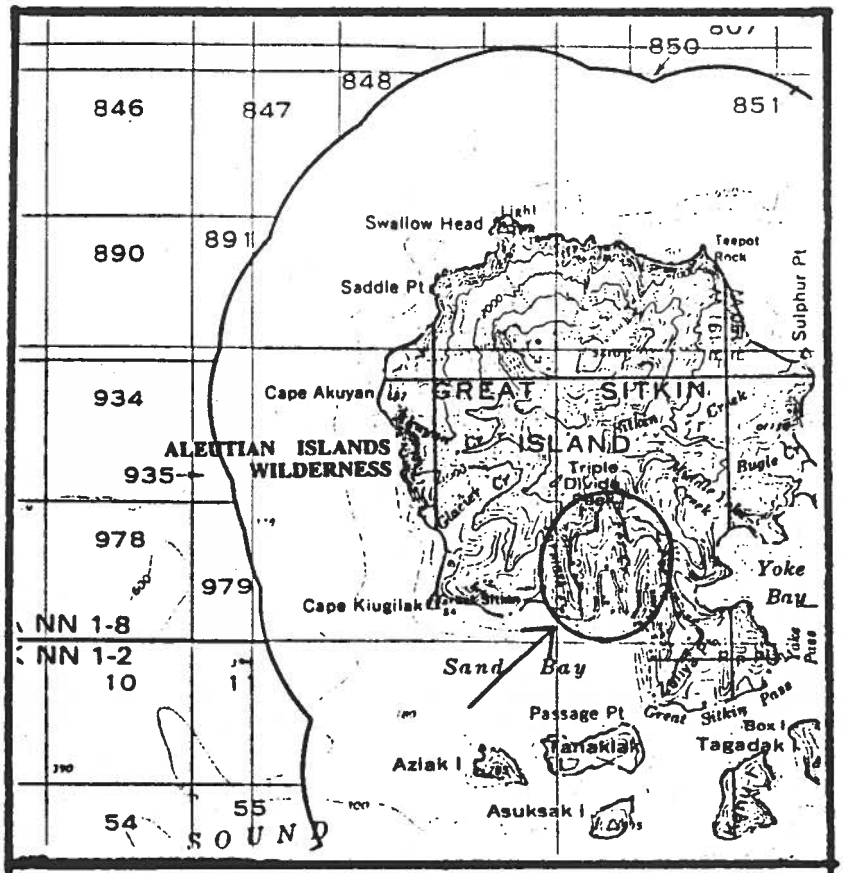

Figure 8. Great Sitkin Island study area.

The Fox Creek drainage was not investigated by the Service until 1988. The Fox Creek drainage appeared "cleaner" than the Little Fox Creek drainage, as there were no obvious signs of POL spills. All the buildings discovered appeared to be living quarters, as most of the housing units contained water boilers. Numerous empty ammunition bunkers were found pocketing the east side of the valley.

In total, 4 sample sites (Figure 9) were established and 18 soil, 6 sediment and no fish samples collected.

Site GS-1 Fox Creek Sediment. Sediment samples were collected near the upper end of Fox Creek, 500 feet below a bridge.

Site GS-2 Building Transformers. Soil samples were collected below 3 or 4 transformers located on the west side of the valley, near collapsed buildings. The transformers appeared to be intact and possibly full fluid.

Site GS-3 Road Transformers. Soil samples were collected around three transformers laying in the road. The road lies behind the beach berm and connects the east and west sides of the valley. The three transformers appeared intact.

Site GS-4 Collapsed Building. Soil samples were collected in the center of a bare-soil-area surrounded by collapsed buildings, which looked as if they were combined living quarters and workshops. Old bedsprings were in some rooms and machinery parts were in others.

SEMISOPOCHNOI ISLAND

Semisopochnoi Island consists of 56,013 acres. The military's presence on the island affected the southern portion of the island (Figure 10). Military debris consists of 8 quonset huts, a wrecked aircraft and miscellaneous debris (U.S. Army 1977). The Atomic Energy Commission constructed scientific and weather stations on Semisopochnoi Island to monitor their nuclear tests on Amchitka Island. In 1973, all equipment and structures were removed from Semisopochnoi Island by Navy helicopter and the occupation site cleaned up.

In total, 5 sample sites were established (Figure 11) and 12 sediment and 18 soil samples collected.

Site SE-1 Camp Lake Sediment. Sediment was collected from a small pond which receives runoff from an area containing collapsed quonset huts and debris piles. Several corroded barrels were found in the pond.

Site SE-2 Hill Quonset. Soil samples were collected from the bottom of a pit filled with the wooden remnants of a quonset hut. Sand-filled barrels surrounded the pit to form a wind break.

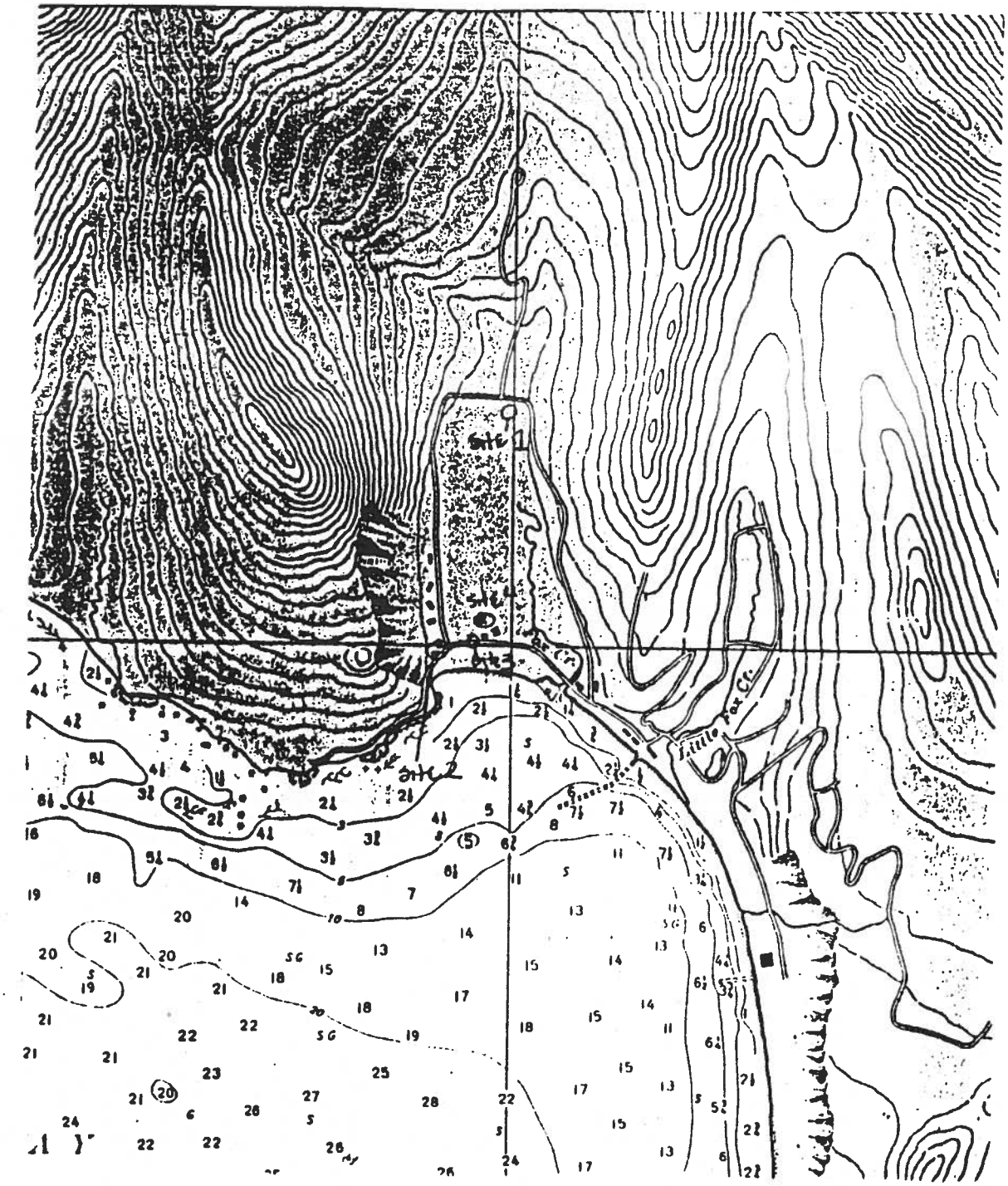

Figure 9. Contaminant sample sites, Great Sitkin Island Fox Creek Drainage.

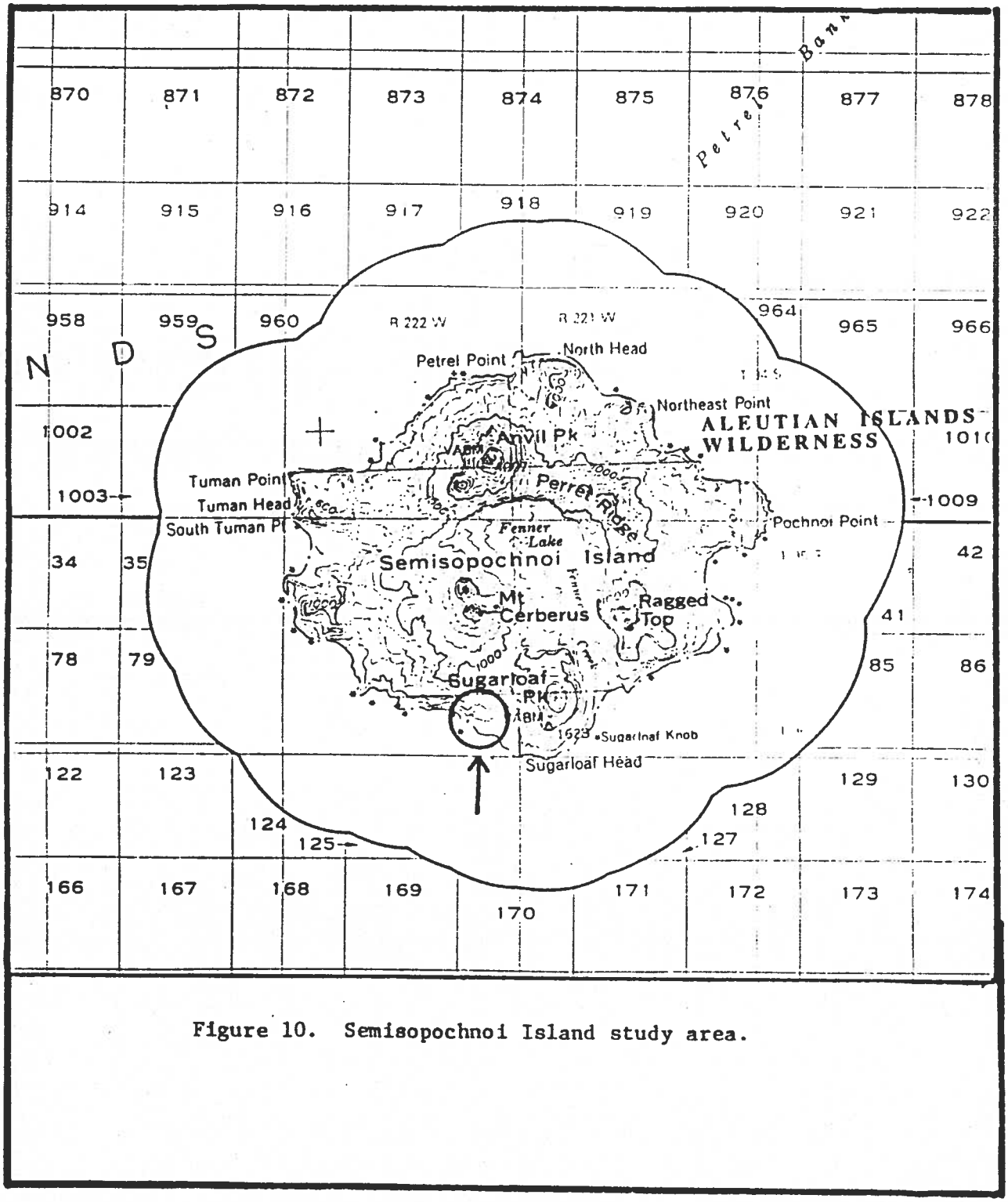

Figure 10. Semisopochnoi Island study area.

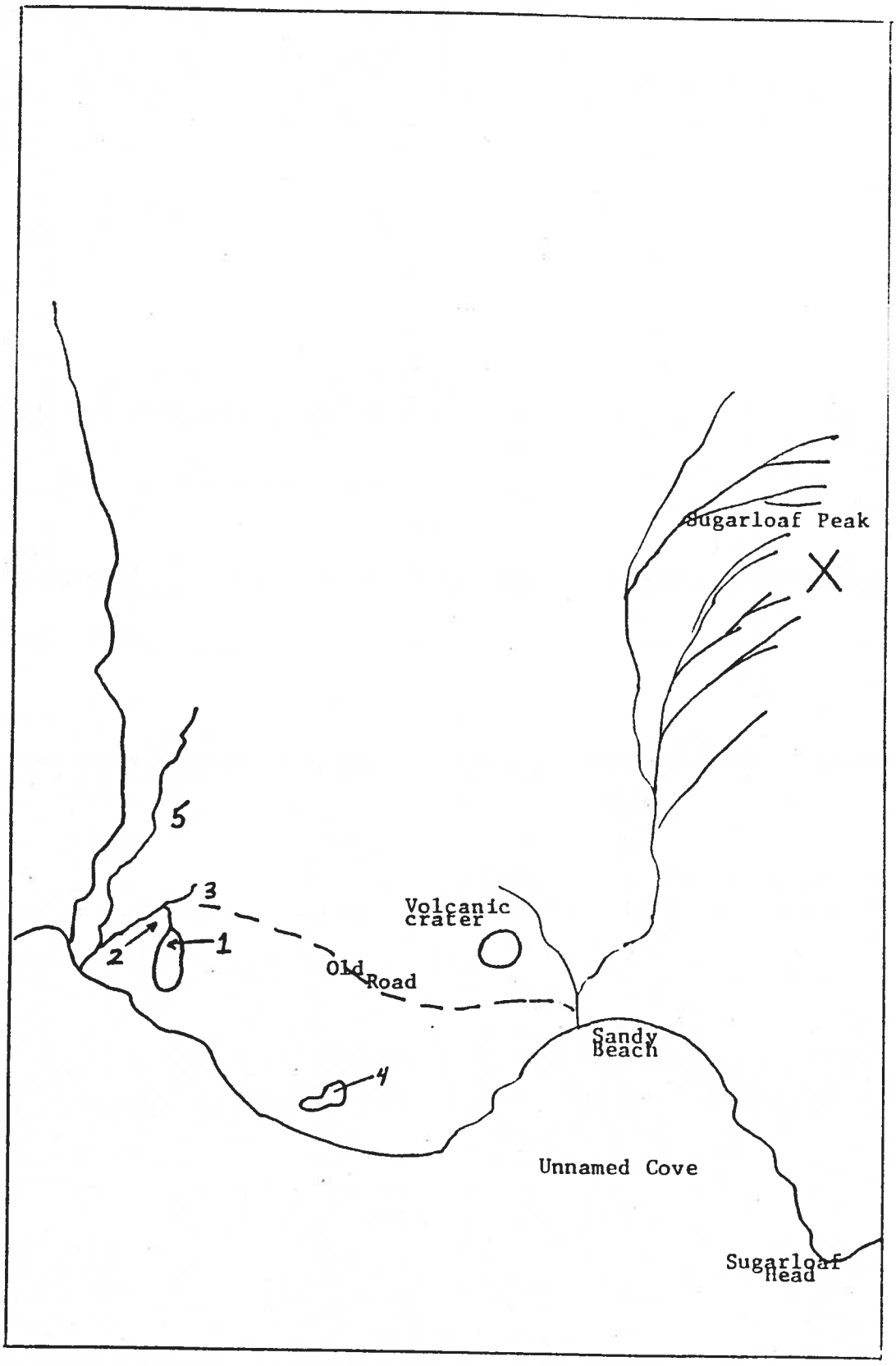

Figure 11. Contaminant sample sites, Semisopochnoi Island

Site SE-3 Barrel Dump. Soil was collected around a pile of barrels which were in various states of corrosion. The dump was located on the top of a hill, above the quonset hut camp. The discolored soil smelled of POLs.

Site SE-4 Sediment Control. Sediment was collected in a pond located near the coastline bluffs. No sources of contamination were observed near the pond.

Site SE-5 Fiberglass Hill. Soil was collected around the base of a circular, fiberglass foundation. No sources of contamination existed in the area.

ANALYTICAL RESULTS

Table 1 lists the chemical compounds and inorganics analyzed by Service-contracted laboratories. The lower levels of detection for PCBs is 0.5 ppm and 0.02 ppm for the balance of organochlorine analytes. The detection limit for PAHs is 0.01 ppm. Inorganics detection levels vary for each sample and element. Attu Island's 1990 analytical data included total organic carbon and grain size measurements.

All PAHs and organochlorine concentrations are expressed in ppm and were determined on a wet weight (ww) basis. Inorganic concentrations are also expressed in ppm, but were determined on a dry weight (dw) basis, unless otherwise indicated. Fish samples were analyzed as composites of whole-body specimens.

All raw, untabulated, analytical data and Quality Control/Quality Assurance Reports are available upon request.

ATTU ISLAND

Organochlorines No analytes were detected above quantification limits in any fish and sediment samples; however, soil collected from four sites did contain a variety of organochlorines. Site AT-66 (Chichagof Point: Radio Shack) contained 5800 ppm to 9200 ppm Arochlor 1254, as confirmed by gas chromatography/mass spectrometry (GC/MS). Site AT-68 (Navy Town: Tank Farm Utility Pole Transformer) contained trace amounts (.36 ppm to .93 ppm) of Arochlor 1254. Site AT-67 (Beach Road: POL Burn Pit) contained Total PCBs between .21 to .26 ppm. Site AT-50 (Navy Town Paint Shop) contained "unknown organochlorine components" at concentrations between .18 and .38 ppm.

Polycyclic Aromatic Hydrocarbons PAHs were detected in the majority of soil and sediment samples at concentrations less than 11 ppm. Table 2 summarizes the PAH analytical results. The highest concentrations occurred at Navy Town's pumping station (Site AT-13; 4.4 ppm), Coast Artillery Hill's quonset hut #1 (Site AT-22; 6.3 ppm), Murder Point's quonset hut ditch (Site

Table 1. Analytes for the Aleutian Islands, military contaminants study, Alaska Maritime National Wildlife Refuge, 1988-1990.

INORGANICS	POLYNUCLEAR AROMATIC HYDROCARBONS	ORGANOCHLORINES
aluminum (Al)	naphthalene	oxychlordane
arsenic (As)	1-methylnaphthalene	cis-nonachlor
cadmium (Cd)	2-methylnaphthalene	alpha chlordane
chromium (Cr)	2,6 dimethylnaphthalene	gamma chlordane
copper (Cu)	2,3,4-trimethylnaphthalene	transnonachlor
iron (Fe)	1-methylphenanthrene	heptachlor
mercury (Hg)	acenaphthylene	heptachlorepoxide
nickel (Ni)	acenaphthene	o,p'-DDE
lead (Pb)	fluorene	p,p'-DDE
selenium (Se)	phenanthrene	o,p'-DDD
zinc (Zn)	anthracene	p,p'-DDD
	fluoranthene	o,p'-DDT
incidentals:	pyrene	p,p' DDT
aluminum (Al)	benzo(a)anthracene	total DDT
barium (Ba)	chrysene	mirex
beryllium (Be)	benzo(b)fluoranthene	dieldrin
boron (B)	benzo(k)fluoranthene	aldrin
cobalt (Co)	benzo(e)pyrene	alpha BHC
magnesium (Mg)	benzo(a)pyrene	hexachlorobenzene
molybdenum (Mo)	perylene	beta BHC
silver (Ag)	indeno(1,2,3-c,d)pyrene	lindane
strontium (Sr)	dibenzo(a,h)anthracene	delta BHC
vanadium (V)	benzo(g,h,i)perylene	total Cl-2 (PCB)
	biphenyl	total Cl-3 (PCB)
		total Cl-4 (PCB)
		total Cl-5 (PCB)
		total Cl-6 (PCB)
		total Cl-7 (PCB)
		total Cl-8 (PCB)
		total Cl-9 (PCB)
		total PCBs
		toxaphene

Table 2. Summary of polycyclic aromatic hydrocarbon analytical data, Attu Island.

Site No.	Matrix	No. of Compounds + Detected and Conc. Range (ppm)	Most Abundant PAH Compound Detected
1	soil	14 (.01 - 2.5)	phenanthrene
2	sediment	9 (.01 - .14)	fluoranthrene
3	soil	10 (.01 - .42)	1,2-benzanthracene
4	sediment	8 (.01 - .08)	fluoranthrene
5	soil	13 (.03 - 2.6)	benzo(e)-, benzo(a)-pyrene
6	sediment	12 (.02 - .19)	pyrene
7	sediment	non-detectable	
8	sediment	4 (<.02)	pyrene
9	soil	11 (.01 - .43)	pyrene
10	sediment	non-detectable	
	soil	10 (.01 - .14)	benzo(e)pyrene
11	soil	14 (.01 - 1.6)	phenanthrene/pyrene
12	soil	non-detectable	
13	soil	9 (.03 - 4.4)	pyrene/1,2-benzanthracene
14	sediment	6 (.01 - .08)	phenanthrene
15	sediment	13 (.01 - 2.5)	phenanthrene/pyrene
16	sediment	9 (.01 - .07)	phenanthrene
17	sediment	4 (.01 - .06)	benz(b)fluoranthrene
18	soil	non-detectable	
19	soil	12 (.01 - .33)	fluoranthrene/pyrene
20	sediment	4 (.01 - .03)	fluoranthrene
21	sediment	4 (.01 - .02)	benzo(e)-, benzo(a)-pyrene
22	soil	14 (.23 - 6.3)	phenanthrene chrysene 1,2-benzanthracene
23	sediment	non-detectable	
24	sediment	4 (.01 - .02)	benz(b)fluoranthrene
27	sediment	5 (.01 - .03)	benzo(e)pyrene
28	soil	12 (.01 - 2.1)	1,2-benzanthracene/ benz(b)fluoranthrene
29	sediment	8 (.01 - .02)	chrysene
	fish	non-detectable	
30	soil	12 (.01 - .10)	benzo(e)pyrene
31	soil	8 (.01 - .11)	benzo(e)pyrene
32	fish	non-detectable	
33	soil	11 (.01 - .08)	phenanthrene
34	sediment	10 (.01 - 4.1)	chrysene
35	sediment	13 (.02 - .34)	phenanthrene/pyrene
36	sediment	non-detectable	
37	sediment	9 (.01 - .06)	benzo(e)pyrene

+ = there is a total of 14 PAH compounds

Table 2. (continued). Summary of polycyclic aromatic hydrocarbon analytical data, Attu Island.

Site No.	Matrix	No. of Compounds + Detected and Conc. Range (ppm)	Most Abundant PAH Compound Detected
38	soil	9 (.01 - .12)	benzo(e)pyrene
39	soil	9 (.01 - 2.0)	pyrene/chrysene
40	sediment	4 (.01 - .03)	pyrene
41	soil	13 (.01 - .41)	phenanthrene/pyrene
42	soil	14 (.09 - 3.7)	phenanthrene/pyrene
43	soil	12 (.01 - 1.3)	chrysene/pyrene
44	sediment	non-detectable	
45	sediment	non-detectable	
	fish	1 (.02)	phenanthrene
46	soil	non-detectable	
47	soil	non-detectable	
48	soil	non-detectable	
49	soil	8 (.01 - .04)	naphthalene
50	?	13 (.01 - .11)	naphthalene/pyrene
51	soil	8 (.01 - .05)	fluoranthrene
52	soil	10 (.01 - .13)	phenanthrene
53	soil	11 (.01 - 1.6)	1,2-benzanthracene/ benz(b)fluoranthrene
54	?	non-detectable	
55	soil	10 (.01 - .05)	benzo(e)pyrene
57	soil	13 (.01 - .16)	phenanthrene
58	soil	9 (.01 - .09)	benzo(e)pyrene
59*	sediment	non-detectable	
60*	soil	non-detectable	
61*	sediment	non-detectable	
62*	soil	non-detectable	
63*	soil	non-detectable	
64	soil	6 (.01 - 1.0)	phenanthrene/ chrysene
65*	soil	non-detectable	
66	soil	6 (.01 - .04)	phenanthrene
67	soil	10 (.01 - .31)	1,2-benzanthracene
68	soil	6 (.01 - .47)	phenanthrene

+ = there is a total of 14 PAH compounds
* = control sample

AT-34; 4.1 ppm), Siddens Valley's powerhouse (Site AT-42; 3.7 ppm) and in paint chips collected from Navy Town's paint shop (Site AT-50; 11 ppm). PAHs were not detected in any fish sample.

Inorganics With the exception of lead, all inorganic analytes were detected in Dolly Varden fish specimens. Dolly Varden collected from Site AT-56 (Coast Guard Pumphouse Pool) had the most number (4) of highest mean inorganic concentrations (Table 3). However, threespine stickleback collected from Site AT-32 (Lake Nicholas) had the highest observed concentrations for six of the eleven inorganic analytes.

Seventeen of 23 sediment sample sites had selected inorganic analytes with concentrations above control sediment sample concentrations (Table 4). Samples collected from ponds in East Massacre Valley (Site AT-6) had the highest number of analytes (9 of 11) which exceeded control concentrations. The same site had the most analytes (Cd, Cr, Cu, Pb,) with the highest concentrations.

Twenty-six of 34 soil sample sites had selected inorganic analytes with concentrations above control soil sample concentrations (Table 5). Soil collected off the concrete floor of a collapsed building (Site AT-51) and from around a barrel dump (Site AT-3) had the most analytes (7) which exceeded control concentrations. Site AT-51 also had the most analytes (Ni, Pb, Zn), with the highest concentrations.

TANAGA ISLAND

Organochlorines No analytes were detected above quantification limits in any soil sample. Only one sediment sampling site contained any organochlorines: Site TA-8 (Pumping Station; Total PCBs, .36 ppm to .40 ppm. Fish tissue was not available for organochlorine analyses.

Polycyclic Aromatic Hydrocarbons PAHs were detected in half of the soil and sediment samples and at concentrations less than 6.5 ppm. Table 6 summarizes the PAH analytical results. Fish samples were not available for PAH analyses. Soil collected around a fuel container (Site TA-4) had the most PAH compounds detected (11 of 14) and the highest concentrations. Site TA-7's (Paint Shed) soil samples also contained 11 PAH compounds; however, concentrations were lower. With the exception of one replicate, no PAHs were detected in any control soil sample.

PAH concentrations in sediment were lower than in soil. The highest PAH concentrations (.01 ppm to .15 ppm) in sediment were at Site TA-8, with chrysene being the most abundant. Even though Site TA-6 had 11 of 14 PAH compounds detected, their concentrations were low (< 0.08 ppm). PAHs were not detected in any control sediment.

Table 3. Summary of mean inorganic concentrations (ppm) in fish collected from Attu Island.

	SAMPLE SITES				
Element	**29**	**32**	**40**	**45**	**56**
aluminum	52	485	328	206	20
arsenic	.16	<0.2	<0.2	.13	.28
cadmium	<0.4	.61	<0.4	<0.4	<0.4
chromium	<1	3.8	1.0	2.7	1.7
copper	3.5	11.8	4.5	4.7	6.0
iron	144	866	798	616	169
lead	<4	<0.5	<4	<4	<4
mercury	.15	.38	.13	.10	.22
nickel	<2	2.2	<2	2.6	1.6
selenium	6.0	4.6	5.5	4.1	3.2
zinc	133	170	106	112	181

Site 29: Dolly Varden, Peaceful River, 3 composite, whole-body samples.

Site 32: Threespine stickleback, Lake Nicholas, 3 composite, whole-body samples.

Site 40: Dolly Varden, Bassett Creek, 1 composite, whole-body sample.

Site 45: Dolly Varden, Henderson River, 3 composite, whole-body samples.

Site 56: Dolly Varden, Peaceful River, 5 composite, whole-body samples.

Table 4. Summary of sediment sample sites with inorganic concentrations greater than control sample concentrations, Attu Island.

Sample Sites	INORGANIC ANALYTES										
	Al	As	Cd	Cr	Cu	Fe	Hg+	Ni	Pb	Se*	Zn#
Control	23500-37100	3-6	<0.5	7-21	103-152	37000-66300	.01-.02	16-18	<5-6	<.2-.3	48-74
2		16	2			77500			120		326
4									45		
6		17	9	471	1090	156000			689		1470
10			2			98500					
14									48		
15									28		
16		13	8			231000			100		1640
17									59		
20							.36				
23			3					42	23		
27					200				67		
34		32			509				110		736
36				29				110			
37									240		
40				32				27			87
44					176				10		91
45				23							94

+ = Virtually all samples were above control concentrations, but <.10 ppm.

* = Virtually all samples were above control concentrations, but <3.3 ppm.

= Virtually all samples were above control concentrations. Those listed are the highest observed concentrations.

Table 5. Summary of soil and other matrices sample sites with inorganic concentrations greater than control sample concentrations, Attu Island. Highest concentrations are underlined.

Sample Sites	INORGANIC ANALYTES (ppm) Al	As	Cd	Cr	Cu	Fe	Hg	Ni	Pb	Se	Zn
Control	2980-49600	.8-3.7	<0.3-0.5	5-35	11-57	1290-84100	.03-.11	2-38	<4-31	1.4-2.4	3-91
1			2		141		.16		89		243
3		25	4	70	147	129000			130		239
11			3	3300					5850		523
12			1								
13			2		179						292
28	66100	14			132						
30					80						
31			4		141				480		1710
38			4						400		2110
39		12	2		74				78		1070
41					91		.23		75		215
42		11			352				210		1410
43		7	3		292	122000			2120		
46					141						
47					105						
49					90				190		
50 (Paint Chips)		16	8		112000		.20		8170		2100
51			10	230	1600	171000		290	32700		11700
52					1650				310		485
53											242
54 (? matrix)		45	24				.14		620		6370
55					85				52		
57					466		.15		110		1330
58		17			198				21500		421
64						422000					639
66		8	17		155		.56		170		676
67		12			92						236
68							.14				

Table 6. Summary of polycyclic aromatic hydrocarbon analytical data, Tanaga Island.

Site No.	Matrix	No. of Compounds + Detected and Conc. Range (ppm)	Most Abundant PAH Compound Detected
1	soil	7 (.03 - 2.2)	chrysene
2	soil	5 (.02 - .19)	1,2-benzanthracene
3	soil	non-detectable	
4	soil	11 (.01 - 6.5)	phenanthrene
5	soil	non-detectable	
6	sediment	13 (.01 - .08)	pyrene
7	soil	11 (.01 - .08)	benzo(b)fluoranthrene
8	sediment	10 (.01 - .15)	chrysene
9	sediment	non-detectable	
10	sediment	3 (.10 - .37)	phenanthrene
11	fish	no samples analyzed	
12*	soil	7 (.01 - 1.4)	benzo(e)pyrene/chrysene
13*	sediment	non-detectable	
14	fish	no samples analyzed	
15	sediment	non-detectable	

+ = there is a total of 14 PAH compounds
* = control sample

Inorganics The following summarizes the range of concentrations (ppm) or mean concentration (ppm) of soil, sediment and fish collected from Tanaga Island.

	Soil (range)	Sediment (range)	Dolly Varden (mean, n=3)
Aluminum	21400 - 38800	573 - 52700	45
Arsenic	1.1 - 6.6	0.2 - 17.8	<0.2
Cadmium	<0.4 - 2.6	<0.3 - 8.9	.12
Chromium	5.7 - 25	2 - 26	1.0
Copper	17 - 67.4	11 - 215	5.6
Iron	19100 - 35300	39300 - 466000	564
Lead	<5 - 140	<3 - 90	<0.5
Mercury	<0.01 - 0.17	<0.01 - 0.46	0.73 - 0.77
Nickel	8.5 - 18	<3 - 17	.63
Selenium	<0.1 - 0.55	<0.1 - 0.8	0.89 - 1.4
Zinc	29 - 453	21 - 1170	165

The majority of the highest inorganic concentrations (Hg, Se, Cd, Cu, Zn) in soil were associated with Site TA-7, the paint shed. Site TA-2 (Workshop #1) had the highest concentrations of chromium, iron and lead in soil. Soil samples from around the fuel container (Site TA-4) had the highest arsenic levels. Site TA-12, the control soil site, had data anomalies, as unusually high levels of aluminum and nickel were detected.

The majority of the highest inorganic concentrations (Hg, Se, As, Cr, Cu, Ni, Zn) in sediment were associated with Site TA-8, the pumping station. With the exception of lead, Site TA-6 (Drainage Ditch) had the highest concentrations for the remaining inorganics. Lead values were highest at Site TA-15, the radio shack. The lowest inorganic concentrations detected occurred in the control sample (Site TA-13), except for aluminum.

LITTLE KISKA ISLAND

Organochlorines No analytes were detected above quantification limits in any soil and sediment samples. However, all three threespine stickleback samples collected from Site LK-2 (Gun Emplacement Hill Lake) contained low levels (0.02 ppm) of the DDT isomer, p,p'-DDE.

Polycyclic Aromatic Hydrocarbons Fish and soil samples did not contain any detectable levels of PAHs. Low PAH levels were detected in sediment collected from sites LK-1 (Gun Emplacement Hill Lake) and LK-3 (Sluff Lake). Only three of 14 compounds [benzo(b)fluoranthrene, benzo(e)- and benzo(a)pyrene] were detected (0.01 to 0.11 ppm) in LK-1 samples. Naphthalene and benzo(a)pyrene were the only compounds detected (0.04 ppm) in LK-3 samples.

Inorganics The following summarizes the range of concentrations (ppm) or mean concentrations (ppm) of soil, sediment and fish collected from Little Kiska Island.

	Soil (mean, n=3)	Sediment (range)	Three spine stickleback (mean, n=3)
Aluminum	81066	154000 - 354000	437
Arsenic	9.7	0.4 - 1.7	0.2
Cadmium	0.61	<0.3 - 0.4	.45
Chromium	7.3	3 - 4.2	1.9
Copper	65.7	8.3 - 60.2	17.2
Iron	47800	106000 - 214000	430
Lead	7	<5	<0.5
Mercury	0.10	<0.01 - 0.04	0.29
Nickel	6	<2 - 4	1.0
Selenium	1.6	<0.1 - 0.9	5
Zinc	64.7	24 - 32	296

Gun Emplacement Lake had the highest concentrations of iron and copper in sediment, whereas Sluff Lake had the highest concentrations of aluminum in sediment.

GREAT SITKIN ISLAND (Fox Creek Drainage)

Organochlorines No analytes were detected above quantification limits in any sediment sample. One soil-sample-replicate (Site GS-3, Road Transformers) did contain 0.42 ppm PCBs.

Polycyclic Aromatic Hydrocarbons Most soil and sediment samples did not contain many PAH compounds; however, a total of ten compounds were detected (all <0.06 ppm) in soil collected from Site GS-3. The remaining samples had less than 5 compounds detected, all at the minimum level of detection.

Inorganics The following summarizes the range of concentrations (ppm) and mean concentrations (ppm) detected in soil and sediment collected from Great Sitkin Island.

	Soil (range)	Sediment (mean, n=3)
Aluminum	22700 - 29100	26400
Arsenic	1.0 - 3.1	3.1
Cadmium	0.7 - 1	<0.3
Chromium	2 - 4.3	<2.0
Copper	19 - 427	49.8
Iron	16800 - 32100	25866
Lead	<5 - 38	<5
Mercury	0.06 - 0.14	0.77
Nickel	<3	3.7
Selenium	0.20 - 0.41	0.13
Zinc	43 - 281	30

Site GS-2 (Building Transformers) had significantly elevated copper and lead concentrations, when compared to other soil samples from Great Sitkin Island. Site GS-4 (Collapsed Building) had the highest reported zinc concentration (281 ppm).

SEMISOPOCHNOI ISLAND

Organochlorines No analytes were detected above quantification limits in any soil and sediment samples.

Polycyclic Aromatic Hydrocarbons Only the soil collected from Site SE-3 (Barrel Dump) had any detectable levels of PAHs. The seven detectable PAHs ranged from 0.01 to 2.3 ppm, with phenanthrene having the highest concentrations.

Inorganics The following summarizes the range of concentrations (ppm) detected in collected samples.

	Soil	Sediment
Aluminum	18100 - 33500	11000 - 27500
Arsenic	1.3 - 17.5	0.7 - 1.7
Cadmium	<0.2	<0.2
Chromium	3.5 - 50	4.2 - 8.3
Copper	41.3 - 159	56.9 - 117
Iron	28000 - 243000	10400 - 50000
Lead	<5 - 150	<6
Mercury	0.05 - 0.06	0.06 - 0.14
Nickel	3 - 54	2 - 4.7
Selenium	non-detectable - 0.4	0.7 - 1.6
Zinc	22 - 55	36 - 65

Site SE-3 (Barrel Dump) had the highest inorganic concentrations detected in soil.

DISCUSSION

DATA INTERPRETATION

The process of interpreting sample chemical analyses is aimed at addressing the question "Do the sample data indicate a problem exists?" In its simplest form this act would appear to consist of comparing each sample datum with a list of action levels or threshold levels (= criteria), above which a problem - albeit undefined - exists. Indeed, this would be ideal. However, a variety of problems impede this approach.

In the cases of water and soil/sediment, the total amount of a chemical reported for a sample is not synonymous with the amount that is (biologically) available. The latter is strongly influenced by a complex suite of physical, chemical and biological factors (e.g. pH, Eh, hardness, alkalinity, salinity,

concentration of organic matter, texture). One never has all relevant information for each sample that would allow adjustment of calculated values prior to comparison with a list of criteria (Long and Morgan, 1990; Shea, 1988).

In the case of tissue samples, a different criterion may exist for each species, as well as the particular tissue within that species (e.g. liver vs. kidney vs. muscle vs. whole body homogenate). Moreover, a sublethal criterion (e.g. avoidance, impaired growth, impaired reproductive success) is much lower than a criterion for safe consumption levels or acute mortality.

These and other problems with developing a single set of rigid criteria are thoroughly discussed in Long and Morgan (1990) and Soholt, et al (1981). Nevertheless, an arbitrary set of criteria has been subjectively constructed by amalgamating a variety of information including: EPA's water quality criteria (1980); review papers/series that offer lists of "action levels"; U.S. Food and Drug Administration's (1990) action levels for poisonous or deleterious substances in human food; World Health Organization's list of water quality criteria; and sundry literature dealing with some sort of biological effect of one, a few, or a group of individual chemicals. As many of the above sources as time allowed were reviewed prior to finalizing the set (Appendix C).

Our approach to interpretation consists of a 4-step process, essentially comparing each laboratory-reported value to a series of screens:

(1) Background or control samples taken from the study area (Table 2);
(2) The subjective set of criteria (Appendix C);
(3) Literature values listing averages and ranges for Alaska (i.e. pooled samples) (Gough et al. 1988);
(4) Literature values listing averages and ranges on a worldwide basis (Fortescue, 1980).

In general, we did not consider a sample value problematical unless it exceeded one order of magnitude of the appropriate screen(s). This is a common strategy designed to provide a buffer for a variety of sources of inherent variance, principally site specificity and laboratory methodology.

The final step in data interpretation requires categorizing each site's overall contamination relative to: 1) the types and quantity of contaminants analytically determined to be on-site; 2) the contamination observed to be on-site and 3) the contaminants potential for causing environmental damage.

The contamination categories are:

Low = no contamination of concern was discovered on the site or what was found does not pose an environmental threat.

Medium = contamination discovered on the site is a concern because either Service criteria have been exceeded, gross contamination exists and/or the presence of specific compounds may be indicative of a larger, undefined contaminant problem.

High = contamination discovered on the site poses an environmental threat. Therefore, a detailed site investigation should be performed and the site remediated.

FINDINGS

Of the 67 contaminants analyzed in each sample, 14 analytes have been preliminarily identified as a potential environmental concern (Table 7). These contaminants are of concern because: 1) their concentrations exceed select criteria for the protection of human health and the environment; 2) their concentrations are elevated enough to be potentially toxic (i.e., carcinogenic, mutagenic, bioaccumulate) to humans and the environment; or 3) their mere presence may be indicative of a more extensive problem that has yet to be fully delineated. Profiles of the 15 contaminants of concern are presented in the Appendix D. The following discusses the potential environmental hazards, or lack thereof, at each study area.

Attu Island

Twelve contaminants of concern have been identified on Attu Island (Table 7).

Organochlorine contamination in the aquatic systems the Service sampled does not exist. However, gross organochlorine contamination was discovered at one site (AT-66) and lesser contamination was discovered at three other sites (AT-50, 67, and 68).

The 5800-to-9200 ppm PCBs (Arochlor 1254) discovered at Chichagof Point's radio shack (Site AT-66) was the highest concentration discovered on the island and poses a threat to the area's wildlife, and possibly to Coast Guard personnel stationed on the island. The possible sources of PCBs are deteriorated radio communication equipment and associated capacitors, switches and transformers.

The low PCB levels (.21-.26 ppm) found at Site AT-67 probably originated from the disposal PCB-tainted liquids in the burn pit. Site AT-68's PCBs (.36-.93 ppm) probably originated from leaks in the overhead electrical transformer. Although the levels found at these two site are low and do not pose an environmental threat, their presence may indicate that a larger problem exists, which could be defined by additional, more wide-spread sampling.

Table 7. List of contaminants of concern, Aleutian Islands military contaminants study, Alaska Maritime National Wildlife Refuge, 1988-1990.

POLYCYCYLIC AROMATIC HYDROCARBONS	Attu	Tanaga	Little Kiska	Great Sitkin	Semisopochnoi
naphthalene	x				
phenanthrene	x	x			x
fluoranthene	x				
pyrene	x				
chrysene	x	x			
benzo(e)pyrene	x	x			
benzo(a)pyrene	x				
1,2-benzanthracene	x	x			
ORGANOCHLORINES					
PCBs	x	x		x	
p,p'DDE			x		
INORGANICS					
arsenic		x			
chromium	x				
copper	x			x	
lead	x				

The unknown organochlorine fractions at Site AT-50 may be environmentally threatening, however, further analytical testing would be necessary to make a final determination.

Past Service investigations have discovered PCB contamination on other refuges. Fifty ppm PCB found on the Kenai National Wildlife Refuge, initiated a large remedial measure, on the part of the oil industry, to cleanup (by removal and incineration) PCB-contaminated soil to variable levels based on the location. At the Cape Newenham Air Force Station, located on the Togiak National Wildlife Refuge, 3000 ppm PCBs were discovered and the Air Force is in the process of cleaning the site to a level of 10 ppm.

The Environmental Protection Agency's (EPA) "Polychlorinated Biphenyls Spill Cleanup Policy" (Policy) (52 FR 10688. April 2, 1987) applies to all spills occurring after May 4, 1987 and involving more than 50 ppm PCBs. Even though the PCB contamination on Attu Island probably occurred after 1987, the Policy can be use as a guide to prepare a mitigation plan. The PCB levels found at Site AT-66 are classified by the Policy as "high-concentration PCBs," because the levels found contain more than 500 ppm PCBs. The PCB levels at sites AT-67 and 68 fall below the Policy's 50 ppm criterion.

The Policy requires cleanup of PCBs to different levels depending upon spill location, the potential for exposure to residual PCBs remaining after cleanup, the concentration of the PCBs initially spilled, the nature and size of the population potentially at risk of exposure, etc. The most stringent cleanup standards would be for "residential/commercial area;" less stringent standards exist for "restricted access areas, both with and without substations." Because the Attu Island sites are remotely-located, in a restricted area and near residential facilities, it is difficult to select the appropriate cleanup standards. Final cleanup standards could be any of the following: 10, 25, or 50 ppm PCBs, with or without a clean soil cap.

Therefore, Service (i.e., Ecological Services Anchorage, and Togiak National Wildlife Refuge) staff should work with EPA, the Alaska Department of Environmental Conservation, and Corps to develop a remedial plan-of-action, using EPA's Policy as a guide. Because the Corps is the agency responsible for cleaning up abandoned military facilities, the Service expects the Corps to adopt the remedial plan and cleanup the PCB-contaminated soil.

Analytical data indicate that PAH contaminations at the majority of the soil/sediment sample sites are above background concentrations (<11 ppm), but are not characteristic of gross contamination. However, selected PAH compounds were detected at levels associated with "moderate soil contamination" (phenanthrene, 6.3 ppm at Site AT-22 and 3.7 ppm at Site AT-42; benzo(a)pyrene, 2.6 ppm at Site AT-5; naphthalene, 11 ppm at Site

AT-50): See Appendix C. One might want to draw conclusions, based on analytical data alone, that the island is not contaminated with PAHs. On the contrary, Attu Island is grossly contaminated with petroleum products. Field observations of Bunker "C" fuel and other POL spills (which were not directly sampled) indicate widespread petroleum contamination exists in Navy Town, Peaceful Valley and East and West Massacre valleys.

The Service's discovery of petroleum contamination in Navy Town is not surprising because the area has a history of documented spills. In 1966, the Service conducted a trip to investigate a reported oil slick in Massacre Bay. It was discovered that faulty valves and broken lines were leaking Bunker "C" fuel oil into the unnamed creek which drains the Navy Town-area (Helvie, 1966). The Service and U.S. Coast Guard concluded that the only way to permanently eliminate seepage into the bay was to burn the bunker oil and aircraft fuel. A more thorough Coast Guard investigation of the problem in April 1967 came to the same conclusion (Bates, 1967). The Service, working through the Bureau of Land Management, convinced the Navy to remediate the situation prior to the affected land reverting to the jurisdiction of the Service (Silcock, 1967). In May 1968, the Service stated they had no objection to the Navy's relinquishment of the effected area, as the pollution problem had been "solved." In June 1970, Service biologists reported oil pollution problems in Massacre Bay and contamination in West Massacre and Peaceful River valleys (Spencer, 1970). The Navy received permission from the Coast Guard in August 1970 to burn the remaining fuel in Navy Town's storage tanks and pipelines and other petroleum deposits. The Service inspected the disposal of stored oil in September 1970 and it was estimated that 1000 gallons of oil remained unburned. The Navy proposed to cover any un-burnable oil with fill material. It was observed that the fuel distribution system (i.e., underground pipeline) was the source of pollution to the creek and that the creek would have a persistent iridescent film. The Service concluded that "The crew performing this demolition appears to have done a rather complete job..." (Evans, 1970).

Many underground pipelines and associated valve boxes and pumping stations in Navy Town continue to leak fuel profusely. Large collapsed fuel tanks continue to have fuel pooled within its retaining dikes. The creek draining the Navy Town-area continues to an oily sheen and fuel is abundantly splattered on its vegetated banks.

The Peaceful River Valley is littered with "contaminant time bombs." Site AT-47 is grossly contaminated with asphalt, as asphalt was slowly flowing into the Peaceful River. Dozens of barrel dumps litter the valley, many of which contain POL residues and ammunition.

All inorganic concentrations in whole-body Dolly Varden and threespine stickleback samples were below Service criteria and therefore do not constitute any biological threat.

The following lists the soil sample sites which exceeded Service criteria:

Arsenic:	Sites AT-3 and 54.
Cadmium:	Sites AT-3, 31, 38, 51, and 66.
Chromium:	Sites AT-11, 51.
Copper:	Sites AT-13, 42, 43, 51, 52, 57, 58, and 66.
Nickel:	Site AT-51
Lead:	Sites AT-11, 31, 38, 43, 51, 52, and 58.
Zinc:	Sites AT-11, 31, 38, 39, 42, 51, 52, 57, 58, 64, and 66.

Copper, chromium, iron, lead and zinc had the highest concentrations in soil samples. Site AT-51's elevated lead, zinc, iron and copper concentrations may be due to inadvertently collecting nails and metal particles with the soil, as such items were abundantly scattered on the concrete foundation. Site AT-58's high lead concentrations is probably a result of lead leaching from the cracked 12-volt batteries which litter the area. The occurrence of high chromium and lead levels in soil collected from Casco Cove's barrel dump (Site AT-11) can not be explained.

Inorganic concentrations in Attu Island's sediment samples were compared to values in EPA's freshwater sediment, pollution classification system and categorized as "non-polluted, moderately or heavily polluted:" See Appendix C. All arsenic concentrations are classified as "heavily polluted" and above control concentrations, which ironically were classified as "moderately polluted." Chromium concentrations at Site AT-6 are "heavily polluted" and sites AT-36 and AT-40 are "moderately polluted." Control samples and samples from sites AT-6, 27, 34 and 44 are all classified as having heavy copper pollution. Iron concentrations in all samples are classified as "heavily polluted." Sites AT-4, 14, 17, 23 and 40 have moderate nickel pollution, sites AT-2, 6, 16, 27, 34, 36, and 37 have heavy nickel pollution and the remaining sediment samples were not polluted with nickel. Sites AT-2, 6, 16, and 34 have zinc concentrations classified as "heavily polluted" and sites AT-44 and 45 are "moderately polluted."

Paint chips from site AT-50, and white crystalline powder from site AT-54 respectively exceed the following Service criteria: Cd, Cu, Pb, Zn; As, Cd, Pb, Zn. Site AT-50's elevated lead concentrations proves that the paint is lead-based: there is no explanation why copper levels (112000 ppm) were so high in the paint chips. Analytical data failed to assist in identifying the white crystalline powder collected at Site AT-54.

In conclusion, the Attu Island sample sites have been assigned to one of the following contamination categories. Please refer to the Data Interpretation section of this report for category definition.

None: 4, 7, 8, 9, 10, 12, 14, 16, 17, 20, 21, 23, 24, 27, 29, 32, 33, 36, 40, 44, 45, 48, 55, 56, 59, 60, 61, 62, 63, 65.

Medium: 1, 2, 5, 6, 11, 15, 18, 19, 30, 31, 34, 35, 37, 39, 41, 46, 49, 51, 52, 54, 57, 64.

High: 3, 13, 22, 28, 38, 42, 43, 47, 50, 53, 58, 66, 67, 68.

It should be noted that remediation should be quickly initiated to isolate the PCB contamination at Chichagof Point and that further sampling should be initiated to define the distribution and abundance of PCBs at the other sites testing positive for PCBs. In view of the carcinogenic characteristics of many of the PAH compounds detected, it seems prudent to reduce or eliminate them from the refuge environment. Therefore, cleanup of POLs (especially in the Navy Town-area) should also be initiated quickly to curb the POL leaching into neighboring creeks and wetlands.

Tanaga Island

Six contaminants of concern have been identified on Tanaga Island (Table 7).

Polychlorinated biphenyl was the only organochlorine found in soil samples collected from Tanaga Island. Their presence at Site TA-8 (Pumping Station; .36 to .40 ppm) may be indicative of widespread, low-level contamination. One possible source is the nearby electrical transformer which may have leaked or was drained in the area. The amount of surface-area and the depth of PCB contamination is unknown. Although the detected levels do not pose an environmental threat, more extensive sampling may discover higher concentrations which do.

Analytical data indicate that PAH contamination on Tanaga is low, as all PAH compounds were < 6.5 ppm. No criteria were exceeded which require immediate cleanup; however, direct sampling of barrels and tanks storing POLs and associated spills (which would have resulted in analytical data exceeding criteria) did not occur. The highest PAH concentrations (phenanthrene) were associated with Site TA-4, the leaking Lash Bay Road fuel container. Phenanthrene's concentration classifies the site's soil as having "moderate contamination" that requires further study: See Appendix C. Despite obvious signs of POL spills and barrels containing residual petroleum products, no PAH compounds were detected at Site TA-5, the huge barrel dump near Lash Bay. In view of the carcinogenic characteristics of many of the PAH compounds detected, it seems prudent to reduce or eliminate them from the refuge environment. Therefore, cleanup of POLs should be initiated to curb POL leaching into neighboring creeks and wetlands.

Inorganic concentrations in whole-body fish specimens did not exceed Service criteria. Mercury, selenium, aluminum, cadmium and nickel concentrations in soil and sediment samples did not exceed Service criteria and are considered "clean." Selected sediment and soil samples did contain inorganic concentrations classified as "moderately" and/or "heavily" polluted. Sediment collected from a drainage ditch (Site TA-6) was heavily polluted with arsenic and iron, and moderately polluted with zinc. Sediment collected in proximity to a pumping station (Site TA-8) was heavily polluted with arsenic, copper, iron, and zinc, and moderately polluted with chromium and lead. Sediment collected near a communication center (Site TA-15) was moderately-to-heavily polluted with chromium, moderately polluted with zinc, and heavily polluted with lead.

In conclusion, Tanaga Island's sample sites have been assigned to one of the following contamination categories. Please refer to the Data Interpretation section of this report for category definition.

None: 3, 6, 7, 9, 12, and 13.

Medium: 1, 2, 4, 8, 15.

High: 5, 8, 15.

Little Kiska Island

One contaminant of concern has been identified on Little Kiska Island (Table 7).

The only organochlorine detected on the island was 0.02 ppm p,p'-DDE in three spine stickleback from Gun Emplacement Hill Lake. This concentration did not exceed Service criteria; however, additional sampling of the lake should be conducted to determine its distribution and abundance.

Evidence of petroleum contamination on the island was very low. Those sites suspected of POL contamination were analytically determined to have no, or very low, PAH concentrations. However, direct sampling of barrels and tanks storing POLs and associated spills (which would have resulted in analytical data exceeding criteria) did not occur. In view of the carcinogenic characteristics of many of the PAH compounds possibly detected in the barrels, tanks and spills, it seems prudent to reduce or eliminate them from the refuge environment.

Inorganic concentrations in soil and fish samples did not exceed Service criteria. However, copper and iron in sediment from Gun Emplacement Hill Lake occurred in concentrations classified as heavily polluted.

In conclusion, Little Kiska Island's sample sites have been assigned to one of the following contamination categories. Please refer to the Data Interpretation section of this report for category definition.

None: 2, 3 and 4.

Medium: 1.

High: NONE

Great Sitkin Island (Fox Creek Drainage)

Two contaminants of concern have been identified in Great Sitkin Island's Fox Creek drainage (Table 7).

Only one organochlorine was present in samples collected from the Fox Creek drainage. The low PCB level (.42 ppm) found at Site GS-3 was probably the result of leaking fluid from nearby transformers. Although the levels found do not pose an environmental threat, their presence may indicate that a larger problem (wide distribution and higher concentrations) exists, which could be defined by additional sampling.

Analytical data indicate that PAH contamination in Great Sitkin's Fox Creek is low, as all PAH compounds were < .06 ppm. No criteria were exceeded which require immediate cleanup; however, direct sampling of barrels and tanks storing POLs and associated spills (which would have resulted in analytical data exceeding criteria) did not occur. In view of the carcinogenic characteristics of many of the PAH compounds detected, it seems prudent to reduce or eliminate them from the refuge environment.

Only copper levels in Site GS-2 (Building Transformers) soil samples exceeded Service criteria, as concentrations were over 400 ppm. Sediment samples from the upper reaches of Fox Creek (Site GS-1) were moderately polluted with copper and heavily polluted with iron.

The Service's findings of low-level contamination in the Fox Creek drainage is in sharp contrast to Service findings in the highly and grossly contaminated Little Fox Creek drainage (Crayton, 1990). High priority should be given to remediate the PCB and POL contamination in Little Fox Creek's drainage before conducting any cleanup in the Fox Creek drainage.

In conclusion, Great Sitkin Island's sample sites have been assigned to one of the following contamination categories. Please refer to the Data Interpretation section of this report for category definition.

None: 1 and 4.

Medium: 2.

High: 3.

Semisopochnoi Island

One contaminant of concern has been identified on Semisopochnoi Island (Table 7).

Organochlorine analytes were not detected above quantification limits in any samples and therefore do not pose an environmental threat to the refuge's resources.

Only the Barrel Dump site (SE-3) had any evidence of petroleum-type contamination. PAH concentrations were not elevated; however, more extensive sampling may reveal higher, more widely distributed soil contamination. With the exception of cadmium, inorganic concentrations in Site SE-3's soil were significantly more elevated than background levels. Sediment collected from sites SE-1 (Camp Lake) and the control lake (SE-4) contained copper levels classified as "heavily polluted," which would infer that the area's background concentration for copper in sediment is naturally elevated.

In conclusion, the Semisopochnoi Island sample sites have been assigned to one of the following contamination categories. Please refer to the Data Interpretation section of this report for category definition.

None: 1, 2, 4, 5.

Medium: 3.

High: NONE

The barrel dump could pose a biological threat to refuge resources if allowed to deteriorate and leach elevated levels of inorganics and PAHs. Therefore, in view of the carcinogenic characteristics of many of the compounds detected, it seems prudent to reduce or eliminate them from the refuge environment.

CONCLUSIONS AND RECOMMENDATIONS

Data indicate that the most contaminated island investigated is Attu Island and that its numerous petroleum seeps and spills pose a direct threat to the refuge's aquatic and wildlife resources. Further consultation with the U.S. Environmental Protection Agency might conclude that Coast Guard personnel stationed on Attu Island and recreate around the island may also be at risk. It is important to note that are other areas on Attu Island (e.g.

Holtz Bay, Alexai Point/Creek, Upper West Massacre Valley) that have not been inspected for contaminants. Conducting such inspections may discover areas more contaminated than those already identified in this report.

Tanaga Island, with its low-level PCB contamination and petroleum seep is ranked as the second most contaminated site. Of less immediate concern is the contamination in Great Sitkin Island's Fox Creek drainage (not to be confused with Great Sitkin Island's highly contaminated Little Fox Creek drainage; see Crayton, 1990), Little Kiska Island and Semisopochnoi Island, as the number and concentrations of hazardous substances and POL constituents was generally less than those found on Attu and Tanaga islands.

Potential biological receptors (i.e., organisms subject to being contaminated) from soil contamination found on each of the islands include vegetation, birds, small mammals and humans. Service trust resources potentially affected include migratory birds and anadromous fish. Major media or pathways of concern for all the sites are dermal contact with soil, sediment, water, or waste; inhalation of contaminated suspended particles; and ingestion of contaminated soil and waste. The main migration pathway of concern is transport of contaminated surface soils via runoff into nearby stream habitat.

Efforts must be initiated to: 1) fully identify the contaminant release pathways, 2) prevent the migration of contaminants at concentrations that pose a threat to wildlife and other natural resources, and 3) confirm cleanup operations during the remediation process. The responsibility for such efforts lies with the Corps, as the Corps administers the Department of Defense's Defense Environmental Restoration Program (Program) which is designed to identify, evaluate, and cleanup hazardous waste sites on abandoned military bases and restore the areas to their near original state by implementing remedial actions. All the islands have been identified by the Corps as low-priority Program sites.

In conclusion, it is recommended that:

1. appropriate Regional Office, Field Office and Refuge staff meet to develop a strategy to facilitate a timely cleanup of the affected sites. At a minimum, a letter from our Regional Director to Colonel John W. Pierce (U.S. Army Corps of Engineers, Alaska District) should be sent informing him of our findings, as he has legislative responsibilities under the Defense Environmental Restoration Program to clean abandoned military facilities in Alaska.

2. the U.S. Army Corps of Engineers, under the auspices of the Defense Environmental Restoration Program and in consultation with the U.S. Fish and Wildlife Service, conduct detailed site investigation studies on (in priority)

Attu Island, Tanaga Island, Great Sitkin Island (Fox Creek Drainage), Little Kiska Island and Semisopochnoi Island to substantiate Service findings and delineate the full extent of contamination. Attu Island investigations should include Holtz Bay, Alexai Point/Creek and upper West Massacre Valley.

3. the U.S. Army Corps of Engineers, U.S. Environmental Protection Agency and Service meet to develop a remediation strategy and identify funding sources, to initiate response actions (institutional, containment, treatment and/or disposal) at the following contaminated sites which pose the greatest and immediate threat to wildlife and natural resources:

Attu:	3, 13, 22, 28, 38, 42, 43, 47, 50, 53, 58, 66, 67 and 68.
Tanaga:	5, 8 and 15.
Great Sitkin (Fox Creek drainage)	3.

4. the U.S. Coast Guard on Attu Island and the U.S. Environmental Protection Agency be informed of our findings about Attu Island's PCB contamination so that measures can be initiated, in concert, to investigate potential problems and if appropriate, minimize the exposure of military personnel.

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APPENDIX A

FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES ANCHORAGE
ALEUTIAN ISLANDS MILITARY CONTAMINANTS STUDY PLANS

FISCAL YEARS 1988-1990

U.S. Fish and Wildlife Service
Region 7

ENVIRONMENTAL CONTAMINANTS SAMPLING AT DEFENSE ENVIRONMENTAL RESTORATION PROGRAM CLEANUP SITES ALASKA MARITIME NATIONAL WILDLIFE REFUGE:

Great Sitkin Island — Little Kiska Island
Semisopochnoi Island — Tanaga Island
Attu Island

GENERAL STUDY PLAN
Supplement No. 1: Fiscal Year 1988 Activities

Principal Investigators:

Biological Technician
Alaska Maritime National Wildlife Refuge — Date 5/19/88

Refuge Manager
Alaska Maritime National Wildlife Refuge — Date 5/25/88

Concurrence/Approval:

Environmental Contaminants Specialist
Anchorage Field Office — Date 5/27/88

Environmental Contaminants Coordinator
Region 7 — Date 5/31/88

Refuges Contaminant Coordinator — Date 5/31/88

Project Identification Number: To Be Assigned in Fiscal Year 1989

U.S. Fish and Wildlife Service

Region 7

General Study Plan

Title

Environmental contaminants sampling at Defense Environmental Restoration Program cleanup sites - Alaska Maritime National Wildlife Refuge: Tanaga, Little Kiska, Attu, Semisopochnoi, and Great Sitkin Islands.

Objectives

Phase I.

1. Perform sampling at Tanaga, Little Kiska, Attu, Semisopochnoi, and Great Sitkin Islands on the Alaska Maritime National Wildlife Refuge to determine what contaminants, if any, may have entered the environment surrounding abandoned military installations.

2. Interpret analytical results and draw inferences as to the data's ecological significance and source of contaminants, if any.

Phase II.

1. Identify needs for remedial action and coordinate with other agencies to effect cleanup.

2. Conduct follow-up sampling after cleanup to ensure completion of program.

Justification and Background:

The Defense Environmental Restoration Program (P.L. 98-212, 97 Stat. 1427, Dec. 8, 1983) is part of a Department of Defense program designed to identify, evaluate, and cleanup hazardous waste sites on abandoned military bases and restore the areas to their near orginal state by implementing remedial actions. The program is administered by the U.S. Army Corps of Engineers.

The subject project sites are in the ownership of the Department of the Interior and administered by the U.S. Fish and Wildlife Service (Service) as part of the Alaska Maritime National Wildlife Refuge (Figure 1). The purposes for which the Alaska Maritime National Wildlife Refuge was established include, in part:

(i) To conserve fish and wildlife populations and habitats in their natural diversity . . .

(iv) To ensure, to the maximum extent practicable . . ., water quality and necessary water quantity within the refuge.

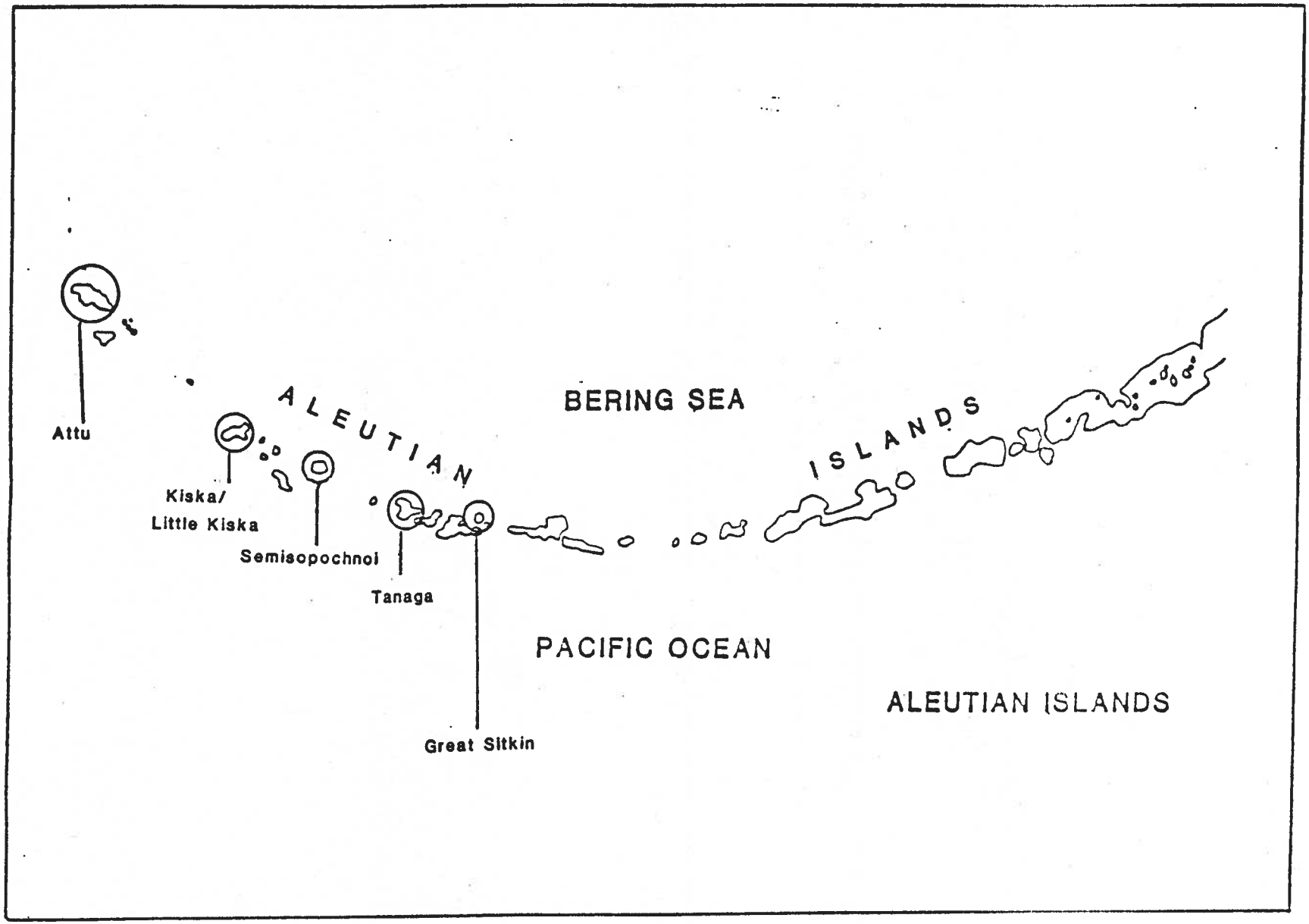

Figure 1: Location of contaminant sampling sites at abandoned military sites in the Aleutian Islands, July 1988.

As the agency charged with the public trust responsibility of managing and protecting the resources and habitats of the Alaska Maritime National Wildlife Refuge, the Service will conduct limited field investigations at the subject sites in an attempt to determine what contaminants, if any, may have entered the refuge environment.

Most of the abandoned military installations are known to contain either petroleum, oil, and lubricant (POL) products and spills or electrical transformers which may contain polychlorinated biphenols (PCBs). Extensive leaching of POL and PCBs into the surrounding environment, depending on their chemical make-up and concentration, could pose a threat to fish and wildlife resources.

The Anchorage Field Office collected contaminant samples around abandoned military installations on Agattu, Kiska, and Great Sitkin Islands between July 15 and August 11, 1987. Collected were 169 individual soil/sediment samples, 32 fish samples, and one individual fish sample. The fish consisted of Dolly Varden (Salvelinus malma), threespine stickleback (Gasterosteus aculeatus), and coastrange sculpin (Cottus aleuticus). Soil samples were collected from 23 sampling sites; sediment samples were collected from eight sampling sites; and fish smples were collected from five lakes and two streams.

The most dramatic evidence of contaminated refuge habitat was found on Great Sitkin Island, a site the Service knew little about. Of Great Sitkin's 39,219 acres, 700 acres are affected by military debris (Figure 2). During World War II, Great Sitkin was utilized as a fuel station by the Navy. The site is located on the south side of the island and has roads, quonset huts (48), wood frame buildings (31), concrete foundations, ammunition magazines (18), pumphouses (2), boilers and generators (2), fuel storage tanks (50), a dock, submarine nets (5), floats and miscellaneous debris (U.S. Army, 1977). The greatest threat to fish and wildlife resources are the pumphouses, generators, and fuel storage tanks.

Some petroleum products remain in partially demolished storage tanks on the island. At some unknown time prior to 1977 these tanks were incompletely burned which caused the internal structure to collapse and spill their fuel contents onto the ground. The fuel was absorbed into the soil and two years later surfaced nearly one-half mile away in the ocean thereby presenting a hazard to local fish and wildlife. In August 1987, the Service collected soil, sediment, and fish samples from seven sites within the drainage. Large pools of petroleum products were discovered in the Little Fox Creek drainage which is pocketed with large fuel storage tanks. One pool was found draining directly into the Creek. Other pools were found to contain numerous submerged and floating rosey finch carcasses and unidentifiable bird species. No results have been received from 1987's sampling efforts therefore 1988's activities will center on collections in the Fox Creek drainage which lies just west of Little Fox Creek.

Ocean Technology, Ltd., under contract with the U.S. Army, visited Tanaga Island to conduct a site inventory of the abandoned military installation (Ocean Technology, Ltd., 1986).

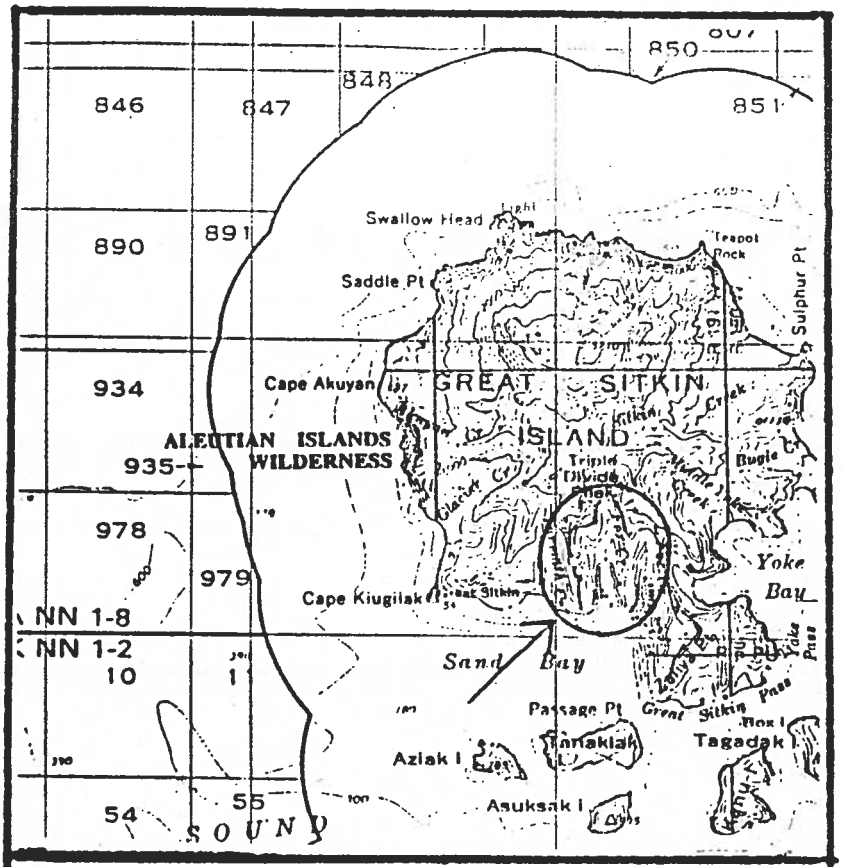

Figure 2: Location of contaminant sampling site on Great Sitkin Island, July 1988.

Of Tanaga's 128,000 acres, 774 acres were used for military purpose. The abandoned facility is located in the southwest corner of the island, on Cape Amagalik (Figure 3). The installation contains a wide variety of wastes and debris; however, only those sites the Service suspects as being contaminated are identified and discussed hereafter. West of a quarry camp is a dump containing rusted, empty 55-gallon drums. Some of these drums still contain diesel and asphaltic material. Combination generator shed/radio shacks are located at the north and south ends of the airstrip, both have 300-gallon, empty fuel tanks behind them. Adjacent to the southwest corner of the airstrip are barrels filled with used engine oil. Alongside a gravel road from the north end of the airstrip are the remains of a generator shed with five gasoline fired generators. Nearby is an elevated transformer rack with two transformers. A small lake is located 400 feet north of this facility. At the southeast end of the lake is a well house which supplies water to the quarry camp. In the vicinity of the quarry camp is an 8-foot wide by 10-foot long fuel tank. Located near the airstrips and runway lighting generator building are pole mounted type transformers.

Attu comprises 223,312 acres and is the western-most island of the Aleutian Chain (Figure 4; U.S. Fish and Wildlife Service, 1988). Attu was occupied by the Japanese Army from June 7, 1942, to May 30, 1943, when the Japanese Army surrendered/lost. The battlefield covers 15 square miles on the eastern side of the island. It is unclear if this is the total acreage affected by military operations. At present, the Coast Guard occupies 1,800 acres with a loran station. The World War II debris consists of quonset huts, wood frame buildings, pumphouse, ammunition magazines, concrete foundations, utility poles, steel tanks and miscellanous debris (U.S. Army, 1977). There is very little textual information about the types and locations of hazardous material which may exist on Attu Island.

Semisopochnoi consists of 56,013 acres (Figure 5; U.S. Fish and Wildlife Service, 1988). The military's presence on the island affected the southern portion of the island. Military debris consists of quonset huts (8), a wrecked aircraft, and miscellanous debris (U.S. Army, 1977). Little textual information on the location of the debris is available.

Little Kiska comprises 1,843 acres (Figure 6; U.S. Fish and Wildlife Service, 1988). The military debris left consists of quonset huts (5), wood frame building (1), coastal-gun emplacements, anti-aircraft emplacements, miscellanous steel and wood debris, roads and POL barrels (100) (U.S. Army, 1977). Like Semisopochnoi Island, little textual information on the location of the debris is available.

The need for the Service to determine the presence or absence of contaminants at abandoned military sites in the Aleutian Islands is great because:

1) there is a potential for contaminants to be transferred from the facility through the food chain to Fish and Wildlife trust resources, and

2) the Service does not want to potentially inherit a contaminant problem when full land management authorities are acquired.

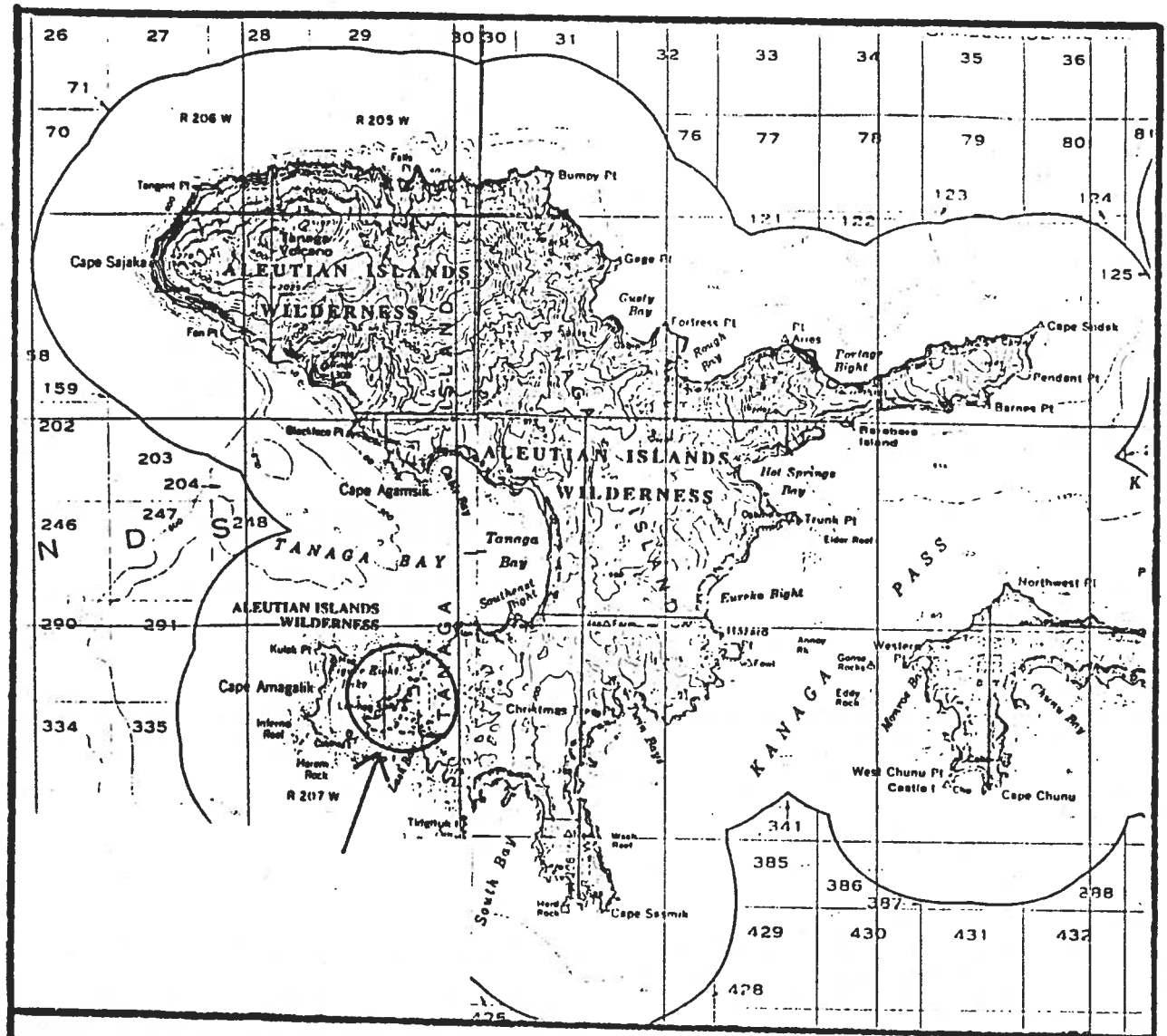

Figure 3: Location of contaminant sampling site on Tanaga Island, July 1988.

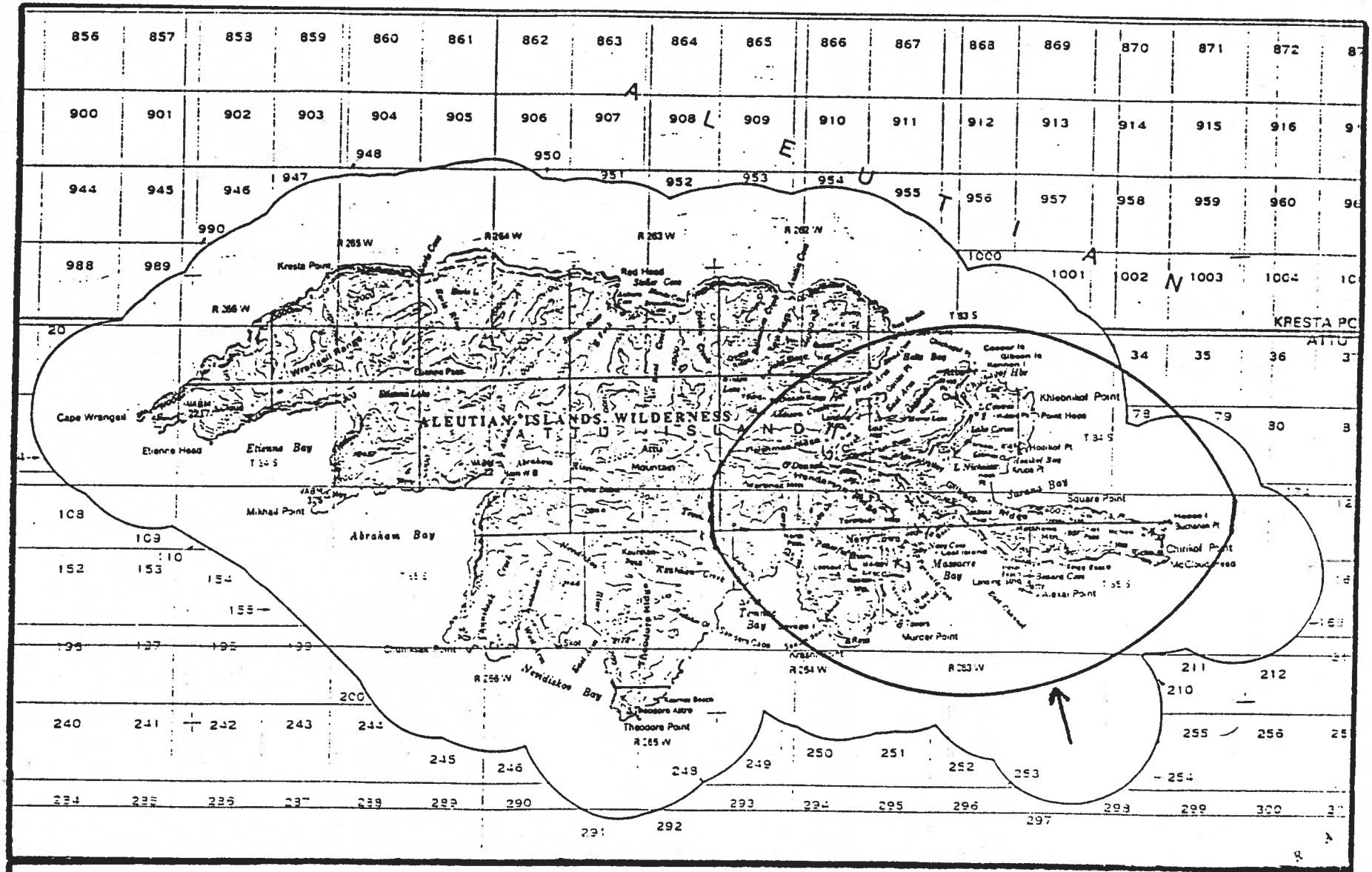

Figure 4: Location of contaminant sampling site on Attu Island, July 1988.

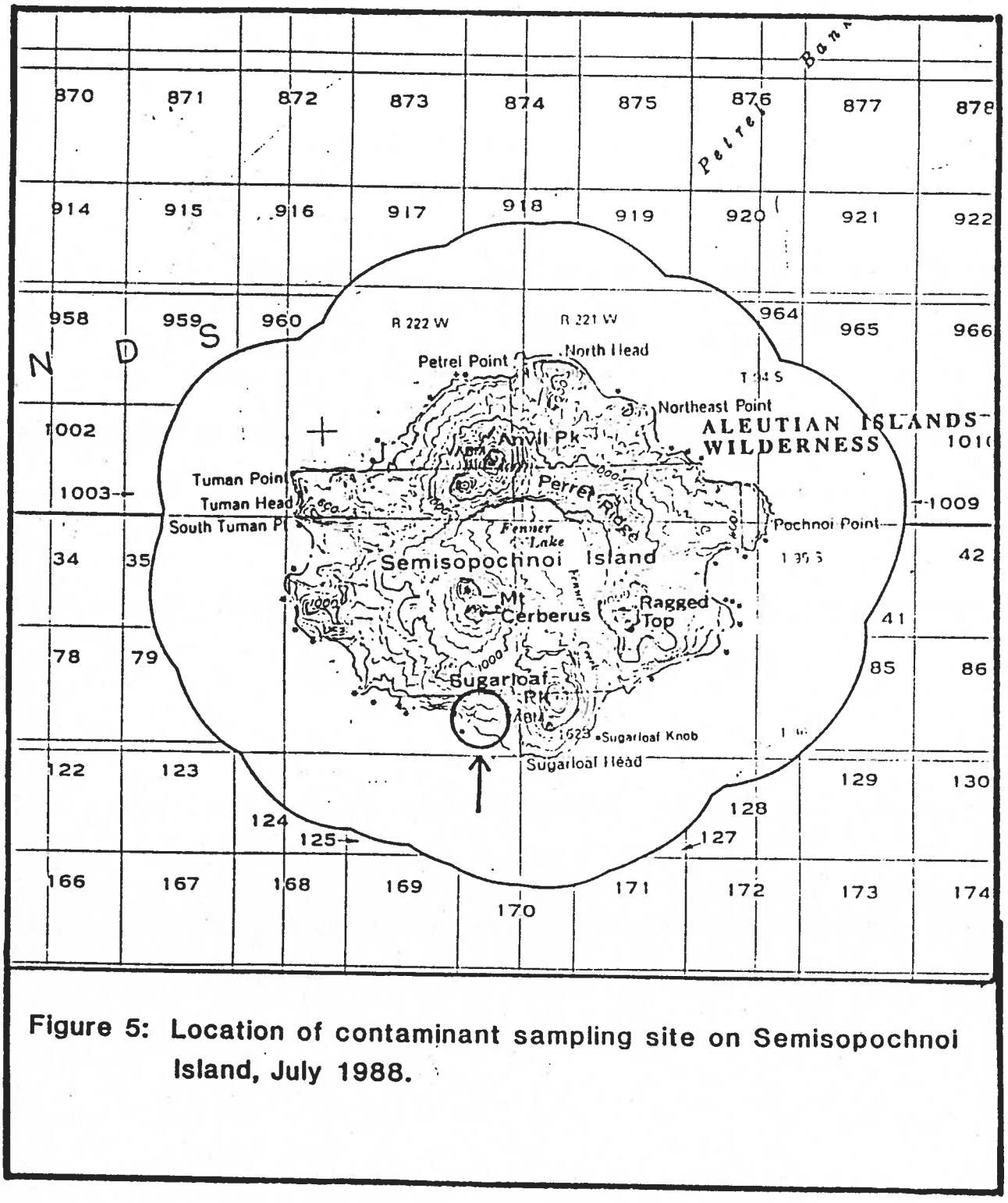

Figure 5: Location of contaminant sampling site on Semisopochnoi Island, July 1988.

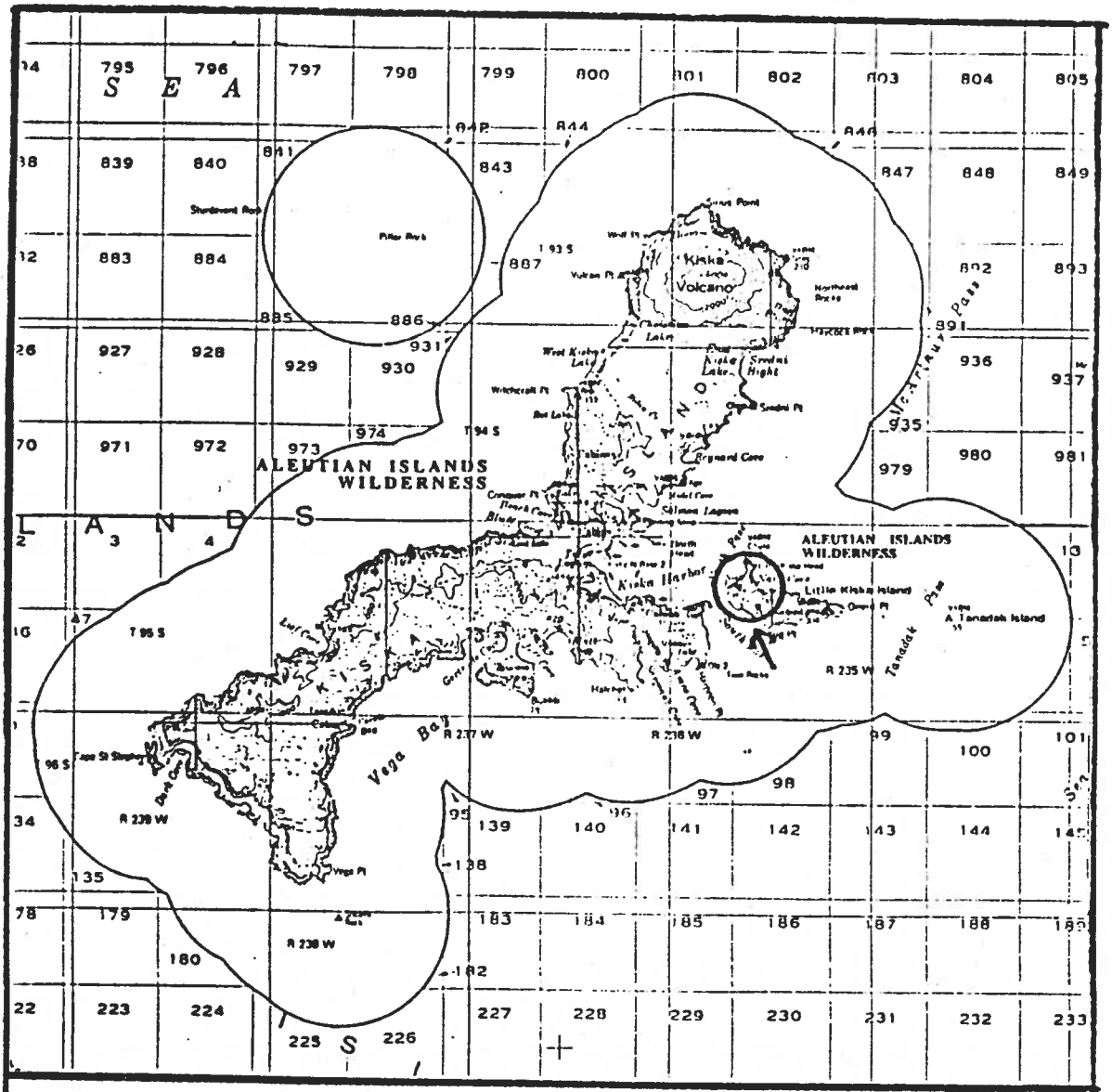

Figure 6: Location of contaminant sampling site on Little Kiska Island, July 1988.

Methods

1. Study Strategies: This study plan has been divided into two investigative phases. Each phase addresses general objectives, the results of which build upon each other. Only Phase I is intended to be addressed in this year's study plan.

   Phase I is designed to establish a data base which will be used to determine whether or not contaminants exist at the sites in concentrations which may adversely impact the surrounding ecosystem.

2. Study Areas:

   A. Little Kiska and Semisopochnoi

   Because little is known about the types and quantity of debris on these islands, it is difficult to definitively state what locations will be sampled. Therefore, prior to establishing final sampling stations each island will first be inventoried for candidate sampling sites. Possible sampling sites are:

   1. power generating facilities
   2. radio shacks
   3. landfills and dumps
   4. airport hangers
   5. garages
   6. fuel storage tanks
   7. barrel dumps
   8. fuel pumping stations
   9. electrical poles
   10. transformers
   11. petroleum-based products storage areas
   12. drainage ditches
   13. streams in proximity to military facilities
   14. lakes or ponds in proximity to military facilities

   B. Great Sitkin

   Soil, sediment, and biological samples will be collected at the aforementioned candidate sampling sites within the Fox Creek drainage and at the upper camp area of Little Fox Creek.

   C. Attu Island

   Based on aerial photography interpretation, soil, sediment, and biological samples will be collected at the aforementioned candidate sampling sites around the following primary areas in the vicinity of Massacre Bay:

   1. Murder Point
   2. Casco Cove
   3. Loaf Point
   4. Navy Town
   5. Casco Point
   6. West and East Massacre Bay Valley
   7. Alexai Point
   8. Peaceful Valley

Areas of secondary concern include the following: Chighagof Point, Jim Fish Valley, West Arm Holtz Bay, and Addison Valley.

C. Tanaga Island

Because of Ocean Technology's report, enough information is known about this site to preliminarily identify sampling locations. The sites which follow will be sampled unless unforeseen sites posing a greater environmental threat are discovered.

1. Near Shore Barrel Dump - 4 stations, 3 composites/station
2. Airstrip Generator Shed/Radio Shack (North) - 1 station, 1 composite
3. Airstrip Generator Shed/Radio Shack (South) - 1 station, 1 composite
4. Airstrip Southeast corner debris - 1 station, 1 composite
5. East Road Generator Shed - 1 station, 1 composite
6. Quarry Camp - 2 stations (fuel tanks, associated debris pile), 2 composites
7. Airstrip Generator Building Transformers - 1 station 1 composite
8. Southwest Station - 1 station, 1 composite

In addition to sampling contaminated sites, up to four control sampling stations will also be established on each island.

3. Field Procedures: Logistical support is being provided by the Alaska Maritime National Maritime Refuge. Transportation to each island site will be via the Service vessel M/V Tiglax or in the case of Great Sitkin Island, access will be by Boston Whaler. Where not prohibited, ground transportation will utilize all-terrain vehicles having low-pressure tires. The Kenai Fisheries Resources field office will assist the Alaska Maritime National Wildlife Refuge in its fish collections. Service volunteers will be available to provide assistance in field collections as well.

The 1988 field schedule is as follows:

May 25	Homer - load gear on M/V Tiglax
June 27	Leave Adak, en route Tanaga
June 28	Arrive Tanaga
June 30	Leave Tanaga, en route Little Kiska
July 1	Arrive Little Kiska
July 3	Leave Little Kiska, en route Attu
July 8	Arrive Attu
July 14	Leave Attu, en route Semisopochnoi
July 18	Arrive Semisopochnoi
July 20	Leave Semisopochnoi, en route Adak
July 21	Arrive Adak
July 23	Sample Great Sitkin
July 26	Leave Adak, en route Homer

Soil and sediment will be collected because of their ability to concentrate and store contaminants. Each sample will be a single composite composed of three to five aliquots taken from the surface and/or shallow sub-surface. All sites will be sampled in triplicate and analyzed for metals and organic-related compounds.

Collected soils will be as fine textured as possible, and from low spots on the site, subject to collecting drainage. For metal analysis, soil will be collected with acetone-rinsed stainless steel utensils, mixed in aluminum foil-lined stainless steel trays, and stored in Zip-lock plastic bags. The stainless steel tray will be relined with aluminum foil for each new sample. For organic-related analyses, all samples will be collected with acetone-rinsed stainless steel utensils, mixed in aluminum foil-lined trays and placed in acid-cleaned jars with teflon-lined caps or wrapped in aluminum foil which in turn will be placed in Zip-lock plastic bags. Soil samples to be analyzed for organic compounds will be stored at approximately 4 degrees centigrade.

Composite sediment samples will be collected from project area lakes, streams, and/or drainage ditches. Like soil samples, control sites will also be established and sampled. All samples will be stored in acid-cleaned polyethylene jars for metal analysis and acid-cleaned glass jars with teflon-lined lids for organic analysis after having been collected with a stainless steel strainer and mixed in a stainless steel bowl. Sediment samples will be stored at approximately 4 degrees centigrade.

Biological samples, if collected, will be from areas which have been obviously impacted or highly suspected to have been impacted by contaminated military wastes. Sampling will probably center around collecting resident fish species (e.g. Salvelinus malma, Gasterosteus aculeatus) using seines and baited minnow traps. Specimens will be weighed, stored in acid-cleaned glass jars, and frozen as soon as possible. Most probably, samples will be composited to achieve the necessary sample weight.

The sampling quantities which follow are minimum requirements, and should be doubled if possible.

Analyte	Quantity (grams)	
	Soil/Sediment	Tissue
metals	10	20
organics	110	25

If extensive areas of contamination should be found, Phase II of the study will be modified to include additional soil, sediment, and biological sampling to determine the extent of contamination into the ecosystem.

4. Analytical Procedures: All samples are to be analyzed for organochlorines and PCBs, aromatic hydrocarbons, and the following priority pollutant heavy metals: antimony (Sb), arsenic (As), beryllium (Be), cadmium (Cd), chromium (Cr), lead (Pb), mercury (Hg), nickel (Ni), selenium (Se), silver (Ag), thallium (Tl), and zinc (Zn). Arsenic and Se values will be determined using flameless atomic absorption spectrophotometry. Cold vapor techniques will be used to determine Hg concentrations. The remaining metals will be analyzed by atomic absorption spectrophotometry. Organic-related concentrations will be determined by using gas chromatography/mass spectrometry.

   It is important to note that the sample holding time, as established and defined by the U.S. Environmental Protection Agency (1986), will be exceeded for all soil and sediment samples analyzed for aromatic hydrocarbons (14 days) and organochlorines with PCBs (to be extracted within 7 to 14 days and analyzed within 40 days after extraction). Therefore, the intergrity of the results generated for these parameters is lessened. Holding times for organic and inorganic analyses in biological matrices have not yet been determined by the scientific community.

5. Cataloging: All samples shall be labelled and be accompanied by a complete catalog, which should include complete data on each sample: regional reference number, date, sample number, site description and location, quantity, weight, and any other pertinent information. The sample catalog will be prepared by Refuge and Ecological Services staff and be entitled "Alaska Maritime - Monitor Military Cleanup."

6. Shipment: Samples should be sent to Anchorage by air, in strong insulated chests containing blue ice. Samples will be shipped to the analytical lab(s) as instructed by th Patuxent Analytical Control Facility in strong coolers with dry ice as needed.

Results

Data from the sampling program will be entered into a computer data base and analyzed with appropriate SPSS statistical software. Appropriate statistical tests will be used for analysis of variability within sample sites and between sample sites and the control site. Most results will be presented in tabular format with summary statistics. Baseline data on contaminant levels in soil sediments will be compared with those from nation-wide and Alaskan databases. The ecological significance of identified contaminant levels will be discussed. Anticipated products of this study include: 1) a Phase I report that will summarize all field activities, present analytical results, describe the biological implications of the analytical results, and if necessary, 2) a Phase II report that will identify the need for any agency coordination on remedial action and suggest any further investigation which might be needed. The Anchorage Ecological Services field office will be responsible for preparing the Phase I and Phase II reports with input and review from Refuge personnel.

Cited Literature

Ocean Technology, Ltd. 1986. Report for Seven Aleutian Islands and Driftwood Bay and Dutch Harbor: Tanaga Island. 40 pp.

U.S. Army Engineer District, Alaska: Corps of Engineers. 1977. Debris removal and cleanup study - Aleutian Islands and Lower Alaska Penisula, Alaska. June. 334 pp.

U.S. Environmental Protection Agency. 1986. Test Methods for Evaluating Solid Waste. Office of Solid Waste and Emergency Response. Third Edition. Four Volumes. SW-846. Washington, D.C. November.

U.S. Fish and Wildlife Service. 1988. Alaska Maritime National Wildlife Refuge Draft Comprehensive Conservation Plan, Wilderness Review and Environmental Impact Statement. February. 2 volumes.

Study Cost Estimate

1.	Analytical (see Appendix for more detailed cost breakdown for analytical tests)	
	A. Tanaga Island - soil, sediment, and/or biological	
	1. 16 sampling stations	
	2. 48 metal and 48 organic samples	$ 34,576.80
	B. Great Sitkin Island - soil, sediment, and/or biological	
	1. 16 sampling stations	
	2. 48 metal and 48 organic samples	$ 34,576.80
	C. Little Kiska Island - soil, sediment, and/or biological	
	1. 16 sampling stations	
	2. 48 metal and 48 organic samples	$ 34,576.80
	D. Semisopochnoi Island - soil, sediment, and/or biological	
	1. 16 sampling stations	
	2. 48 metal and 48 organic samples	$ 34,576.80
	E. Attu Island	
	1. 32 sampling stations	
	2. 96 metal and 96 organic samples	$ 69,153.90
	F. TOTAL PROJECTED ANALYTICAL EXPENDITURES	$207,461.10
2.	Operation	
	A. Jars/Bottles	
	1. Wide-mouth glass jars with teflon-lined closures, I-Chem, No. 241--0250; amber 250ml, 12/case, $20.05/case 5 each	$ 100.25
	No. 221-1000; clear 1000ml, 12/case, $36.60/case 3 each	$ 109.80
	2. Polyethylene wide-mouth jars No. 211-0250; 250ml, 48/case $82.08/case 1 each	$ 82.08
	B Aluminum foil - 2 large rolls	15.00
	C. Zip-lock bags - quart and gallon size - 50 dozen	50.00
	D. Stainless steel spoons - 50 dozen	200.00
	E. Acetone - 1 gallon	40.00
	F. Mixing trays - 6 each	35.00
	G. Stainless steel mixing bowl - 2 each	15.00
	H. Stainless steel strainer - 2 each	10.00
	I. 100 - quart coolers - 4 each	240.00
	J. Stake posts - 100	50.00
	K. Aerial photos	300.00
	L. Topographic maps	50.00
	M. Miscellaneous and unforseen items	500.00
	N. Study Plan Administration - Biological Technician	5,000.00
	O. PROJECTED TOTAL OPERATION EXPENDITURES	$ 6,797.13
3.	INVESTIGATION GRAND TOTAL (ANALYTICAL AND OPERATIONS)	$214,258.23

PROPOSED FOR FUNDING IN FY '89. FUNDS NOT YET AVAILABLE. J. Ubelhe 5/31/88

FY '88 FUNDS J.W.

APPENDIX

ANALYTICAL COST BREAKDOWN

I. Average cost/sample: sediment, soil, and tissue analyses

A.	Organochlorines with PCBs and Aromatic Hydrocarbons	$450.00
B.	Trace Metals	
	1. Arsenic, Selenium, Mercury	83.40
	2. Antimony, Beryllium, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Nickel, Silver, Thallium, Zinc	186.95
C.	TOTAL	$720.35

II. Costs per station assuming triplicate samples are collected

A.	3 metal x $270.35 =	$ 811.05
B.	3 organics x $450.00 =	$1,350.00
C.	Total Cost Per Station	$2,161.05

III. Total numbered stations which can be set up given budget constraints

A. Costs per station $2,161.05

B. Total analytical funds $207,000.00

C. Total number of stations = 96

1. Station number distribution

a.	Attu	32
b.	Great Sitkin	16
c.	Semisopochnoi	16
d.	Little Kiska	16
e.	Tanaga	16

FY____ PROJECT SUBMISSION

Field Station or Refuge Alaska Maritime NWR Date _____

Project Title: Abandoned Military Wastes: Attu Island

Problem Statement: Attu comprises 223,312 acres and is the western-most island of the Aleutian Chain (Figure 4; U.S. Fish and Wildlife Service, 1988). Attu was occupied by the Japanese Army from June 7, 1942, to May 30, 1943, when the Japanese Army surrendered/lost. The battlefield covers 15 square miles on the eastern side of the island. It is unclear if this is the total acreage affected by military operations. At present, the Coast Guard occupies 1,800 acres with a loran station. The World Ware II debris consists of quonset huts, wood frame buildings, pumphouse, ammunition magazines, concrete foundations, utility poles, steel tanks, and miscellaneous debris (U.S. Army, 1977). There is very little textual information about the types and locations of hazardous material which may exist on Attu Island.

Objectives: 1. To determine where cleanup activities need to occure on Attu.
2. To determine what hazardous materials are present on Attu.

Methods: Soil and sediment will be collected because of their ability to concentrate and store contaminants. Each sample will be a single composite composed of three to five aliquots taken from the surface and/or shallow sub-surface. All sites will be sampled in triplicate and analyzed for metals and organic-related compounds. Collected soils will be as fine textured as possible, and from low spots on the site, subject to collecting drainage. For metal analysis, soil will be collected with acetone-rinsed stainless steel utensils, mixed in aluminum foil-lined stainless steel trays, and stored in Zip-lock plastic bags. The stainless steel tray will be relined with aluminum foil for each new sample. For organic-related analyses, all samples will be collected with acetone-rinsed stainless steel utensils, mixed in aluminum foil-lined trays and placed in acid-cleaned jars with teflon-lined caps or wrapped in aluminum foil which in turn will be placed in Zip-lock plastic bags. Soil samples to be analyzed for organic compounds will be stored at approximately 4 degrees centigrade. Composite sediment samples will be collected from project area lakes, streams, and/or drainage ditches. Like soil samples, control sites will also be established and sampled. All samples will be stored in acid-cleaned polyethylene jars for metal analysis and acid-cleaned glass jars with teflon-lined lids for organic analysis after having been collected with a stainless steel strainer and mixed in a stainless steel bowl. Sediment samples will be stored at approximately 4 degrees centigrade. Biological samples, if collected, will be from areas which have been obviously impacted or highly suspected to have been impacted by contaminated military wastes. Sampling will be from areas which have been obviously impacted or highly suspected to have been impacted by contaminated military wastes. Sampling will probably center around collecting resident fish species (e.g. Salvelinus malma, Gasterosteus aculeatus) using seines and baited minnow traps. Specimens will be weighed, stored in acid-cleaned glass jars, and frozen as soon as possible. Most probably, samples will be composited to achieve the necessary sample weight.

FTE'S Required ____

New Hires Required ____

List Major Equipment Purchases: _____

Estimated Annual Budget

Operations:	
Supplies	250.00
Equipment	250.00
Other:	
Shipping	250.00
Per Diem	250.00
Travel	5,000.00
Total:	6,000.00
Contaminant Analysis	50,000.00
Total	56,000.00

PREPARED BY: _____ DATE _____

REVIEWED BY: _____ DATE _____
FIELD SUPERVISOR

FY90 PROJECT SUBMISSION

Field Station or Refuge Alaska Maritime NWR Date _____

Project Title: Environmental contaminants sampling at Defense Environmental Restoration Program cleanup sites - Alaska Maritime NWR, Semisopochnoi Island.

Problem Statement: The Defense Environmental Restoration Program is part of a Department of Defense program designed to identify, evaluate, and cleanup hazardoue waste sites on abandoned military bases and restore the areas to their near original state by implementing remedial actions. The program is administered by the U.S. Army Corps of Engineers. The subject project site is in the ownership of the Department of the Interior and administered by the U.S. Fish and Wildlife Service (Service) as part of the Alaska Maritime National Wildlife Refuge. Most of the abandoned military installations are known to contain either petroleum, oil, lubricant (POL) products and spills or electrical transformers which may contain polychlorinated biphenols (PCB's). Extensive leaching of POL and PCB's into the surrounding environment, depending on their chemical make-up and concentration, could pose a threat to fish and wildlife resources. Semisopochnoi consists of 56,013 acres. The military's presence on the island affected the southern portion of the island. Military debris consists of quonset huts (8), s wrecked aircraft, and miscellaneous debris (U.S. Army, 1977). Little textual information on the location of the debris is available. The need for the Service to determine the presence or absence of contaminants at the abandoned military sites in the Aleutian Islands is great because: 1. There is potential for contaminants to be transferred from the facility through the food chain to Fish and Wildlife trust resources, and 2. the Service does not want to potentially inherit a contaminant problem when full land management authorities are acquired.

Objectives: Phase I: 1. Perform sampling at Semisopochnoi Island on the Alaska Maritime National Wildlife Refuge to determine what contaminants, if any, may have entered the environment surrounding abandoned military installations. 2. Interpret analytical results and draw inferences as to the data's ecological significance and source of contaminants, if any. Phase II: 1. Identifiy needs for remedial action and coordinate with other agencies to effect cleanup.2. Conduct follow-up sampling after cleanup to ensure completion of program.

Methods: 1. Study strategies: This study plan has been divided into two investigative phases. Each phase addresses general objectives, the results of which build upon each other. Only Phase I is intended to be addressed in this year's study plan. Phase I is designed to establish a data base which will be used to determine whether or not contaminants exist at the sites in concentrations which may adversely impact the surrounding ecosystem. Because little is known about the types and quantity of debris on this island, it is difficult to definitely state what locations will be sampled. Therefore, prior to establishing final sampling stations the island will first be inventoried for candidate sampling sites. Possible sampling sites: 1. Power generating facilities, 2. radio shacks, 3. Landfills and dumps, 4. Airport hangers, 5. Garages, 6. Fuel storage tanks, 7. Barrel dumps, 8. Fuel pumping stations, 9. Electrical poles, 10. Transformers, 11. Petroleum-based products storage areas, 12. Drainage ditches, 13. Streams in proximity to military facilities, 14. Lakes or ponds in proximity to military facilities. In addition to sampling contaminanted sites, up to four control sampling stations will also be established on this island. Logistical support is being provided by the Alaska Maritime National Wildlife Refuge. Transportation to the site will be via the Service vessel M/V Tiglax. Where not prohibited, ground transportation will utilize all-terrain vehicles having low-pressure tires. The Kenai Fisheries Resources field office will assist the Alaska Maritime National Wildlife Refuge in its fish collections. Service volunteers will be available to provide assistance in field collections as well. Soil and sediment will be collected because of their ability to concentrate and store contaminants. Each sample will be a single composite composed of three to five aliquots taken from the surface. All sites will be sampled in triplicate and analyzed for metals and organic-related compounds. Composite sediment samples will be collected from project area lakes, streams, and/or drainage ditches. Like soil samples, control sites will also be established and sampled. All samples will be stored in acid-cleaned polyethylene jars for metal analysis and acid-cleaned glass jars with teflon-lined lids for organic analysis after having been collected with a stainless steel strainer and mixed in a stainless steel bowl. Sediment samples will be stored at approximately four degrees centigrade. Biological samples, if collected, will be from areas which have been obviously impacted or highly suspected to have been impacted by contaminanted military wastes. Sampling will probably center around collecting resident fish species (e.g. Salvelinus malma, Gasterosteus aculeatus) using seines and baited minnow traps. Specimens will be weighed, stored in acid-cleaned glass jars, and frozen as soon as possible. Samples will be composited to achieve the necessary sample weight.

FTE'S Required 0

New Hires Required 0

List Major Equipment Purchases: None

Estimated Annual Budget

Operations	
Other:	
Shipping	500.00
Contaminant Analysis	13,500.00
Total	14,000.00

APPENDIX B

SAMPLE CATALOGS FOR THE ALEUTIAN ISLANDS MILITARY CONTAMINANTS STUDY

FISCAL YEARS 1988-1990

Alaska Maritime National Wildlife Refuge
202 Pioneer Avenue
Homer, Alaska

SAMPLE CATALOG

TITLE: Alaska Maritime - military cleanup

STUDY/CATALOG IDENTIFIER: to be assigned in fiscal year '89

STUDY OBJECTIVE: To perform sampling on Tanaga, Little Kiska, Attu, Semisopochnoi, and Great Sitkin Islands on the Alaska Maritime National Wildlife Refuge to determine what contaminants, if any, may have entered the environment surrounding abandoned military installations. To interpret analytical results and draw inferences as to the data's ecological significance and source of contaminants, if any.

BACKGROUND: The Defense Environmental Restoration Program (P.L. 98-212, 97 Stat. 1427, Dec. 8, 1983) is part of a Department of Defense program designed to identify, evaluate, and clean up hazardous waste sites on abandoned and active military bases and restore the areas to their near original state by implementing remedial actions. The program is administered by the U.S. Army Corps of Engineers. The subject project sites are in the ownership of the U.S. Fish and Wildlife Service and administered by the Alaska Maritime NWR.

Each of the project sites are known to contain either petroleum, oil, and lubricant (POL) products and spills or electrical transformers which may contain polychlorinated biphenols (PCBs). Extensive leaching of POL products and PCBs into the surrounding environment, depending on their chemical make-up and concentration, could pose a threat to fish and wildlife resources.

This lot consists of 294 individual soil/sediment samples and 15 composite fish samples. Soil samples were collected from 25 sampling sites; sediment samples were collected from 29 sampling sites and fish were collected from 2 lakes and 1 stream. All samples were collected between June 28 and July 22, 1988.

Each soil/sediment sample is a composite of three to five aliquots collected from the surface and/or shallow sub-surface. All sites were sampled in triplicate and analyzed for metals and organic-related compounds. For metal analysis, soil were collected with acetone-rinsed stainless steel utensils, mixed in aluminum foil-lined stainless steel trays, and stored in Zip-lock plastic bags. For organic-related analyses, all samples were collected with acetone-rinsed stainless steel utensils, mixed in an aluminum foil-lined

tray and placed in acid-cleaned jars with teflon-lined caps or wrapped in aluminum foil which in turn were placed in Zip-lock bags. Composite sediment samples were collected from project area lakes, streams, and/or drainage ditches. Like soil samples, control sites were established and sampled. All sediment samples are stored in acid-cleaned polyethylene jars for metal analysis and acid-cleaned glass jars with teflon-lined lids for organic analysis after having been collected with a stainless steel strainer and mixed in a stainless steel bowl. All samples are stored at approximately 4 degrees centigrade. Fish samples were obtained using seines and baited minnow traps, weighed, stored in acid-cleaned glass jars for organic analysis or for metal analysis, they were stored in Zip-lock bags or acid-cleaned polyethylene jars, and frozen.

INSTRUCTIONS: Each sample is to be analyzed for the contaminants listed on the tabulated catalogs (Table 1 - Metals; Table 2- Organics). Report ppm, dry weight, with % moisture, for aromatic hydrocarbons, organochlorines including PCBs, and heavy metals. The following metals are to be determined using ICP methodologies: Pb, Cu, Cr, Mn, Cd, Ni, Sb, Tl, Fe. The following metals are to be analyzed using AAH methodologies: As, Se. Mercury is to be analyzed using cold vapor techniques. Detection limits should be as low as possible with the prescribed analytical method. All fish samples are to be analyzed as a composite of whole bodies. If there is not enough tissue to perform all the desired analyses, the priorities are for heavy metals: Hg, Pb, Cu, Cr, Cd, Ni, As, Se, Sb, Mn, Tl, and Fe, and for organic-related analysis: aromatic hydrocarbons, and organochlorines including PCBs. Please call this office (907-271-2780) to inform us of your decision on this.

After analysis is completed, please retain the samples until this office has received and reviewed the analytical results. We will then instruct you as to which samples, if any, should be retained and which can be discarded.

If samples are sent to the lab in a cooler, we will include a mailing label to have the cooler returned to this office. Other containers, i.e. cardboard box with styrofoam inserts, may be discarded.

TABULATED CATALOG: Attached

Table 1. METALS: Tabulated Sample Catalog - .....
Alaska Maritime NWR - Monitor Military Cleanup

Table 2. ORGANICS: Tabulated Sample Catalog - .....
Alaska Maritime NWR - Monitor Military Cleanup

ESTIMATED COST:

Heavy Metals	$ 22,184.31
Organics	$ 61,626.00
Total	$ 83,810.31

ACCOUNT NUMBER: to be assigned in fiscal year '89

DATA RECIPIENT(S):

Wayne M. Crayton
U.S. Fish and Wildlife Service
Anchorage Fish and Wildlife Enhancement
605 West 4th Avenue, Room 62
Anchorage, Alaska 99501

Everett Robison-Wilson
U.S. Fish and Wildlife Service
Environmental Contaminants Coordinator
1011 Tudor Road
Anchorage, Alaska 99503

John Martin
U.S. Fish and Wildlife Service
Alaska Maritime NWR
202 Pioneer Avenue
Homer, Alaska 99603

SIGNATURES:

Principal Investigator — Date: 5/22/88

Environmental Contaminants Specialist — Date: 5/24/88

Regional Environmental Contaminants Coordinator — Date

Sample ID Number	Species	Tissue/ Matrix	Sample Type	Weight	Collection Site Description	Collection Date	Analysis Requested and Remarks
ATA010		SOIL	I	56	SE END OF RUNWAY	06/28/88	HM
BTA010		SOIL	I	58	SE END OF RUNWAY	06/28/88	HM
CTA010		SOIL	I	54	SE END OF RUNWAY	06/28/88	HM
ATA020		SOIL	I	44	BUILDING COMPLEX	06/28/88	HM
BTA020		SOIL	I	62	BUILDING COMPLEX	06/28/88	HM
CTA020		SOIL	I	62	BUILDING COMPLEX	06/28/88	HM
ATA030		SOIL	I	58	BUILDING COMPLEX	06/28/88	HM
BTA030		SOIL	I	98	BUILDING COMPLEX	06/28/88	HM
CTA030		SOIL	I	106	BUILDING COMPLEX	06/28/88	HM
ATA040		SOIL	I	132	BUILDING COMPLEX CREEK	06/29/88	HM
BTA040		SOIL	I	94	BUILDING COMPLEX CREEK	06/29/88	HM
CTA040		SOIL	I	98	BUILDING COMPLEX CREEK	06/29/88	HM
ATA050		SOIL	I	68	LARGE BARREL DUMP	06/29/88	HM
BTA050		SOIL	I	56	LARGE BARREL DUMP	06/29/88	HM
CTA050		SOIL	I	76	LARGE BARREL DUMP	06/29/88	HM
ATA06S		SEDIMENT	I	240	HOUSING COMPLEX	06/29/88	HM
BTA06S		SEDIMENT	I	204	HOUSING COMPLEX	06/29/88	HM
CTA06S		SEDIMENT	I	276	HOUSING COMPLEX	06/29/88	HM
ATA070		SOIL	I	70	BY WATER TANK	06/29/88	HM
BTA070		SOIL	I	40	BY WATER TANK	06/29/88	HM
CTA070		SOIL	I	46	BY WATER TANK	06/29/88	HM
ATA08S		SEDIMENT	I	288	PUMPHOUSE LAKE	06/29/88	HM
BTA08S		SEDIMENT	I	316	PUMPHOUSE LAKE	06/29/88	HM
CTA08S		SEDIMENT	I	292	PUMPHOUSE LAKE	06/29/88	HM
ATA09S		SEDIMENT	I	308	RUNWAY DRAINAGE DITCH	06/29/88	HM
BTA09S		SEDIMENT	I	244	RUNWAY DRAINAGE DITCH	06/29/88	HM
CTA09S		SEDIMENT	I	272	RUNWAY DRAINAGE DITCH	06/29/88	HM
ATA100		SOIL	I	96	SE END OF RUNWAY	06/29/88	HM
BTA100		SOIL	I	84	SE END OF RUNWAY	06/29/88	HM
CTA100		SOIL	I	184	SE END OF RUNWAY	06/29/88	HM
ATA11F	DOLLY VARDEN	FISH (4)	C,WB	56	HOUSING COMPLEX STREAM	06/29/88	HM
BTA11F	DOLLY VARDEN	FISH (3)	C,WB	38	HOUSING COMPLEX STREAM	06/29/88	HM
CTA11F	DOLLY VARDEN	FISH (2)	C,WB	50	HOUSING COMPLEX STREAM	06/29/88	HM
ATA120		SOIL	I	128	SOUTHEAST BIGHT	06/29/88	HM
BTA120		SOIL	I	106	SOUTHEAST BIGHT	06/29/88	HM
CTA120		SOIL	I	100	SOUTHEAST BIGHT	06/29/88	HM

Sample ID Number	Species	Tissue/ Matrix	Sample Type	Weight	Collection Site Description	Collection Date	Analysis Requested and Remarks
ATA13S		SEDIMENT	I	416	SOUTHEAST BIGHT LAKE	06/29/88	HM
BTA13S		SEDIMENT	I	386	SOUTHEAST BIGHT LAKE	06/29/88	HM
CTA13S		SEDIMENT	I	380	SOUTHEAST BIGHT LAKE	06/29/88	HM
ATA15S		SEDIMENT	I	260	RADIO SHK-N END RUNWAY	06/30/88	HM
BTA15S		SEDIMENT	I	287	RADIO SHK-N END RUNWAY	06/30/88	HM
CTA15S		SEDIMENT	I	272	RADIO SHK-N END RUNWAY	06/30/88	HM
ALK01S		SEDIMENT	I	131	GUN EMPLACEMENT LAKE	07/03/88	HM
BLK01S		SEDIMENT	I	108	GUN EMPLACEMENT LAKE	07/03/88	HM
CLK01S		SEDIMENT	I	118	GUN EMPLACEMENT LAKE	07/03/88	HM
ALK02F	3-SPND STICKLEBK	FISH (5)	C,WB	16	GUN EMPLACEMENT LAKE	07/03/88	HM
BLK02F	3-SPND STICKLEBK	FISH (5)	C,WB	13	GUN EMPLACEMENT LAKE	07/03/88	HM
CLK02F	3-SPND STICKLEBK	FISH (5)	C,WB	16	GUN EMPLACEMENT LAKE	07/03/88	HM
ALK03S		SEDIMENT	I	204	SLUFF LAKE	07/03/88	HM
BLK03S		SEDIMENT	I	160	SLUFF LAKE	07/03/88	HM
CLK03S		SEDIMENT	I	154	SLUFF LAKE	07/03/88	HM
ALK04O		SOIL	I	148	BARE HILL	07/03/88	HM
BLK04O		SOIL	I	118	BARE HILL	07/03/88	HM
CLK04O		SOIL	I	158	BARE HILL	07/03/88	HM
AAT01O		SOIL	I	158	ENGINEER HILL	07/07/88	HM
BAT01O		SOIL	I	142	ENGINEER HILL	07/07/88	HM
CAT01O		SOIL	I	103	ENGINEER HILL	07/07/88	HM
AAT02S		SEDIMENT	I	228	ENGINEER HILL	07/07/88	HM
BAT02S		SEDIMENT	I	210	ENGINEER HILL	07/07/88	HM
CAT02S		SEDIMENT	I	228	ENGINEER HILL	07/07/88	HM
AAT03O		SOIL	I	170	N END W MASS VALLEY	07/07/88	HM
BAT03O		SOIL	I	38	N END W MASS VALLEY	07/07/88	HM
CAT03O		SOIL	I	88	N END W MASS VALLEY	07/07/88	HM
AAT04S		SEDIMENT	I	140	E SIDE HOGBACK RD	07/07/88	HM
BAT04S		SEDIMENT	I	136	E SIDE HOGBACK RD	07/07/88	HM
CAT04S		SEDIMENT	I	100	E SIDE HOGBACK RD	07/07/88	HM
AAT05O		SOIL	I	98	HENDERSON MARSH	07/08/88	HM
BAT05O		SOIL	I	32	HENDERSON MARSH	07/08/88	HM
CAT05O		SOIL	I	102	HENDERSON MARSH	07/08/88	HM
AAT06S		SEDIMENT	I	120	E MASS VALLEY	07/08/88	HM
BAT06S		SEDIMENT	I	146	E MASS VALLEY	07/08/88	HM
CAT06S		SEDIMENT	I	114	E MASS VALLEY	07/08/88	HM

Sample ID Number	Species	Tissue/ Matrix	Sample Type	Weight	Collection Site Description	Collection Date	Analysis Requested and Remarks
AAT07S		SEDIMENT	I	266	UPPER E MASS VALLEY	07/08/88	HM
BAT07S		SEDIMENT	I	218	UPPER E MASS VALLEY	07/08/88	HM
CAT07S		SEDIMENT	I	248	UPPER E MASS VALLEY	07/08/88	HM
AAT08S		SEDIMENT	I	244	E MASS VALLEY STREAM	07/08/88	HM
BAT08S		SEDIMENT	I	ND	E MASS VALLEY STREAM	07/08/88	HM
CAT08S		SEDIMENT	I	ND	E MASS VALLEY STREAM	07/08/88	HM
AAT09D		SOIL	I	108	E MASS VAL BARREL DUMP	07/08/88	HM
BAT09D		SOIL	I	44	E MASS VAL BARREL DUMP	07/08/88	HM
CAT09D		SOIL	I	43	E MASS VAL BARREL DUMP	07/08/88	HM
AAT10S		SEDIMENT	I	158	E MASS VAL TRANS POLE	07/08/88	HM
BAT10S		SEDIMENT	I	148	E MASS VAL TRANS POLE	07/08/88	HM
CAT10S		SEDIMENT	I	186	E MASS VAL TRANS POLE	07/08/88	HM
AAT11D		SOIL	I	126	E BREAKWTR CASCO COVE	07/08/88	HM
BAT11D		SOIL	I	100	E BREAKWTR CASCO COVE	07/08/88	HM
CAT11D		SOIL	I	128	E BREAKWTR CASCO COVE	07/08/88	HM
AAT12D		SOIL	I	113	ASPHALT TANK STREAM	07/09/88	HM
BAT12D		SOIL	I	178	ASPHALT TANK STREAM	07/09/88	HM
CAT12D		SOIL	I	214	ASPHALT TANK STREAM	07/09/88	HM
AAT13D		SOIL	I	158	FUEL PUMPS-ASPHALT STR	07/09/88	HM
BAT13D		SOIL	I	132	FUEL PUMPS-ASPHALT STR	07/09/88	HM
CAT13D		SOIL	I	118	FUEL PUMPS-ASPHALT STR	07/09/88	HM
AAT14S		SEDIMENT	I	164	FUEL TANK VALLEY STREAM	07/09/88	HM
BAT14S		SEDIMENT	I	132	FUEL TANK VALLEY STREAM	07/09/88	HM
CAT14S		SEDIMENT	I	166	FUEL TANK VALLEY STREAM	07/09/88	HM
AAT15S		SEDIMENT	I	72	2 FUEL TANKS-FT STREAM	07/09/88	HM
BAT15S		SEDIMENT	I	94	2 FUEL TANKS-FT STREAM	07/09/88	HM
CAT15S		SEDIMENT	I	98	2 FUEL TANKS-FT STREAM	07/09/88	HM
AAT16S		SEDIMENT	I	138	TRANSF-FUEL TANK VALLEY	07/09/88	HM
BAT16S		SEDIMENT	I	138	TRANSF-FUEL TANK VALLEY	07/09/88	HM
CAT16S		SEDIMENT	I	158	TRANSF-FUEL TANK VALLEY	07/09/88	HM
AAT17S		SEDIMENT	I	208	FUEL TANK VALLEY STREAM	07/09/88	HM
BAT17S		SEDIMENT	I	128	FUEL TANK VALLEY STREAM	07/09/88	HM
CAT17S		SEDIMENT	I	178	FUEL TANK VALLEY STREAM	07/09/88	HM
AAT18D		SOIL	I	148	NEWLY BULLDOZED TOP HILL	07/09/88	HM
BAT18D		SOIL	I	168	NEWLY BULLDOZED TOP HILL	07/09/88	HM
CAT18D		SOIL	I	150	NEWLY BULLDOZED TOP HILL	07/09/88	HM

Sample ID Number	Species	Tissue/ Matrix	Sample Type	Weight	Collection Site Description	Collection Date	Analysis Requested and Remarks
AAT19Q		SOIL	I	166	E SIDE QUONSET HUT VALL	07/10/88	HM
BAT19Q		SOIL	I	198	E SIDE QUONSET HUT VALL	07/10/88	HM
CAT19Q		SOIL	I	178	E SIDE QUONSET HUT VALL	07/10/88	HM
AAT20S		SEDIMENT	I	178	MIDDLE QUONSET HUT VALL	07/10/88	HM
BAT20S		SEDIMENT	I	138	MIDDLE QUONSET HUT VALL	07/10/88	HM
CAT20S		SEDIMENT	I	232	MIDDLE QUONSET HUT VALL	07/10/88	HM
AAT21S		SEDIMENT	I	226	QUONSET HUT VALL CREEK	07/10/88	HM
BAT21S		SEDIMENT	I	308	QUONSET HUT VALL CREEK	07/10/88	HM
CAT21S		SEDIMENT	I	266	QUONSET HUT VALL CREEK	07/10/88	HM
AAT22Q		SOIL	I	112	E SIDE QUONSET HUT VALL	07/10/88	HM
BAT22Q		SOIL	I	118	E SIDE QUONSET HUT VALL	07/10/88	HM
CAT22Q		SOIL	I	124	E SIDE QUONSET HUT VALL	07/10/88	HM
AAT23S		SEDIMENT	I	180	W SIDE QUONSET HUT VALL	07/10/88	HM
BAT23S		SEDIMENT	I	196	W SIDE QUONSET HUT VALL	07/10/88	HM
CAT23S		SEDIMENT	I	188	W SIDE QUONSET HUT VALL	07/10/88	HM
AAT24S		SEDIMENT	I	538	LAKE ELWOOD	07/10/88	HM
BAT24S		SEDIMENT	I	358	LAKE ELWOOD	07/10/88	HM
CAT24S		SEDIMENT	I	320	LAKE ELWOOD	07/10/88	HM
AAT27S		SEDIMENT	I	186	OLD RUNWAY REVETEMENT	07/11/88	HM
BAT27S		SEDIMENT	I	288	OLD RUNWAY REVETEMENT	07/11/88	HM
CAT27S		SEDIMENT	I	228	OLD RUNWAY REVETEMENT	07/11/88	HM
AAT28Q		SOIL	I	112	LRG ASPHALT BARREL DUMP	07/11/88	HM
BAT28Q		SOIL	I	114	LRG ASPHALT BARREL DUMP	07/11/88	HM
CAT28Q		SOIL	I	164	LRG ASPHALT BARREL DUMP	07/11/88	HM
AAT29S		SEDIMENT	I	278	PEACEFUL RIVER	07/11/88	HM
BAT29S		SEDIMENT	I	294	PEACEFUL RIVER	07/11/88	HM
CAT29S		SEDIMENT	I	194	PEACEFUL RIVER	07/11/88	HM
AAT30Q		SOIL	I	128	TRANS SITE CASCO PT	07/11/88	HM
BAT30Q		SOIL	I	172	TRANS SITE CASCO PT	07/11/88	HM
CAT30Q		SOIL	I	194	TRANS SITE CASCO PT	07/11/88	HM
AAT31Q		SOIL	I	114	TRANS SITE MURDER PT	07/11/88	HM
BAT31Q		SOIL	I	94	TRANS SITE MURDER PT	07/11/88	HM
CAT31Q		SOIL	I	123	TRANS SITE MURDER PT	07/11/88	HM

Sample ID Number	Species	Tissue/ Matrix	Sample Type	Weight	Collection Site Description	Collection Date	Analysis Requested and Remarks
AAT32F	3-SPND STICKLEBK	FISH (9)	C,WB	17	LAKE NICHOLAS	07/11/88	HM
BAT32F	3-SPND STICKLEBK	FISH (8)	C,WB	15	LAKE NICHOLAS	07/11/88	HM
CAT32F	3-SPND STICKLEBK	FISH (6)	C,WB	15	LAKE NICHOLAS	07/11/88	HM
AAT33O		SOIL	I	116	MURDER PT-SUBMERG BUILDG	07/11/88	HM
BAT33O		SOIL	I	98	MURDER PT-SUBMERG BUILDG	07/11/88	HM
CAT33O		SOIL	I	128	MURDER PT-SUBMERG BUILDG	07/11/88	HM
AAT34S		SEDIMENT	I	204	MURDER PT-QUONSET HUTS	07/12/88	HM
BAT34S		SEDIMENT	I	180	MURDER PT-QUONSET HUTS	07/12/88	HM
CAT34S		SEDIMENT	I	168	MURDER PT-QUONSET HUTS	07/12/88	HM
AAT35S		SEDIMENT	I	350	MURDER PT LAKE	07/12/88	HM
BAT35S		SEDIMENT	I	ND	MURDER PT LAKE	07/12/88	HM
CAT35S		SEDIMENT	I	478	MURDER PT LAKE	07/12/88	HM
AAT36S		SEDIMENT	I	436	WATER TOWER LAKE-MURD PT	07/12/88	HM
BAT36S		SEDIMENT	I	423	WATER TOWER LAKE-MURD PT	07/12/88	HM
CAT36S		SEDIMENT	I	346	WATER TOWER LAKE-MURD PT	07/12/88	HM
AAT37S		SEDIMENT	I	266	RADIO TOWER/BUILDINGS	07/12/88	HM
BAT37S		SEDIMENT	I	152	RADIO TOWER/BUILDINGS	07/12/88	HM
CAT37S		SEDIMENT	I	264	RADIO TOWER/BUILDINGS	07/12/88	HM
AAT38S		SOIL	I	168	NEXT TO SITE 31-MURD PT	07/12/88	HM
BAT38S		SOIL	I	144	NEXT TO SITE 31-MURD PT	07/12/88	HM
CAT38S		SOIL	I	118	NEXT TO SITE 31-MURD PT	07/12/88	HM
AGS01S		SEDIMENT	I	340	FOX CR BRIDGE	07/22/88	HM
BGS01S		SEDIMENT	I	451	FOX CR BRIDGE	07/22/88	HM
CGS01S		SEDIMENT	I	592	FOX CR BRIDGE	07/22/88	HM
AGS02O		SOIL	I	198	W SIDE OF FOX CR VAL	07/22/88	HM
BGS02O		SOIL	I	212	W SIDE OF FOX CR VAL	07/22/88	HM
CGS02O		SOIL	I	196	W SIDE OF FOX CR VAL	07/22/88	HM
AGS03O		SOIL	I	196	MIDDLE FOX CREEK VALL	07/22/88	HM
BGS03O		SOIL	I	192	MIDDLE FOX CREEK VALL	07/22/88	HM
CGS03O		SOIL	I	156	MIDDLE FOX CREEK VALL	07/22/88	HM
AGS04O		SOIL	I	202	MIDDLE FOX CREEK VALL	07/22/88	HM
BGS04O		SOIL	I	156	MIDDLE FOX CREEK VALL	07/22/88	HM
CGS04O		SOIL	I	204	MIDDLE FOX CREEK VALL	07/22/88	HM

I = individual
C = composite
WB = whole body
HM = heavy metals: ICP(Pb,Cu,Cr,Mn,Cd, Ni,Sb,Tl,Fe), AAH(As,Se),CV(Hg)
ND = not determined

Table 2. Organics: Tabulated Sample Catalog:.....
Alaska Maritime - military cleanup

Sample ID Number	Species	Tissue/ Matrix	Sample Type	Weight	Collection Site Description	Collection Date	Analysis Requested and Remarks
ATA010		SOIL	I	148	SE END OF RUNWAY	06/28/88	O,A
BTA010		SOIL	I	106	SE END OF RUNWAY	06/28/88	O,A
CTA010		SOIL	I	168	SE END OF RUNWAY	06/28/88	O,A
ATA020		SOIL	I	118	BUILDING COMPLEX	06/28/88	O,A
BTA020		SOIL	I	128	BUILDING COMPLEX	06/28/88	O,A
CTA020		SOIL	I	142	BUILDING COMPLEX	06/28/88	O,A
ATA030		SOIL	I	118	BUILDING COMPLEX	06/28/88	O,A
BTA030		SOIL	I	96	BUILDING COMPLEX	06/28/88	O,A
CTA030		SOIL	I	120	BUILDING COMPLEX	06/28/88	O,A
ATA040		SOIL	I	131	BUILDING COMPLEX CREEK	06/29/88	O,A
BTA040		SOIL	I	182	BUILDING COMPLEX CREEK	06/29/88	O,A
CTA040		SOIL	I	158	BUILDING COMPLEX CREEK	06/29/88	O,A
ATA050		SOIL	I	224	LARGE BARREL DUMP	06/29/88	O,A
BTA050		SOIL	I	228	LARGE BARREL DUMP	06/29/88	O,A
CTA050		SOIL	I	248	LARGE BARREL DUMP	06/29/88	O,A
ATA06S		SEDIMENT	I	129	HOUSING COMPLEX	06/29/88	O,A
BTA06S		SEDIMENT	I	217	HOUSING COMPLEX	06/29/88	O,A
CTA06S		SEDIMENT	I	243	HOUSING COMPLEX	06/29/88	O,A
ATA070		SOIL	I	114	BY WATER TANK	06/29/88	O,A
BTA070		SOIL	I	166	BY WATER TANK	06/29/88	O,A
CTA070		SOIL	I	128	BY WATER TANK	06/29/88	O,A
BTA08S		SEDIMENT	I	197	PUMPHOUSE LAKE	06/29/88	O,A
CTA08S		SEDIMENT	I	193	PUMPHOUSE LAKE	06/29/88	O,A
ATA09S		SEDIMENT	I	363	RUNWAY DRAINAGE DITCH	06/29/88	O,A
BTA09S		SEDIMENT	I	535	RUNWAY DRAINAGE DITCH	06/29/88	O,A
CTA09S		SEDIMENT	I	363	RUNWAY DRAINAGE DITCH	06/29/88	O,A
ATA100		SOIL	I	302	SE END OF RUNWAY	06/29/88	O,A
BTA100		SOIL	I	302	SE END OF RUNWAY	06/29/88	O,A
CTA100		SOIL	I	278	SE END OF RUNWAY	06/29/88	O,A
ATA120		SOIL	I	168	SOUTHEAST BIGHT	06/29/88	O,A
BTA120		SOIL	I	148	SOUTHEAST BIGHT	06/29/88	O,A
CTA120		SOIL	I	166	SOUTHEAST BIGHT	06/29/88	O,A
ATA13S		SEDIMENT	I	467	SOUTHEAST BIGHT LAKE	06/29/88	O,A
BTA13S		SEDIMENT	I	469	SOUTHEAST BIGHT LAKE	06/29/88	O,A
CTA13S		SEDIMENT	I	484	SOUTHEAST BIGHT LAKE	06/29/88	O,A

Sample ID Number	Species	Tissue/ Matrix	Sample Type	Weight	Collection Site Description	Collection Date	Analysis Requested and Remarks
BTA15S		SEDIMENT	I	287	RADIO SHK-N END RUNWAY	06/30/88	D,A
ALK01S		SEDIMENT	I	281	GUN EMPLACEMENT LAKE	07/03/88	D,A
BLK01S		SEDIMENT	I	321	GUN EMPLACEMENT LAKE	07/03/88	D,A
CLK01S		SEDIMENT	I	315	GUN EMPLACEMENT LAKE	07/03/88	D,A
ALK02F	3-SPND STICKLEBK	FISH	C,WB	131	GUN EMPLACEMENT LAKE	07/03/88	D,A
BLK02F	3-SPND STICKLEBK	FISH	C,WB	127	GUN EMPLACEMENT LAKE	07/03/88	D,A
CLK02F	3-SPND STICKLEBK	FISH	C,WB	125	GUN EMPLACEMENT LAKE	07/03/88	D,A
ALK03S		SEDIMENT	I	361	SLUFF LAKE	07/03/88	D,A
BLK03S		SEDIMENT	I	357	SLUFF LAKE	07/03/88	D,A
CLK03S		SEDIMENT	I	389	SLUFF LAKE	07/03/88	D,A
ALK04D		SOIL	I	270	BARE HILL	07/03/88	D,A
BLK04D		SOIL	I	174	BARE HILL	07/03/88	D,A
CLK04D		SOIL	I	222	BARE HILL	07/03/88	D,A
AAT01D		SOIL	I	242	ENGINEER HILL	07/07/88	D,A
BAT01D		SOIL	I	213	ENGINEER HILL	07/07/88	D,A
CAT01D		SOIL	I	162	ENGINEER HILL	07/07/88	D,A
BAT02S		SEDIMENT	I	331	ENGINEER HILL	07/07/88	D,A
CAT02S		SEDIMENT	I	183	ENGINEER HILL	07/07/88	D,A
AAT03D		SOIL	I	250	N END W MASS VALLEY	07/07/88	D,A
BAT03D		SOIL	I	196	N END W MASS VALLEY	07/07/88	D,A
CAT03D		SOIL	I	250	N END W MASS VALLEY	07/07/88	D,A
AAT04S		SEDIMENT	I	279	E SIDE HOGBACK RD	07/07/88	D,A
BAT04S		SEDIMENT	I	313	E SIDE HOGBACK RD	07/07/88	D,A
CAT04S		SEDIMENT	I	251	E SIDE HOGBACK RD	07/07/88	D,A
AAT05D		SOIL	I	228	HENDERSON MARSH	07/08/88	D,A
BAT05D		SOIL	I	278	HENDERSON MARSH	07/08/88	D,A
CAT05D		SOIL	I	154	HENDERSON MARSH	07/08/88	D,A
AAT06S		SEDIMENT	I	289	E MASS VALLEY	07/08/88	D,A
CAT06S		SEDIMENT	I	231	E MASS VALLEY	07/08/88	D,A
AAT07S		SEDIMENT	I	385	UPPER E MASS VALLEY	07/08/88	D,A
BAT07S		SEDIMENT	I	391	UPPER E MASS VALLEY	07/08/88	D,A
CAT07S		SEDIMENT	I	405	UPPER E MASS VALLEY	07/08/88	D,A

Sample ID Number	Species	Tissue/ Matrix	Sample Type	Weight	Collection Site Description	Collection Date	Analysis Requested and Remarks
AAT08S		SEDIMENT	I	395	E MASS VALLEY STREAM	07/08/88	O,A
BAT08S		SEDIMENT	I	365	E MASS VALLEY STREAM	07/08/88	O,A
CAT08S		SEDIMENT	I	403	E MASS VALLEY STREAM	07/08/88	O,A
AAT09O		SOIL	I	196	E MASS VAL BARREL DUMP	07/08/88	O,A
BAT09O		SOIL	I	248	E MASS VAL BARREL DUMP	07/08/88	O,A
CAT09O		SOIL	I	238	E MASS VAL BARREL DUMP	07/08/88	O,A
AAT10S		SEDIMENT	I	271	E MASS VAL TRANS POLE	07/08/88	O,A
BAT10S		SEDIMENT	I	265	E MASS VAL TRANS POLE	07/08/88	O,A
CAT10S		SEDIMENT	I	257	E MASS VAL TRANS POLE	07/08/88	O,A
AAT11O		SOIL	I	210	E BREAKWTR CASCO COVE	07/08/88	O,A
BAT11O		SOIL	I	233	E BREAKWTR CASCO COVE	07/08/88	O,A
CAT11O		SOIL	I	186	E BREAKWTR CASCO COVE	07/08/88	O,A
AAT12O		SOIL	I	334	ASPHALT TANK STREAM	07/09/88	O,A
BAT12O		SOIL	I	318	ASPHALT TANK STREAM	07/09/88	O,A
CAT12O		SOIL	I	290	ASPHALT TANK STREAM	07/09/88	O,A
AAT13O		SOIL	I	268	FUEL PUMPS-ASPHALT STR	07/09/88	O,A
BAT13O		SOIL	I	288	FUEL PUMPS-ASPHALT STR	07/09/88	O,A
CAT13O		SOIL	I	198	FUEL PUMPS-ASPHALT STR	07/09/88	O,A
AAT14S		SEDIMENT	I	347	FUEL TANK VALLEY STREAM	07/09/88	O,A
BAT14S		SEDIMENT	I	291	FUEL TANK VALLEY STREAM	07/09/88	O,A
CAT14S		SEDIMENT	I	307	FUEL TANK VALLEY STREAM	07/09/88	O,A
AAT15S		SEDIMENT	I	257	2 FUEL TANKS-FT STREAM	07/09/88	O,A
BAT15S		SEDIMENT	I	255	2 FUEL TANKS-FT STREAM	07/09/88	O,A
CAT15S		SEDIMENT	I	257	2 FUEL TANKS-FT STREAM	07/09/88	O,A
AAT16S		SEDIMENT	I	287	TRANSF-FUEL TANK VALLEY	07/09/88	O,A
BAT16S		SEDIMENT	I	301	TRANSF-FUEL TANK VALLEY	07/09/88	O,A
CAT16S		SEDIMENT	I	293	TRANSF-FUEL TANK VALLEY	07/09/88	O,A
BAT17S		SEDIMENT	I	221	FUEL TANK VALLEY STREAM	07/09/88	O,A
CAT17S		SEDIMENT	I	291	FUEL TANK VALLEY STREAM	07/09/88	O,A
AAT18O		SOIL	I	378	NEWLY BULLDOZED TOP HILL	07/09/88	O,A
BAT18O		SOIL	I	286	NEWLY BULLDOZED TOP HILL	07/09/88	O,A
CAT18O		SOIL	I	296	NEWLY BULLDOZED TOP HILL	07/09/88	O,A

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APPENDIX A

FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES ANCHORAGE
ALEUTIAN ISLANDS MILITARY CONTAMINANTS STUDY PLANS

FISCAL YEARS 1988-1990

U.S. Fish and Wildlife Service
Region 7

ENVIRONMENTAL CONTAMINANTS SAMPLING AT DEFENSE ENVIRONMENTAL RESTORATION PROGRAM CLEANUP SITES ALASKA MARITIME NATIONAL WILDLIFE REFUGE:

Great Sitkin Island — Little Kiska Island
Semisopochnoi Island — Tanaga Island
Attu Island

GENERAL STUDY PLAN
Supplement No. 1: Fiscal Year 1988 Activities

Principal Investigators:

Biological Technician
Alaska Maritime National Wildlife Refuge — Date 5/19/88

Refuge Manager
Alaska Maritime National Wildlife Refuge — Date 5/25/88

Concurrence/Approval:

Environmental Contaminants Specialist
Anchorage Field Office — Date 5/27/88

Environmental Contaminants Coordinator
Region 7 — Date 5/31/88

Refuges Contaminant Coordinator — Date 5/31/88

Project Identification Number: To Be Assigned in Fiscal Year 1989

U.S. Fish and Wildlife Service

Region 7

General Study Plan

Title

Environmental contaminants sampling at Defense Environmental Restoration Program cleanup sites - Alaska Maritime National Wildlife Refuge: Tanaga, Little Kiska, Attu, Semisopochnoi, and Great Sitkin Islands.

Objectives

Phase I.

1. Perform sampling at Tanaga, Little Kiska, Attu, Semisopochnoi, and Great Sitkin Islands on the Alaska Maritime National Wildlife Refuge to determine what contaminants, if any, may have entered the environment surrounding abandoned military installations.

2. Interpret analytical results and draw inferences as to the data's ecological significance and source of contaminants, if any.

Phase II.

1. Identify needs for remedial action and coordinate with other agencies to effect cleanup.

2. Conduct follow-up sampling after cleanup to ensure completion of program.

Justification and Background:

The Defense Environmental Restoration Program (P.L. 98-212, 97 Stat. 1427, Dec. 8, 1983) is part of a Department of Defense program designed to identify, evaluate, and cleanup hazardous waste sites on abandoned military bases and restore the areas to their near orginal state by implementing remedial actions. The program is administered by the U.S. Army Corps of Engineers.

The subject project sites are in the ownership of the Department of the Interior and administered by the U.S. Fish and Wildlife Service (Service) as part of the Alaska Maritime National Wildlife Refuge (Figure 1). The purposes for which the Alaska Maritime National Wildlife Refuge was established include, in part:

(i) To conserve fish and wildlife populations and habitats in their natural diversity . . .

(iv) To ensure, to the maximum extent practicable . . ., water quality and necessary water quantity within the refuge.

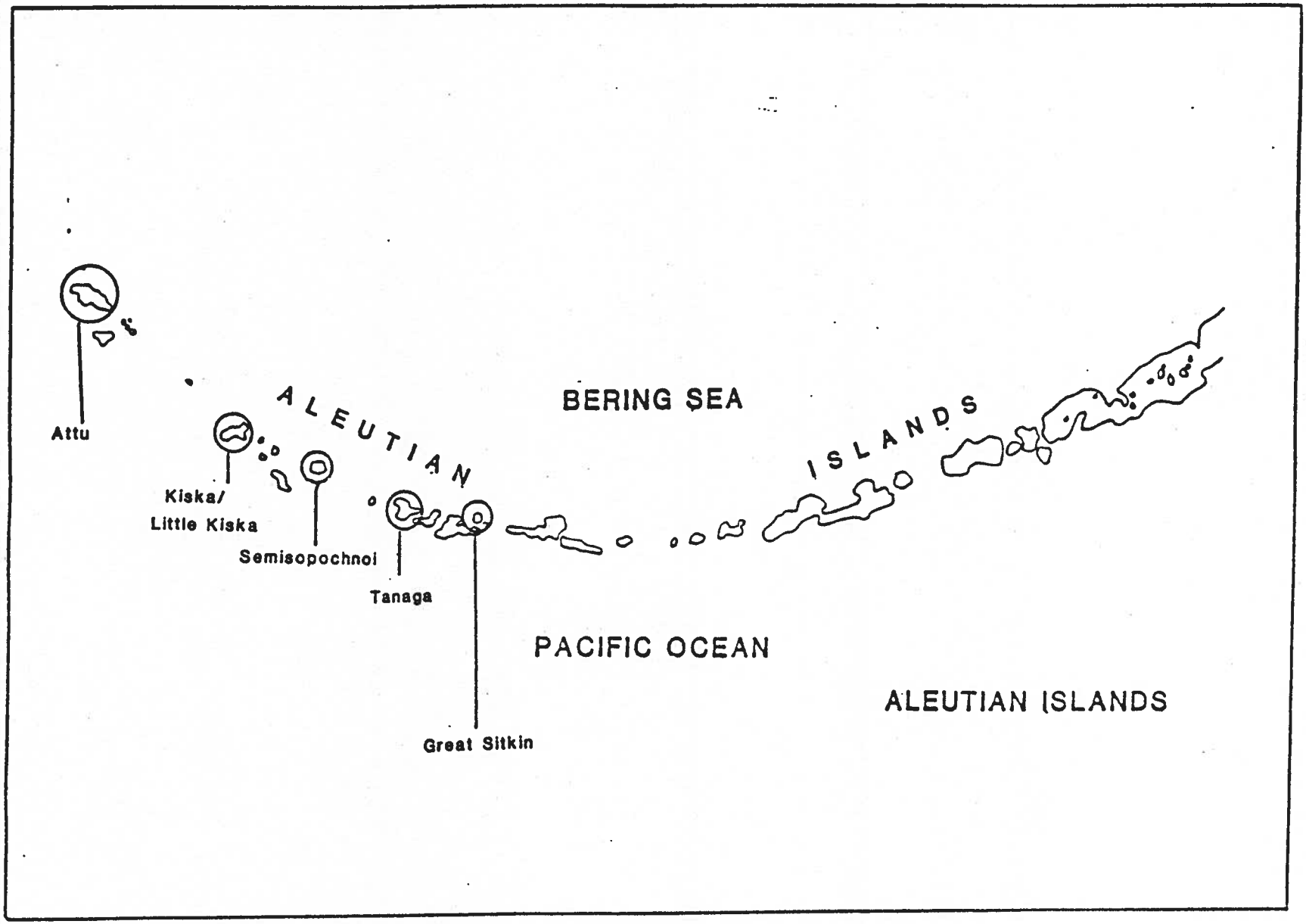

Figure 1: Location of contaminant sampling sites at abandoned military sites in the Aleutian Islands, July 1988.

As the agency charged with the public trust responsibility of managing and protecting the resources and habitats of the Alaska Maritime National Wildlife Refuge, the Service will conduct limited field investigations at the subject sites in an attempt to determine what contaminants, if any, may have entered the refuge environment.

Most of the abandoned military installations are known to contain either petroleum, oil, and lubricant (POL) products and spills or electrical transformers which may contain polychlorinated biphenols (PCBs). Extensive leaching of POL and PCBs into the surrounding environment, depending on their chemical make-up and concentration, could pose a threat to fish and wildlife resources.

The Anchorage Field Office collected contaminant samples around abandoned military installations on Agattu, Kiska, and Great Sitkin Islands between July 15 and August 11, 1987. Collected were 169 individual soil/sediment samples, 32 fish samples, and one individual fish sample. The fish consisted of Dolly Varden (Salvelinus malma), threespine stickleback (Gasterosteus aculeatus), and coastrange sculpin (Cottus aleuticus). Soil samples were collected from 23 sampling sites; sediment samples were collected from eight sampling sites; and fish smples were collected from five lakes and two streams.

The most dramatic evidence of contaminated refuge habitat was found on Great Sitkin Island, a site the Service knew little about. Of Great Sitkin's 39,219 acres, 700 acres are affected by military debris (Figure 2). During World War II, Great Sitkin was utilized as a fuel station by the Navy. The site is located on the south side of the island and has roads, quonset huts (48), wood frame buildings (31), concrete foundations, ammunition magazines (18), pumphouses (2), boilers and generators (2), fuel storage tanks (50), a dock, submarine nets (5), floats and miscellaneous debris (U.S. Army, 1977). The greatest threat to fish and wildlife resources are the pumphouses, generators, and fuel storage tanks.

Some petroleum products remain in partially demolished storage tanks on the island. At some unknown time prior to 1977 these tanks were incompletely burned which caused the internal structure to collapse and spill their fuel contents onto the ground. The fuel was absorbed into the soil and two years later surfaced nearly one-half mile away in the ocean thereby presenting a hazard to local fish and wildlife. In August 1987, the Service collected soil, sediment, and fish samples from seven sites within the drainage. Large pools of petroleum products were discovered in the Little Fox Creek drainage which is pocketed with large fuel storage tanks. One pool was found draining directly into the Creek. Other pools were found to contain numerous submerged and floating rosey finch carcasses and unidentifiable bird species. No results have been received from 1987's sampling efforts therefore 1988's activities will center on collections in the Fox Creek drainage which lies just west of Little Fox Creek.

Ocean Technology, Ltd., under contract with the U.S. Army, visited Tanaga Island to conduct a site inventory of the abandoned military installation (Ocean Technology, Ltd., 1986).

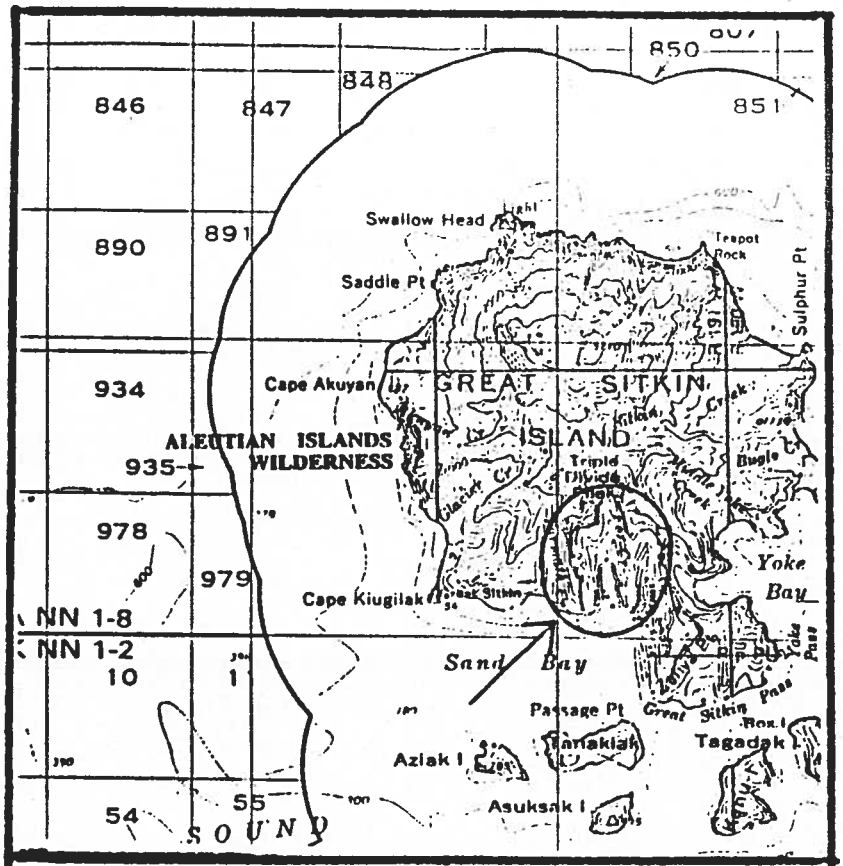

Figure 2: Location of contaminant sampling site on Great Sitkin Island, July 1988.

Of Tanaga's 128,000 acres, 774 acres were used for military purpose. The abandoned facility is located in the southwest corner of the island, on Cape Amagalik (Figure 3). The installation contains a wide variety of wastes and debris; however, only those sites the Service suspects as being contaminated are identified and discussed hereafter. West of a quarry camp is a dump containing rusted, empty 55-gallon drums. Some of these drums still contain diesel and asphaltic material. Combination generator shed/radio shacks are located at the north and south ends of the airstrip, both have 300-gallon, empty fuel tanks behind them. Adjacent to the southwest corner of the airstrip are barrels filled with used engine oil. Alongside a gravel road from the north end of the airstrip are the remains of a generator shed with five gasoline fired generators. Nearby is an elevated transformer rack with two transformers. A small lake is located 400 feet north of this facility. At the southeast end of the lake is a well house which supplies water to the quarry camp. In the vicinity of the quarry camp is an 8-foot wide by 10-foot long fuel tank. Located near the airstrips and runway lighting generator building are pole mounted type transformers.

Attu comprises 223,312 acres and is the western-most island of the Aleutian Chain (Figure 4; U.S. Fish and Wildlife Service, 1988). Attu was occupied by the Japanese Army from June 7, 1942, to May 30, 1943, when the Japanese Army surrendered/lost. The battlefield covers 15 square miles on the eastern side of the island. It is unclear if this is the total acreage affected by military operations. At present, the Coast Guard occupies 1,800 acres with a loran station. The World War II debris consists of quonset huts, wood frame buildings, pumphouse, ammunition magazines, concrete foundations, utility poles, steel tanks and miscellanous debris (U.S. Army, 1977). There is very little textual information about the types and locations of hazardous material which may exist on Attu Island.

Semisopochnoi consists of 56,013 acres (Figure 5; U.S. Fish and Wildlife Service, 1988). The military's presence on the island affected the southern portion of the island. Military debris consists of quonset huts (8), a wrecked aircraft, and miscellanous debris (U.S. Army, 1977). Little textual information on the location of the debris is available.

Little Kiska comprises 1,843 acres (Figure 6; U.S. Fish and Wildlife Service, 1988). The military debris left consists of quonset huts (5), wood frame building (1), coastal-gun emplacements, anti-aircraft emplacements, miscellanous steel and wood debris, roads and POL barrels (100) (U.S. Army, 1977). Like Semisopochnoi Island, little textual information on the location of the debris is available.

The need for the Service to determine the presence or absence of contaminants at abandoned military sites in the Aleutian Islands is great because:

1) there is a potential for contaminants to be transferred from the facility through the food chain to Fish and Wildlife trust resources, and

2) the Service does not want to potentially inherit a contaminant problem when full land management authorities are acquired.

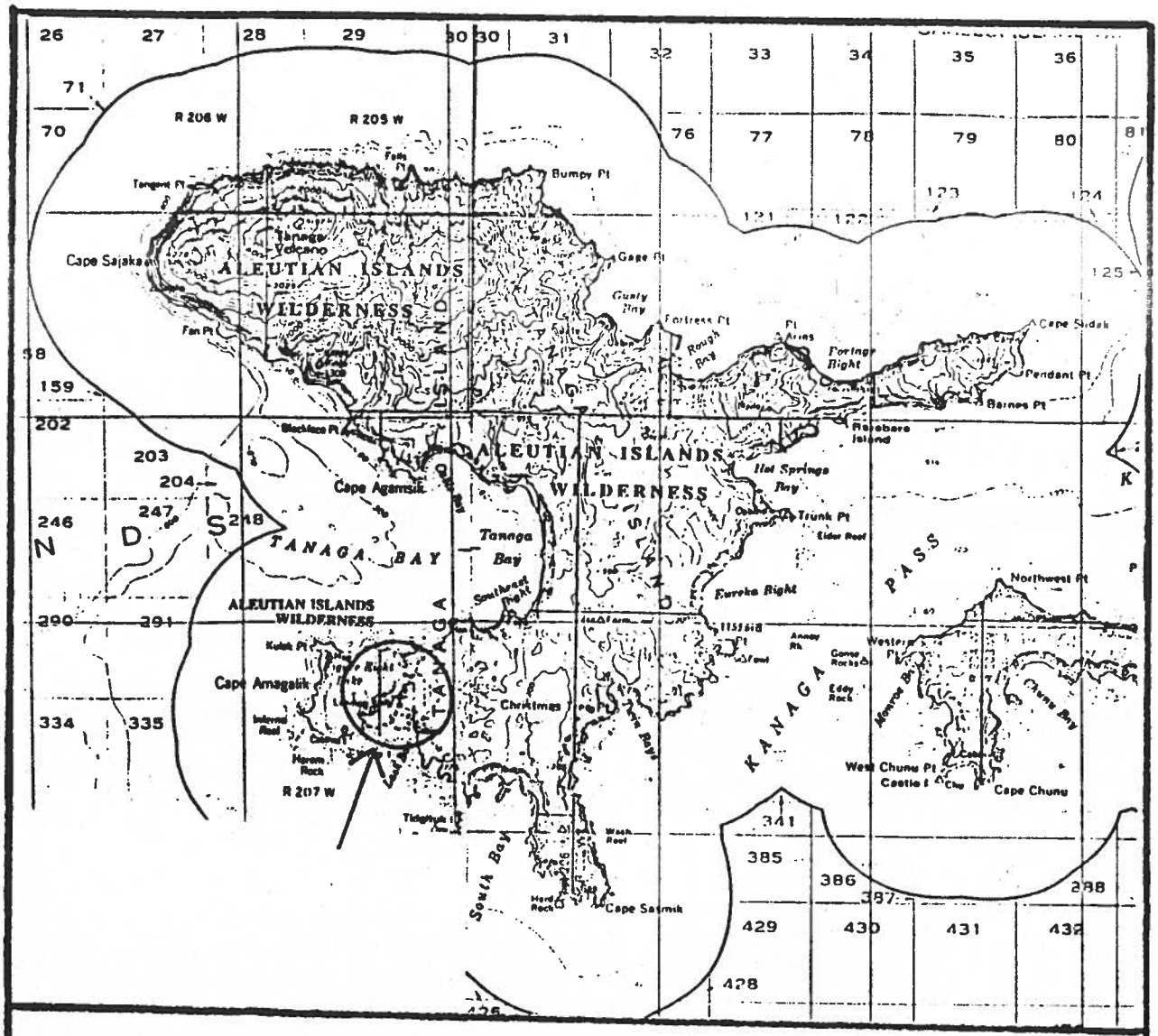

Figure 3: Location of contaminant sampling site on Tanaga Island, July 1988.

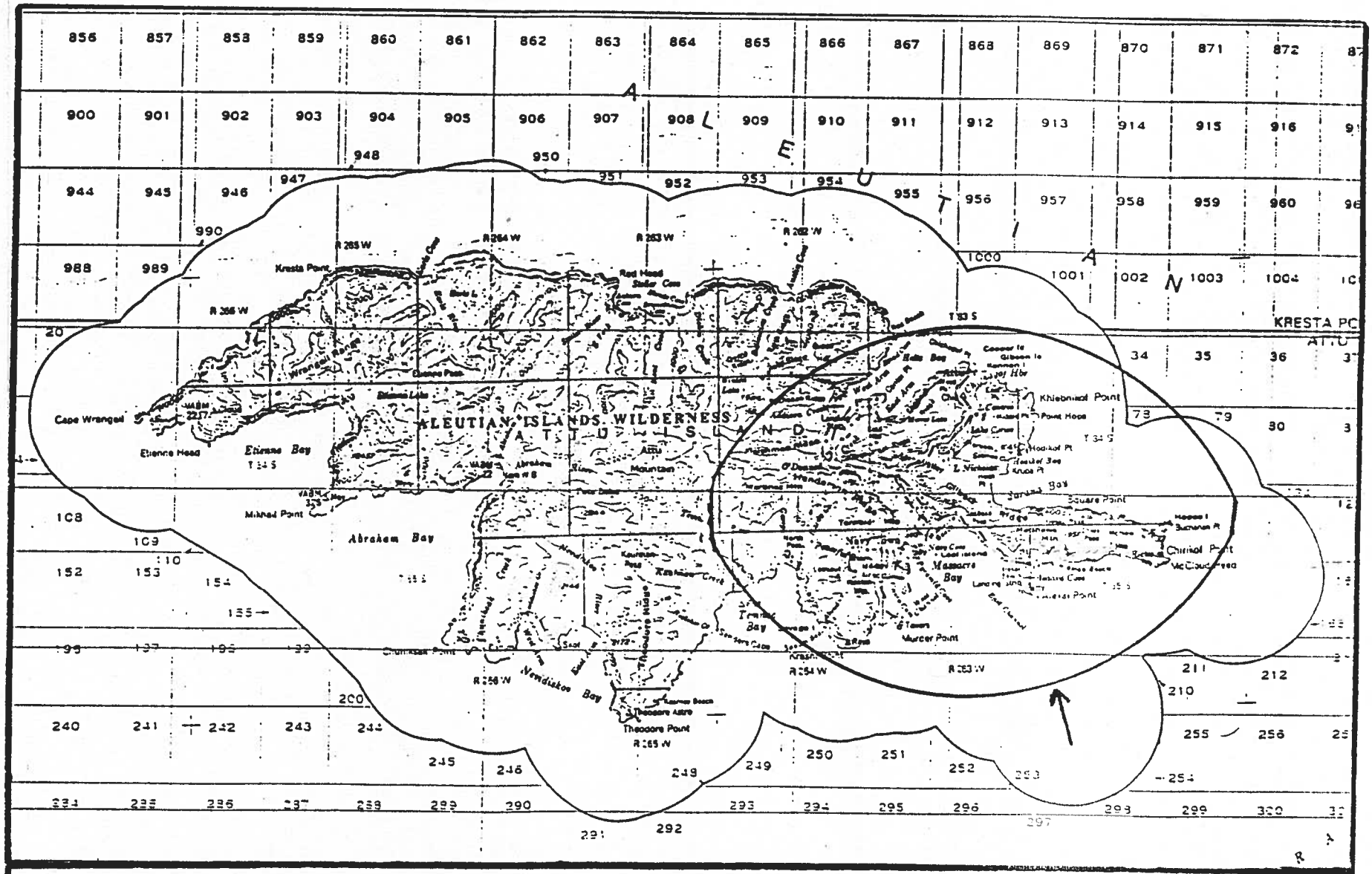

Figure 4: Location of contaminant sampling site on Attu Island, July 1988.

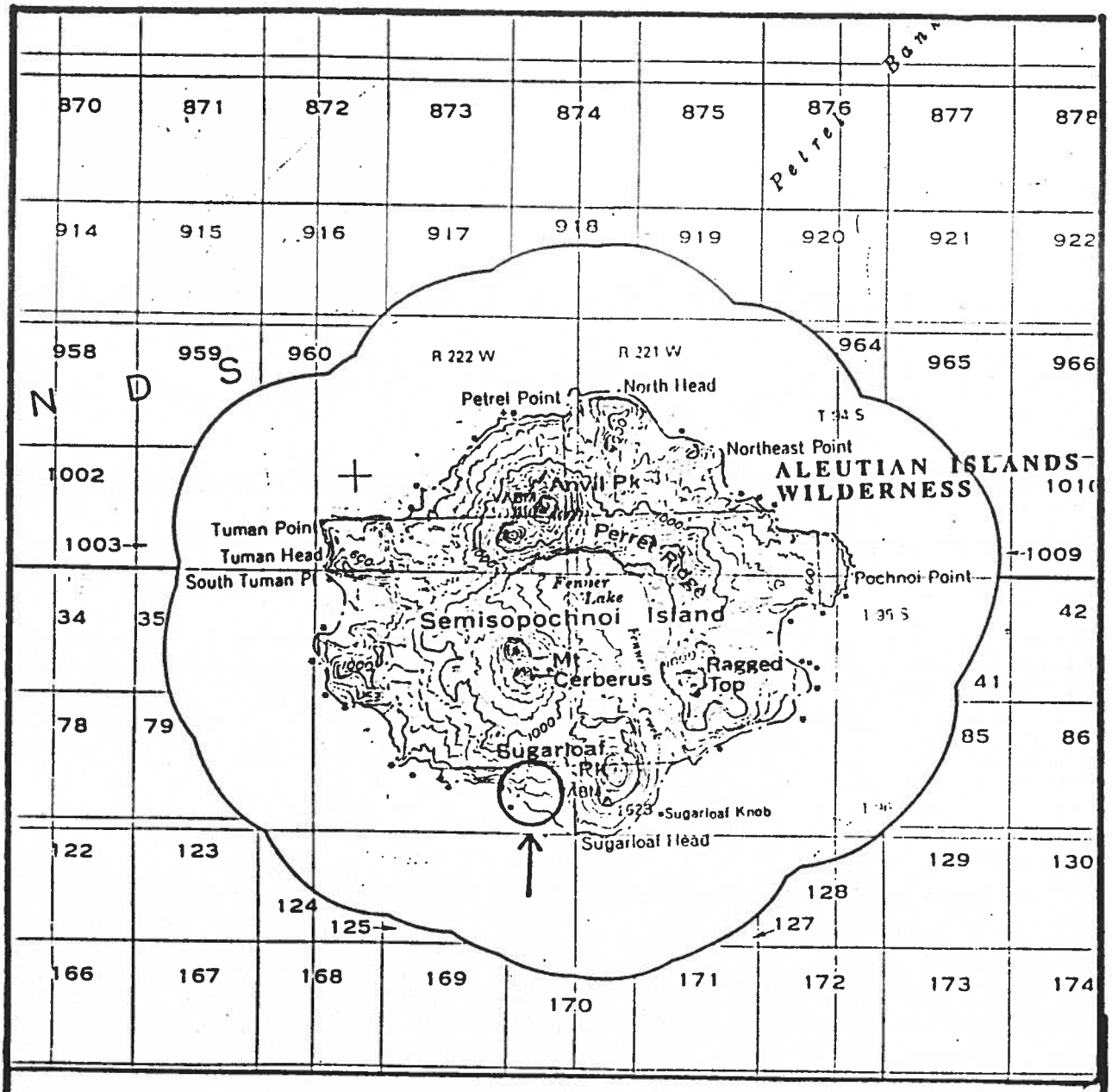

Figure 5: Location of contaminant sampling site on Semisopochnoi Island, July 1988.

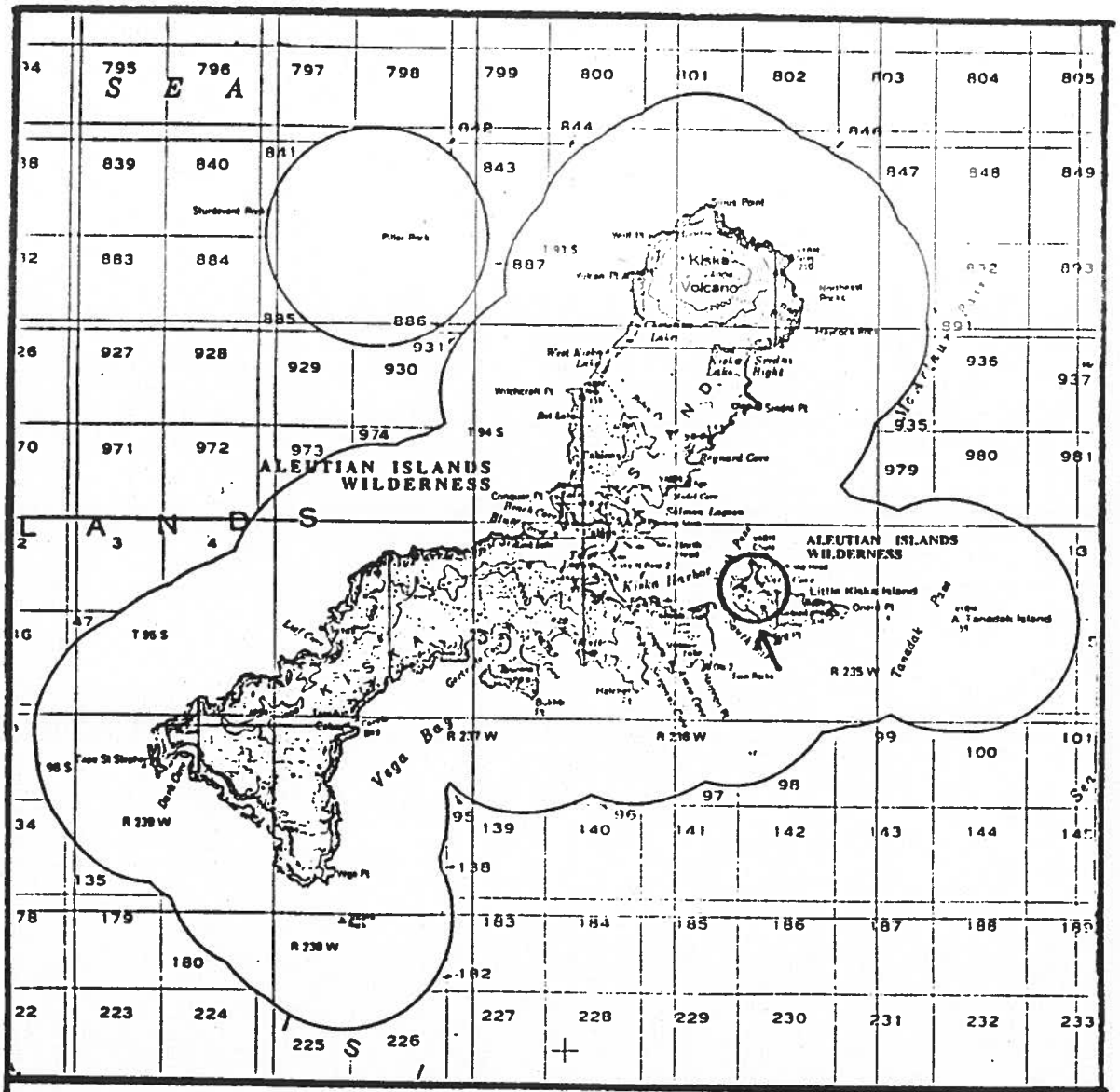

Figure 6: Location of contaminant sampling site on Little Kiska Island, July 1988.

Methods

1. Study Strategies: This study plan has been divided into two investigative phases. Each phase addresses general objectives, the results of which build upon each other. Only Phase I is intended to be addressed in this year's study plan.

   Phase I is designed to establish a data base which will be used to determine whether or not contaminants exist at the sites in concentrations which may adversely impact the surrounding ecosystem.

2. Study Areas:

   A. Little Kiska and Semisopochnoi

   Because little is known about the types and quantity of debris on these islands, it is difficult to definitively state what locations will be sampled. Therefore, prior to establishing final sampling stations each island will first be inventoried for candidate sampling sites. Possible sampling sites are:

   1. power generating facilities
   2. radio shacks
   3. landfills and dumps
   4. airport hangers
   5. garages
   6. fuel storage tanks
   7. barrel dumps
   8. fuel pumping stations
   9. electrical poles
   10. transformers
   11. petroleum-based products storage areas
   12. drainage ditches
   13. streams in proximity to military facilities
   14. lakes or ponds in proximity to military facilities

   B. Great Sitkin

   Soil, sediment, and biological samples will be collected at the aforementioned candidate sampling sites within the Fox Creek drainage and at the upper camp area of Little Fox Creek.

   C. Attu Island

   Based on aerial photography interpretation, soil, sediment, and biological samples will be collected at the aforementioned candidate sampling sites around the following primary areas in the vicinity of Massacre Bay:

   1. Murder Point
   2. Casco Cove
   3. Loaf Point
   4. Navy Town
   5. Casco Point
   6. West and East Massacre Bay Valley
   7. Alexai Point
   8. Peaceful Valley

Areas of secondary concern include the following: Chighagof Point, Jim Fish Valley, West Arm Holtz Bay, and Addison Valley.

C. Tanaga Island

Because of Ocean Technology's report, enough information is known about this site to preliminarily identify sampling locations. The sites which follow will be sampled unless unforeseen sites posing a greater environmental threat are discovered.

1. Near Shore Barrel Dump - 4 stations, 3 composites/station
2. Airstrip Generator Shed/Radio Shack (North) - 1 station, 1 composite
3. Airstrip Generator Shed/Radio Shack (South) - 1 station, 1 composite
4. Airstrip Southeast corner debris - 1 station, 1 composite
5. East Road Generator Shed - 1 station, 1 composite
6. Quarry Camp - 2 stations (fuel tanks, associated debris pile), 2 composites
7. Airstrip Generator Building Transformers - 1 station 1 composite
8. Southwest Station - 1 station, 1 composite

In addition to sampling contaminated sites, up to four control sampling stations will also be established on each island.

3. Field Procedures: Logistical support is being provided by the Alaska Maritime National Maritime Refuge. Transportation to each island site will be via the Service vessel M/V Tiglax or in the case of Great Sitkin Island, access will be by Boston Whaler. Where not prohibited, ground transportation will utilize all-terrain vehicles having low-pressure tires. The Kenai Fisheries Resources field office will assist the Alaska Maritime National Wildlife Refuge in its fish collections. Service volunteers will be available to provide assistance in field collections as well.

The 1988 field schedule is as follows:

May 25	Homer - load gear on M/V Tiglax
June 27	Leave Adak, en route Tanaga
June 28	Arrive Tanaga
June 30	Leave Tanaga, en route Little Kiska
July 1	Arrive Little Kiska
July 3	Leave Little Kiska, en route Attu
July 8	Arrive Attu
July 14	Leave Attu, en route Semisopochnoi
July 18	Arrive Semisopochnoi
July 20	Leave Semisopochnoi, en route Adak
July 21	Arrive Adak
July 23	Sample Great Sitkin
July 26	Leave Adak, en route Homer

Soil and sediment will be collected because of their ability to concentrate and store contaminants. Each sample will be a single composite composed of three to five aliquots taken from the surface and/or shallow sub-surface. All sites will be sampled in triplicate and analyzed for metals and organic-related compounds.

Collected soils will be as fine textured as possible, and from low spots on the site, subject to collecting drainage. For metal analysis, soil will be collected with acetone-rinsed stainless steel utensils, mixed in aluminum foil-lined stainless steel trays, and stored in Zip-lock plastic bags. The stainless steel tray will be relined with aluminum foil for each new sample. For organic-related analyses, all samples will be collected with acetone-rinsed stainless steel utensils, mixed in aluminum foil-lined trays and placed in acid-cleaned jars with teflon-lined caps or wrapped in aluminum foil which in turn will be placed in Zip-lock plastic bags. Soil samples to be analyzed for organic compounds will be stored at approximately 4 degrees centigrade.

Composite sediment samples will be collected from project area lakes, streams, and/or drainage ditches. Like soil samples, control sites will also be established and sampled. All samples will be stored in acid-cleaned polyethylene jars for metal analysis and acid-cleaned glass jars with teflon-lined lids for organic analysis after having been collected with a stainless steel strainer and mixed in a stainless steel bowl. Sediment samples will be stored at approximately 4 degrees centigrade.

Biological samples, if collected, will be from areas which have been obviously impacted or highly suspected to have been impacted by contaminated military wastes. Sampling will probably center around collecting resident fish species (e.g. Salvelinus malma, Gasterosteus aculeatus) using seines and baited minnow traps. Specimens will be weighed, stored in acid-cleaned glass jars, and frozen as soon as possible. Most probably, samples will be composited to achieve the necessary sample weight.

The sampling quantities which follow are minimum requirements, and should be doubled if possible.

Analyte	Quantity (grams)	
	Soil/Sediment	Tissue
metals	10	20
organics	110	25

If extensive areas of contamination should be found, Phase II of the study will be modified to include additional soil, sediment, and biological sampling to determine the extent of contamination into the ecosystem.

4. Analytical Procedures: All samples are to be analyzed for organochlorines and PCBs, aromatic hydrocarbons, and the following priority pollutant heavy metals: antimony (Sb), arsenic (As), beryllium (Be), cadmium (Cd), chromium (Cr), lead (Pb), mercury (Hg), nickel (Ni), selenium (Se), silver (Ag), thallium (Tl), and zinc (Zn). Arsenic and Se values will be determined using flameless atomic absorption spectrophotometry. Cold vapor techniques will be used to determine Hg concentrations. The remaining metals will be analyzed by atomic absorption spectrophotometry. Organic-related concentrations will be determined by using gas chromatography/mass spectrometry.

   It is important to note that the sample holding time, as established and defined by the U.S. Environmental Protection Agency (1986), will be exceeded for all soil and sediment samples analyzed for aromatic hydrocarbons (14 days) and organochlorines with PCBs (to be extracted within 7 to 14 days and analyzed within 40 days after extraction). Therefore, the intergrity of the results generated for these parameters is lessened. Holding times for organic and inorganic analyses in biological matrices have not yet been determined by the scientific community.

5. Cataloging: All samples shall be labelled and be accompanied by a complete catalog, which should include complete data on each sample: regional reference number, date, sample number, site description and location, quantity, weight, and any other pertinent information. The sample catalog will be prepared by Refuge and Ecological Services staff and be entitled "Alaska Maritime - Monitor Military Cleanup."

6. Shipment: Samples should be sent to Anchorage by air, in strong insulated chests containing blue ice. Samples will be shipped to the analytical lab(s) as instructed by th Patuxent Analytical Control Facility in strong coolers with dry ice as needed.

Results

Data from the sampling program will be entered into a computer data base and analyzed with appropriate SPSS statistical software. Appropriate statistical tests will be used for analysis of variability within sample sites and between sample sites and the control site. Most results will be presented in tabular format with summary statistics. Baseline data on contaminant levels in soil sediments will be compared with those from nation-wide and Alaskan databases. The ecological significance of identified contaminant levels will be discussed. Anticipated products of this study include: 1) a Phase I report that will summarize all field activities, present analytical results, describe the biological implications of the analytical results, and if necessary, 2) a Phase II report that will identify the need for any agency coordination on remedial action and suggest any further investigation which might be needed. The Anchorage Ecological Services field office will be responsible for preparing the Phase I and Phase II reports with input and review from Refuge personnel.

Cited Literature

Ocean Technology, Ltd. 1986. Report for Seven Aleutian Islands and Driftwood Bay and Dutch Harbor: Tanaga Island. 40 pp.

U.S. Army Engineer District, Alaska: Corps of Engineers. 1977. Debris removal and cleanup study - Aleutian Islands and Lower Alaska Penisula, Alaska. June. 334 pp.

U.S. Environmental Protection Agency. 1986. Test Methods for Evaluating Solid Waste. Office of Solid Waste and Emergency Response. Third Edition. Four Volumes. SW-846. Washington, D.C. November.

U.S. Fish and Wildlife Service. 1988. Alaska Maritime National Wildlife Refuge Draft Comprehensive Conservation Plan, Wilderness Review and Environmental Impact Statement. February. 2 volumes.

Study Cost Estimate

1.	Analytical (see Appendix for more detailed cost breakdown for analytical tests)	
	A. Tanaga Island - soil, sediment, and/or biological	
	1. 16 sampling stations	
	2. 48 metal and 48 organic samples	$ 34,576.80
	B. Great Sitkin Island - soil, sediment, and/or biological	
	1. 16 sampling stations	
	2. 48 metal and 48 organic samples	$ 34,576.80
	C. Little Kiska Island - soil, sediment, and/or biological	
	1. 16 sampling stations	
	2. 48 metal and 48 organic samples	$ 34,576.80
	D. Semisopochnoi Island - soil, sediment, and/or biological	
	1. 16 sampling stations	
	2. 48 metal and 48 organic samples	$ 34,576.80
	E. Attu Island	
	1. 32 sampling stations	
	2. 96 metal and 96 organic samples	$ 69,153.90
	F. TOTAL PROJECTED ANALYTICAL EXPENDITURES	$207,461.10
2.	Operation	
	A. Jars/Bottles	
	1. Wide-mouth glass jars with teflon-lined closures, I-Chem, No. 241--0250; amber 250ml, 12/case, $20.05/case 5 each	$ 100.25
	No. 221-1000; clear 1000ml, 12/case, $36.60/case 3 each	$ 109.80
	2. Polyethylene wide-mouth jars No. 211-0250; 250ml, 48/case $82.08/case 1 each	$ 82.08
	B Aluminum foil - 2 large rolls	15.00
	C. Zip-lock bags - quart and gallon size - 50 dozen	50.00
	D. Stainless steel spoons - 50 dozen	200.00
	E. Acetone - 1 gallon	40.00
	F. Mixing trays - 6 each	35.00
	G. Stainless steel mixing bowl - 2 each	15.00
	H. Stainless steel strainer - 2 each	10.00
	I. 100 - quart coolers - 4 each	240.00
	J. Stake posts - 100	50.00
	K. Aerial photos	300.00
	L. Topographic maps	50.00
	M. Miscellaneous and unforseen items	500.00
	N. Study Plan Administration - Biological Technician	5,000.00
	O. PROJECTED TOTAL OPERATION EXPENDITURES	$ 6,797.13
3.	INVESTIGATION GRAND TOTAL (ANALYTICAL AND OPERATIONS)	$214,258.23

PROPOSED FOR FUNDING IN FY '89. FUNDS NOT YET AVAILABLE. J. Uhlhe 5/31/88

FY '88 FUNDS J.W.

APPENDIX

ANALYTICAL COST BREAKDOWN

I. Average cost/sample: sediment, soil, and tissue analyses

A.	Organochlorines with PCBs and Aromatic Hydrocarbons	$450.00
B.	Trace Metals	
	1. Arsenic, Selenium, Mercury	83.40
	2. Antimony, Beryllium, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Nickel, Silver, Thallium, Zinc	186.95
C.	TOTAL	$720.35

II. Costs per station assuming triplicate samples are collected

A.	3 metal x $270.35 =	$ 811.05
B.	3 organics x $450.00 =	$1,350.00
C.	Total Cost Per Station	$2,161.05

III. Total numbered stations which can be set up given budget constraints

A.	Costs per station	$2,161.05
B.	Total analytical funds	$207,000.00
C.	Total number of stations =	96
1.	Station number distribution	
a.	Attu	32
b.	Great Sitkin	16
c.	Semisopochnoi	16
d.	Little Kiska	16
e.	Tanaga	16

FY____ PROJECT SUBMISSION

Field Station or Refuge Alaska Maritime NWR Date _____

Project Title: Abandoned Military Wastes: Attu Island

Problem Statement: Attu compriees 223,312 acres and is the weetern-most island of the Aleutian Chain (Figure 4; U.S. Fish and Wildlife Service, 1988). Attu wae occupied by the Japanese Army from June 7, 1942, to May 30, 1943, when the Japanese Army surrendered/lost. The battlefield covers 15 square miles on the eastern side of the island. It is unclear if this is the total acreage affected by military operations. At present, the Coast Guard occupies 1,800 acres with a loran station. The World Ware II debris consists of quonset huts, wood frame buildings, pumphouse, ammunition magazines, concrete foundations, utility poles, steel tanks, and miscellaneous debris (U.S. Army, 1977). There is very little textual information about the types and locations of hazardous material which may exist on Attu Island.

Objectives: 1. To determine where cleanup activities need to occure on Attu.
2. To determine what hazardous meteriels ere present on Attu.

Methods: Soil and sediment will be collected because of their ability to concentrate and store contaminants. Each sample will be a single composite composed of three to five aliquots taken from the surface and/or shallow sub-surface. All sites will be sampled in triplicate and analyzed for metals and organic-related compounds. Collected soils will be as fine textured as possible, and from low spots on the site, subject to collecting drainage. For metal analysis, soil will be collected with acetone-rinsed stainless steel utensils, mixed in aluminum foil-lined stainless steel trays, and stored in Zip-lock plastic bags. The stainless steel tray will be relined with aluminum foil for eech new sample. For organic-related analyses, all samples will be collected with acetone-rinsed stainless steel utensils, mixed in aluminum foil-lined trays and placed in acid-cleaned jars with teflon-lined caps or wrapped in aluminum foil which in turn will be placed in Zip-lock plastic bags. Soil samplee to be analyzed for organic compounds will be stored at approximately 4 degrees centigrade. Composite sediment samples will be collected from project area lakes, streams, and/or drainage ditches. Like soil samples, control sites will also be established and sampled. All samples will be stored in acid-cleaned polyethylene jars for metal analysis and acid-cleaned glass jars with teflon-lined lids for organic analysis after having been collected with a stainless steel strainer and mixed in a stainless steel bowl. Sediment samples will be stored at approximately 4 degrees centigrade. Biological samples, if collected, will be from areas which have been obviously impacted or highly suspected to have been impacted by contaminated military wastes. Sampling will be from areas which have been obviously impacted or highly suspected to have been impacted by contaminated military wastes. Sampling will probably center around collecting resident fish species (e.g. Salvelinus malma, Gasterosteus aculeatus) using seines and baited minnow traps. Specimens will be weighed, stored in acid-cleaned glass jars, and frozen as soon ee possible. Most probably, samples will be composited to achieve the necessary sample weight.

FTE'S Required _____

New Hires Required _____

List Major Equipment Purchases: _____

Estimated Annual Budget

Operations:	
Supplies	250.00
Equipment	250.00
Other:	
Shipping	250.00
Per Diem	250.00
Travel	5,000.00
Total:	6,000.00
Contaminant Analysis	50,000.00
Total	56,000.00

PREPARED BY: _____ DATE _____

REVIEWED BY: _____ DATE _____
FIELD SUPERVISOR

FY90___ PROJECT SUBMISSION

Field Station or Refuge Alaska Maritime NWR Date _____

Project Title: Environmental contaminants sampling at Defense Environmental Restoration Program cleanup sites - Alaska Maritime NWR, Semisopochnoi Island.

Problem Statement: The Defense Environmental Restoration Program is part of a Department of Defense program designed to identify, evaluate, and cleanup hazardous waste sites on abandoned military bases and restore the areas to their near original state by implementing remedial actions. The program is administered by the U.S. Army Corps of Engineers. The subject project site is in the ownership of the Department of the Interior and administered by the U.S. Fish and Wildlife Service (Service) as part of the Alaska Maritime National Wildlife Refuge. Most of the abandoned military installations are known to contain either petroleum, oil, lubricant (POL) products and spills or electrical transformers which may contain polychlorinated biphenols (PCB's). Extensive leaching of POL and PCB's into the surrounding environment, depending on their chemical make-up and concentration, could pose a threat to fish and wildlife resources. Semisopochnoi consists of 56,013 acres. The military's presence on the island affected the southern portion of the island. Military debris consists of quonset huts (8), a wrecked aircraft, and miscellaneous debris (U.S. Army, 1977). Little textual information on the location of the debris is available. The need for the Service to determine the presence or absence of contaminants at the abandoned military sites in the Aleutian Islands is great because: 1. There is potential for contaminants to be transferred from the facility through the food chain to Fish and Wildlife trust resources, and 2. the Service does not want to potentially inherit a contaminant problem when full land management authorities are acquired.

Objectives: Phase I: 1. Perform sampling at Semisopochnoi Island on the Alaska Maritime National Wildlife Refuge to determine what contaminants, if any, may have entered the environment surrounding abandoned military installations. 2. Interpret analytical results and draw inferences as to the data's ecological significance and source of contaminants, if any. Phase II: 1. Identify needs for remedial action and coordinate with other agencies to effect cleanup.2. Conduct follow-up sampling after cleanup to ensure completion of program.

Methods: 1. Study strategies: This study plan has been divided into two investigative phases. Each phase addresses general objectives, the results of which build upon each other. Only Phase I is intended to be addressed in this year's study plan. Phase I is designed to establish a data base which will be used to determine whether or not contaminants exist at the sites in concentrations which may adversely impact the surrounding ecosystem. Because little is known about the types and quantity of debris on this island, it is difficult to definitely state what locations will be sampled. Therefore, prior to establishing final sampling stations the island will first be inventoried for candidate sampling sites. Possible sampling sites: 1. Power generating facilities, 2. radio shacks, 3. Landfills and dumps, 4. Airport hangers, 5. Garages, 6. Fuel storage tanks, 7. Barrel dumps, 8. Fuel pumping stations, 9. Electrical poles, 10. Transformers, 11. Petroleum-based products storage areas, 12. Drainage ditches, 13. Streams in proximity to military facilities, 14. Lakes or ponds in proximity to military facilities. In addition to sampling contaminanted sites, up to four control sampling stations will also be established on this island. Logistical support is being provided by the Alaska Maritime National Wildlife Refuge. Transportation to the site will be via the Service vessel M/V Tiglax. Where not prohibited, ground transportation will utilize all-terrain vehicles having low-pressure tires. The Kenai Fisheries Resources field office will assist the Alaska Maritime National Wildlife Refuge in its fish collections. Service volunteers will be available to provide assistance in field collections as well. Soil and sediment will be collected because of their ability to concentrate and store contaminants. Each sample will be a single composite composed of three to five eliquots taken from the surface. All sites will be sampled in triplicate and analyzed for metals and organic-related compounds. Composite sediment samples will be collected from project area lakes, streams, and/or drainage ditches. Like soil samples, control sites will also be established and sampled. All samples will be stored in acid-cleaned polyethylene jars for metal analysis and acid-cleaned glass jars with teflon-lined lids for organic analysis after having been collected with a stainless steel strainer and mixed in a stainless steel bowl. Sediment samples will be stored at approximately four degrees centigrade. Biological samples, if collected, will be from areas which have been obviously impacted or highly suspected to have been impacted by contaminantsd military wastes. Sampling will probably center around collecting resident fish species (e.g. Salvelinus malma, Gasterosteus aculeatus) using seines and baited minnow traps. Specimens will be weighed, stored in acid-cleaned glass jars, and frozen as soon as possible. Samples will be composited to achieve the necessary sample weight.

FTE'S Required 0

New Hires Required 0

List Major Equipment Purchases: None

Estimated Annual Budget

Operations	
Other:	
Shipping	500.00
Contaminant Analysis	13,500.00
Total	14,000.00

APPENDIX B

SAMPLE CATALOGS FOR THE ALEUTIAN ISLANDS MILITARY CONTAMINANTS STUDY

FISCAL YEARS 1988-1990

Alaska Maritime National Wildlife Refuge
202 Pioneer Avenue
Homer, Alaska

SAMPLE CATALOG

TITLE: Alaska Maritime - military cleanup

STUDY/CATALOG IDENTIFIER: to be assigned in fiscal year '89

STUDY OBJECTIVE: To perform sampling on Tanaga, Little Kiska, Attu, Semisopochnoi, and Great Sitkin Islands on the Alaska Maritime National Wildlife Refuge to determine what contaminants, if any, may have entered the environment surrounding abandoned military installations. To interpret analytical results and draw inferences as to the data's ecological significance and source of contaminants, if any.

BACKGROUND: The Defense Environmental Restoration Program (P.L. 98-212, 97 Stat. 1427, Dec. 8, 1983) is part of a Department of Defense program designed to identify, evaluate, and clean up hazardous waste sites on abandoned and active military bases and restore the areas to their near original state by implementing remedial actions. The program is administered by the U.S. Army Corps of Engineers. The subject project sites are in the ownership of the U.S. Fish and Wildlife Service and administered by the Alaska Maritime NWR.

Each of the project sites are known to contain either petroleum, oil, and lubricant (POL) products and spills or electrical transformers which may contain polychlorinated biphenols (PCBs). Extensive leaching of POL products and PCBs into the surrounding environment, depending on their chemical make-up and concentration, could pose a threat to fish and wildlife resources.

This lot consists of 294 individual soil/sediment samples and 15 composite fish samples. Soil samples were collected from 25 sampling sites; sediment samples were collected from 29 sampling sites and fish were collected from 2 lakes and 1 stream. All samples were collected between June 28 and July 22, 1988.

Each soil/sediment sample is a composite of three to five aliquots collected from the surface and/or shallow sub-surface. All sites were sampled in triplicate and analyzed for metals and organic-related compounds. For metal analysis, soil were collected with acetone-rinsed stainless steel utensils, mixed in aluminum foil-lined stainless steel trays, and stored in Zip-lock plastic bags. For organic-related analyses, all samples were collected with acetone-rinsed stainless steel utensils, mixed in an aluminum foil-lined

tray and placed in acid-cleaned jars with teflon-lined caps or wrapped in aluminum foil which in turn were placed in Zip-lock bags. Composite sediment samples were collected from project area lakes, streams, and/or drainage ditches. Like soil samples, control sites were established and sampled. All sediment samples are stored in acid-cleaned polyethylene jars for metal analysis and acid-cleaned glass jars with teflon-lined lids for organic analysis after having been collected with a stainless steel strainer and mixed in a stainless steel bowl. All samples are stored at approximately 4 degrees centigrade. Fish samples were obtained using seines and baited minnow traps, weighed, stored in acid-cleaned glass jars for organic analysis or for metal analysis, they were stored in Zip-lock bags or acid-cleaned polyethylene jars, and frozen.

INSTRUCTIONS: Each sample is to be analyzed for the contaminants listed on the tabulated catalogs (Table 1 - Metals; Table 2- Organics). Report ppm, dry weight, with % moisture, for aromatic hydrocarbons, organochlorines including PCBs, and heavy metals. The following metals are to be determined using ICP methodologies: Pb, Cu, Cr, Mn, Cd, Ni, Sb, Tl, Fe. The following metals are to be analyzed using AAH methodologies: As, Se. Mercury is to be analyzed using cold vapor techniques. Detection limits should be as low as possible with the prescribed analytical method. All fish samples are to be analyzed as a composite of whole bodies. If there is not enough tissue to perform all the desired analyses, the priorities are for heavy metals: Hg, Pb, Cu, Cr, Cd, Ni, As, Se, Sb, Mn, Tl, and Fe, and for organic-related analysis: aromatic hydrocarbons, and organochlorines including PCBs. Please call this office (907-271-2780) to inform us of your decision on this.

After analysis is completed, please retain the samples until this office has received and reviewed the analytical results. We will then instruct you as to which samples, if any, should be retained and which can be discarded.

If samples are sent to the lab in a cooler, we will include a mailing label to have the cooler returned to this office. Other containers, i.e. cardboard box with styrofoam inserts, may be discarded.

TABULATED CATALOG: Attached

Table 1. METALS: Tabulated Sample Catalog - .....
Alaska Maritime NWR - Monitor Military Cleanup

Table 2. ORGANICS: Tabulated Sample Catalog - .....
Alaska Maritime NWR - Monitor Military Cleanup

ESTIMATED COST:

Heavy Metals	$ 22,184.31
Organics	$ 61,626.00
Total	$ 83,810.31

ACCOUNT NUMBER: to be assigned in fiscal year '89

DATA RECIPIENT(S):

Wayne M. Crayton
U.S. Fish and Wildlife Service
Anchorage Fish and Wildlife Enhancement
605 West 4th Avenue, Room 62
Anchorage, Alaska 99501

Everett Robison-Wilson
U.S. Fish and Wildlife Service
Environmental Contaminants Coordinator
1011 Tudor Road
Anchorage, Alaska 99503

John Martin
U.S. Fish and Wildlife Service
Alaska Maritime NWR
202 Pioneer Avenue
Homer, Alaska 99603

SIGNATURES:

Principal Investigator — Date: 8/22/88

Environmental Contaminants Specialist — Date: 8/24/88

Regional Environmental Contaminants Coordinator — Date

Sample ID Number	Species	Tissue/ Matrix	Sample Type	Weight	Collection Site Description	Collection Date	Analysis Requested and Remarks
ATA01D		SOIL	I	56	SE END OF RUNWAY	06/28/88	HM
BTA01D		SOIL	I	58	SE END OF RUNWAY	06/28/88	HM
CTA01D		SOIL	I	54	SE END OF RUNWAY	06/28/88	HM
ATA02D		SOIL	I	44	BUILDING COMPLEX	06/28/88	HM
BTA02D		SOIL	I	62	BUILDING COMPLEX	06/28/88	HM
CTA02D		SOIL	I	62	BUILDING COMPLEX	06/28/88	HM
ATA03D		SOIL	I	58	BUILDING COMPLEX	06/28/88	HM
BTA03D		SOIL	I	98	BUILDING COMPLEX	06/28/88	HM
CTA03D		SOIL	I	106	BUILDING COMPLEX	06/28/88	HM
ATA04D		SOIL	I	132	BUILDING COMPLEX CREEK	06/29/88	HM
BTA04D		SOIL	I	94	BUILDING COMPLEX CREEK	06/29/88	HM
CTA04D		SOIL	I	98	BUILDING COMPLEX CREEK	06/29/88	HM
ATA05D		SOIL	I	68	LARGE BARREL DUMP	06/29/88	HM
BTA05D		SOIL	I	56	LARGE BARREL DUMP	06/29/88	HM
CTA05D		SOIL	I	76	LARGE BARREL DUMP	06/29/88	HM
ATA06S		SEDIMENT	I	240	HOUSING COMPLEX	06/29/88	HM
BTA06S		SEDIMENT	I	204	HOUSING COMPLEX	06/29/88	HM
CTA06S		SEDIMENT	I	276	HOUSING COMPLEX	06/29/88	HM
ATA07D		SOIL	I	70	BY WATER TANK	06/29/88	HM
BTA07D		SOIL	I	40	BY WATER TANK	06/29/88	HM
CTA07D		SOIL	I	46	BY WATER TANK	06/29/88	HM
ATA08S		SEDIMENT	I	288	PUMPHOUSE LAKE	06/29/88	HM
BTA08S		SEDIMENT	I	316	PUMPHOUSE LAKE	06/29/88	HM
CTA08S		SEDIMENT	I	292	PUMPHOUSE LAKE	06/29/88	HM
ATA09S		SEDIMENT	I	308	RUNWAY DRAINAGE DITCH	06/29/88	HM
BTA09S		SEDIMENT	I	244	RUNWAY DRAINAGE DITCH	06/29/88	HM
CTA09S		SEDIMENT	I	272	RUNWAY DRAINAGE DITCH	06/29/88	HM
ATA10D		SOIL	I	96	SE END OF RUNWAY	06/29/88	HM
BTA10D		SOIL	I	84	SE END OF RUNWAY	06/29/88	HM
CTA10D		SOIL	I	184	SE END OF RUNWAY	06/29/88	HM
ATA11F	DOLLY VARDEN	FISH (4)	C,WB	56	HOUSING COMPLEX STREAM	06/29/88	HM
BTA11F	DOLLY VARDEN	FISH (3)	C,WB	38	HOUSING COMPLEX STREAM	06/29/88	HM
CTA11F	DOLLY VARDEN	FISH (2)	C,WB	50	HOUSING COMPLEX STREAM	06/29/88	HM
ATA12D		SOIL	I	128	SOUTHEAST BIGHT	06/29/88	HM
BTA12D		SOIL	I	106	SOUTHEAST BIGHT	06/29/88	HM
CTA12D		SOIL	I	100	SOUTHEAST BIGHT	06/29/88	HM

Sample ID Number	Species	Tissue/ Matrix	Sample Type	Weight	Collection Site Description	Collection Date	Analysis Requested and Remarks
ATA13S		SEDIMENT	I	416	SOUTHEAST BIGHT LAKE	06/29/88	HM
BTA13S		SEDIMENT	I	386	SOUTHEAST BIGHT LAKE	06/29/88	HM
CTA13S		SEDIMENT	I	380	SOUTHEAST BIGHT LAKE	06/29/88	HM
ATA15S		SEDIMENT	I	260	RADIO SHK-N END RUNWAY	06/30/88	HM
BTA15S		SEDIMENT	I	287	RADIO SHK-N END RUNWAY	06/30/88	HM
CTA15S		SEDIMENT	I	272	RADIO SHK-N END RUNWAY	06/30/88	HM
ALK01S		SEDIMENT	I	131	GUN EMPLACEMENT LAKE	07/03/88	HM
BLK01S		SEDIMENT	I	108	GUN EMPLACEMENT LAKE	07/03/88	HM
CLK01S		SEDIMENT	I	118	GUN EMPLACEMENT LAKE	07/03/88	HM
ALK02F	3-SPND STICKLEBK	FISH (5)	C,WB	16	GUN EMPLACEMENT LAKE	07/03/88	HM
BLK02F	3-SPND STICKLEBK	FISH (5)	C,WB	13	GUN EMPLACEMENT LAKE	07/03/88	HM
CLK02F	3-SPND STICKLEBK	FISH (5)	C,WB	16	GUN EMPLACEMENT LAKE	07/03/88	HM
ALK03S		SEDIMENT	I	204	SLUFF LAKE	07/03/88	HM
BLK03S		SEDIMENT	I	160	SLUFF LAKE	07/03/88	HM
CLK03S		SEDIMENT	I	154	SLUFF LAKE	07/03/88	HM
ALK04O		SOIL	I	148	BARE HILL	07/03/88	HM
BLK04O		SOIL	I	118	BARE HILL	07/03/88	HM
CLK04O		SOIL	I	158	BARE HILL	07/03/88	HM
AAT01O		SOIL	I	158	ENGINEER HILL	07/07/88	HM
BAT01O		SOIL	I	142	ENGINEER HILL	07/07/88	HM
CAT01O		SOIL	I	103	ENGINEER HILL	07/07/88	HM
AAT02S		SEDIMENT	I	228	ENGINEER HILL	07/07/88	HM
BAT02S		SEDIMENT	I	210	ENGINEER HILL	07/07/88	HM
CAT02S		SEDIMENT	I	228	ENGINEER HILL	07/07/88	HM
AAT03O		SOIL	I	170	N END W MASS VALLEY	07/07/88	HM
BAT03O		SOIL	I	38	N END W MASS VALLEY	07/07/88	HM
CAT03O		SOIL	I	88	N END W MASS VALLEY	07/07/88	HM
AAT04S		SEDIMENT	I	140	E SIDE HOGBACK RD	07/07/88	HM
BAT04S		SEDIMENT	I	136	E SIDE HOGBACK RD	07/07/88	HM
CAT04S		SEDIMENT	I	100	E SIDE HOGBACK RD	07/07/88	HM
AAT05O		SOIL	I	98	HENDERSON MARSH	07/08/88	HM
BAT05O		SOIL	I	32	HENDERSON MARSH	07/08/88	HM
CAT05O		SOIL	I	102	HENDERSON MARSH	07/08/88	HM
AAT06S		SEDIMENT	I	120	E MASS VALLEY	07/08/88	HM
BAT06S		SEDIMENT	I	146	E MASS VALLEY	07/08/88	HM
CAT06S		SEDIMENT	I	114	E MASS VALLEY	07/08/88	HM

Sample ID Number	Species	Tissue/ Matrix	Sample Type	Weight	Collection Site Description	Collection Date	Analysis Requested and Remarks
AAT07S		SEDIMENT	I	266	UPPER E MASS VALLEY	07/08/88	HM
BAT07S		SEDIMENT	I	218	UPPER E MASS VALLEY	07/08/88	HM
CAT07S		SEDIMENT	I	248	UPPER E MASS VALLEY	07/08/88	HM
AAT08S		SEDIMENT	I	244	E MASS VALLEY STREAM	07/08/88	HM
BAT08S		SEDIMENT	I	ND	E MASS VALLEY STREAM	07/08/88	HM
CAT08S		SEDIMENT	I	ND	E MASS VALLEY STREAM	07/08/88	HM
AAT09D		SOIL	I	108	E MASS VAL BARREL DUMP	07/08/88	HM
BAT09D		SOIL	I	44	E MASS VAL BARREL DUMP	07/08/88	HM
CAT09D		SOIL	I	43	E MASS VAL BARREL DUMP	07/08/88	HM
AAT10S		SEDIMENT	I	158	E MASS VAL TRANS POLE	07/08/88	HM
BAT10S		SEDIMENT	I	148	E MASS VAL TRANS POLE	07/08/88	HM
CAT10S		SEDIMENT	I	186	E MASS VAL TRANS POLE	07/08/88	HM
AAT11D		SOIL	I	126	E BREAKWTR CASCO COVE	07/08/88	HM
BAT11D		SOIL	I	100	E BREAKWTR CASCO COVE	07/08/88	HM
CAT11D		SOIL	I	128	E BREAKWTR CASCO COVE	07/08/88	HM
AAT12D		SOIL	I	113	ASPHALT TANK STREAM	07/09/88	HM
BAT12D		SOIL	I	178	ASPHALT TANK STREAM	07/09/88	HM
CAT12D		SOIL	I	214	ASPHALT TANK STREAM	07/09/88	HM
AAT13D		SOIL	I	158	FUEL PUMPS-ASPHALT STR	07/09/88	HM
BAT13D		SOIL	I	132	FUEL PUMPS-ASPHALT STR	07/09/88	HM
CAT13D		SOIL	I	118	FUEL PUMPS-ASPHALT STR	07/09/88	HM
AAT14S		SEDIMENT	I	164	FUEL TANK VALLEY STREAM	07/09/88	HM
BAT14S		SEDIMENT	I	132	FUEL TANK VALLEY STREAM	07/09/88	HM
CAT14S		SEDIMENT	I	166	FUEL TANK VALLEY STREAM	07/09/88	HM
AAT15S		SEDIMENT	I	72	2 FUEL TANKS-FT STREAM	07/09/88	HM
BAT15S		SEDIMENT	I	94	2 FUEL TANKS-FT STREAM	07/09/88	HM
CAT15S		SEDIMENT	I	98	2 FUEL TANKS-FT STREAM	07/09/88	HM
AAT16S		SEDIMENT	I	138	TRANSF-FUEL TANK VALLEY	07/09/88	HM
BAT16S		SEDIMENT	I	138	TRANSF-FUEL TANK VALLEY	07/09/88	HM
CAT16S		SEDIMENT	I	158	TRANSF-FUEL TANK VALLEY	07/09/88	HM
AAT17S		SEDIMENT	I	208	FUEL TANK VALLEY STREAM	07/09/88	HM
BAT17S		SEDIMENT	I	128	FUEL TANK VALLEY STREAM	07/09/88	HM
CAT17S		SEDIMENT	I	178	FUEL TANK VALLEY STREAM	07/09/88	HM
AAT18D		SOIL	I	148	NEWLY BULLDOZED TOP HILL	07/09/88	HM
BAT18D		SOIL	I	168	NEWLY BULLDOZED TOP HILL	07/09/88	HM
CAT18D		SOIL	I	150	NEWLY BULLDOZED TOP HILL	07/09/88	HM

Sample ID Number	Species	Tissue/ Matrix	Sample Type	Weight	Collection Site Description	Collection Date	Analysis Requested and Remarks
AAT19Q		SOIL	I	166	E SIDE QUONSET HUT VALL	07/10/88	HM
BAT19Q		SOIL	I	198	E SIDE QUONSET HUT VALL	07/10/88	HM
CAT19Q		SOIL	I	178	E SIDE QUONSET HUT VALL	07/10/88	HM
AAT20S		SEDIMENT	I	178	MIDDLE QUONSET HUT VALL	07/10/88	HM
BAT20S		SEDIMENT	I	138	MIDDLE QUONSET HUT VALL	07/10/88	HM
CAT20S		SEDIMENT	I	232	MIDDLE QUONSET HUT VALL	07/10/88	HM
AAT21S		SEDIMENT	I	226	QUONSET HUT VALL CREEK	07/10/88	HM
BAT21S		SEDIMENT	I	308	QUONSET HUT VALL CREEK	07/10/88	HM
CAT21S		SEDIMENT	I	266	QUONSET HUT VALL CREEK	07/10/88	HM
AAT22Q		SOIL	I	112	E SIDE QUONSET HUT VALL	07/10/88	HM
BAT22Q		SOIL	I	118	E SIDE QUONSET HUT VALL	07/10/88	HM
CAT22Q		SOIL	I	124	E SIDE QUONSET HUT VALL	07/10/88	HM
AAT23S		SEDIMENT	I	180	W SIDE QUONSET HUT VALL	07/10/88	HM
BAT23S		SEDIMENT	I	196	W SIDE QUONSET HUT VALL	07/10/88	HM
CAT23S		SEDIMENT	I	188	W SIDE QUONSET HUT VALL	07/10/88	HM
AAT24S		SEDIMENT	I	538	LAKE ELWOOD	07/10/88	HM
BAT24S		SEDIMENT	I	358	LAKE ELWOOD	07/10/88	HM
CAT24S		SEDIMENT	I	320	LAKE ELWOOD	07/10/88	HM
AAT27S		SEDIMENT	I	186	OLD RUNWAY REVETEMENT	07/11/88	HM
BAT27S		SEDIMENT	I	288	OLD RUNWAY REVETEMENT	07/11/88	HM
CAT27S		SEDIMENT	I	228	OLD RUNWAY REVETEMENT	07/11/88	HM
AAT28Q		SOIL	I	112	LRG ASPHALT BARREL DUMP	07/11/88	HM
BAT28Q		SOIL	I	114	LRG ASPHALT BARREL DUMP	07/11/88	HM
CAT28Q		SOIL	I	164	LRG ASPHALT BARREL DUMP	07/11/88	HM
AAT29S		SEDIMENT	I	278	PEACEFUL RIVER	07/11/88	HM
BAT29S		SEDIMENT	I	294	PEACEFUL RIVER	07/11/88	HM
CAT29S		SEDIMENT	I	194	PEACEFUL RIVER	07/11/88	HM
AAT30Q		SOIL	I	128	TRANS SITE CASCO PT	07/11/88	HM
BAT30Q		SOIL	I	172	TRANS SITE CASCO PT	07/11/88	HM
CAT30Q		SOIL	I	194	TRANS SITE CASCO PT	07/11/88	HM
AAT31Q		SOIL	I	114	TRANS SITE MURDER PT	07/11/88	HM
BAT31Q		SOIL	I	94	TRANS SITE MURDER PT	07/11/88	HM
CAT31Q		SOIL	I	123	TRANS SITE MURDER PT	07/11/88	HM

Sample ID Number	Species	Tissue/ Matrix	Sample Type	Weight	Collection Site Description	Collection Date	Analysis Requested and Remarks
AAT32F	3-SPND STICKLEBK	FISH (9)	C,WB	17	LAKE NICHOLAS	07/11/88	HM
BAT32F	3-SPND STICKLEBK	FISH (8)	C,WB	15	LAKE NICHOLAS	07/11/88	HM
CAT32F	3-SPND STICKLEBK	FISH (6)	C,WB	15	LAKE NICHOLAS	07/11/88	HM
AAT33O		SOIL	I	116	MURDER PT-SUBMERG BUILDG	07/11/88	HM
BAT33O		SOIL	I	98	MURDER PT-SUBMERG BUILDG	07/11/88	HM
CAT33O		SOIL	I	128	MURDER PT-SUBMERG BUILDG	07/11/88	HM
AAT34S		SEDIMENT	I	204	MURDER PT-QUONSET HUTS	07/12/88	HM
BAT34S		SEDIMENT	I	180	MURDER PT-QUONSET HUTS	07/12/88	HM
CAT34S		SEDIMENT	I	168	MURDER PT-QUONSET HUTS	07/12/88	HM
AAT35S		SEDIMENT	I	350	MURDER PT LAKE	07/12/88	HM
BAT35S		SEDIMENT	I	ND	MURDER PT LAKE	07/12/88	HM
CAT35S		SEDIMENT	I	478	MURDER PT LAKE	07/12/88	HM
AAT36S		SEDIMENT	I	436	WATER TOWER LAKE-MURD PT	07/12/88	HM
BAT36S		SEDIMENT	I	423	WATER TOWER LAKE-MURD PT	07/12/88	HM
CAT36S		SEDIMENT	I	346	WATER TOWER LAKE-MURD PT	07/12/88	HM
AAT37S		SEDIMENT	I	266	RADIO TOWER/BUILDINGS	07/12/88	HM
BAT37S		SEDIMENT	I	152	RADIO TOWER/BUILDINGS	07/12/88	HM
CAT37S		SEDIMENT	I	264	RADIO TOWER/BUILDINGS	07/12/88	HM
AAT38S		SOIL	I	168	NEXT TO SITE 31-MURD PT	07/12/88	HM
BAT38S		SOIL	I	144	NEXT TO SITE 31-MURD PT	07/12/88	HM
CAT38S		SOIL	I	118	NEXT TO SITE 31-MURD PT	07/12/88	HM
A6S01S		SEDIMENT	I	340	FOX CR BRIDGE	07/22/88	HM
B6S01S		SEDIMENT	I	451	FOX CR BRIDGE	07/22/88	HM
C6S01S		SEDIMENT	I	592	FOX CR BRIDGE	07/22/88	HM
A6S02O		SOIL	I	198	N SIDE OF FOX CR VAL	07/22/88	HM
B6S02O		SOIL	I	212	N SIDE OF FOX CR VAL	07/22/88	HM
C6S02O		SOIL	I	196	N SIDE OF FOX CR VAL	07/22/88	HM
A6S03O		SOIL	I	196	MIDDLE FOX CREEK VALL	07/22/88	HM
B6S03O		SOIL	I	192	MIDDLE FOX CREEK VALL	07/22/88	HM
C6S03O		SOIL	I	156	MIDDLE FOX CREEK VALL	07/22/88	HM
A6S04O		SOIL	I	202	MIDDLE FOX CREEK VALL	07/22/88	HM
B6S04O		SOIL	I	156	MIDDLE FOX CREEK VALL	07/22/88	HM
C6S04O		SOIL	I	204	MIDDLE FOX CREEK VALL	07/22/88	HM

I = individual
C = composite
WB = whole body
HM = heavy metals; ICP(Pb,Cu,Cr,Mn,Cd, Ni,Sb,Tl,Fe), AAH(As,Se),CV(Hg)
ND = not determined

Table 2. Organics: Tabulated Sample Catalog:.....
Alaska Maritime - military cleanup

Sample ID Number	Species	Tissue/ Matrix	Sample Type	Weight	Collection Site Description	Collection Date	Analysis Requested and Remarks
ATA010		SOIL	I	148	SE END OF RUNWAY	06/28/88	O,A
BTA010		SOIL	I	106	SE END OF RUNWAY	06/28/88	O,A
CTA010		SOIL	I	168	SE END OF RUNWAY	06/28/88	O,A
ATA020		SOIL	I	118	BUILDING COMPLEX	06/28/88	O,A
BTA020		SOIL	I	128	BUILDING COMPLEX	06/28/88	O,A
CTA020		SOIL	I	142	BUILDING COMPLEX	06/28/88	O,A
ATA030		SOIL	I	118	BUILDING COMPLEX	06/28/88	O,A
BTA030		SOIL	I	96	BUILDING COMPLEX	06/28/88	O,A
CTA030		SOIL	I	120	BUILDING COMPLEX	06/28/88	O,A
ATA040		SOIL	I	131	BUILDING COMPLEX CREEK	06/29/88	O,A
BTA040		SOIL	I	182	BUILDING COMPLEX CREEK	06/29/88	O,A
CTA040		SOIL	I	158	BUILDING COMPLEX CREEK	06/29/88	O,A
ATA050		SOIL	I	224	LARGE BARREL DUMP	06/29/88	O,A
BTA050		SOIL	I	228	LARGE BARREL DUMP	06/29/88	O,A
CTA050		SOIL	I	248	LARGE BARREL DUMP	06/29/88	O,A
ATA06S		SEDIMENT	I	129	HOUSING COMPLEX	06/29/88	O,A
BTA06S		SEDIMENT	I	217	HOUSING COMPLEX	06/29/88	O,A
CTA06S		SEDIMENT	I	243	HOUSING COMPLEX	06/29/88	O,A
ATA070		SOIL	I	114	BY WATER TANK	06/29/88	O,A
BTA070		SOIL	I	166	BY WATER TANK	06/29/88	O,A
CTA070		SOIL	I	128	BY WATER TANK	06/29/88	O,A
BTA08S		SEDIMENT	I	197	PUMPHOUSE LAKE	06/29/88	O,A
CTA08S		SEDIMENT	I	193	PUMPHOUSE LAKE	06/29/88	O,A
ATA09S		SEDIMENT	I	363	RUNWAY DRAINAGE DITCH	06/29/88	O,A
BTA09S		SEDIMENT	I	535	RUNWAY DRAINAGE DITCH	06/29/88	O,A
CTA09S		SEDIMENT	I	363	RUNWAY DRAINAGE DITCH	06/29/88	O,A
ATA100		SOIL	I	302	SE END OF RUNWAY	06/29/88	O,A
BTA100		SOIL	I	302	SE END OF RUNWAY	06/29/88	O,A
CTA100		SOIL	I	278	SE END OF RUNWAY	06/29/88	O,A
ATA120		SOIL	I	168	SOUTHEAST BIGHT	06/29/88	O,A
BTA120		SOIL	I	148	SOUTHEAST BIGHT	06/29/88	O,A
CTA120		SOIL	I	166	SOUTHEAST BIGHT	06/29/88	O,A
ATA13S		SEDIMENT	I	467	SOUTHEAST BIGHT LAKE	06/29/88	O,A
BTA13S		SEDIMENT	I	469	SOUTHEAST BIGHT LAKE	06/29/88	O,A
CTA13S		SEDIMENT	I	484	SOUTHEAST BIGHT LAKE	06/29/88	O,A

Sample ID Number	Species	Tissue/ Matrix	Sample Type	Weight	Collection Site Description	Collection Date	Analysis Requested and Remarks
BTA15S		SEDIMENT	I	287	RADIO SHK-N END RUNWAY	06/30/88	O,A
ALK01S		SEDIMENT	I	281	GUN EMPLACEMENT LAKE	07/03/88	O,A
BLK01S		SEDIMENT	I	321	GUN EMPLACEMENT LAKE	07/03/88	O,A
CLK01S		SEDIMENT	I	315	GUN EMPLACEMENT LAKE	07/03/88	O,A
ALK02F	3-SPND STICKLEBK	FISH	C,WB	131	GUN EMPLACEMENT LAKE	07/03/88	O,A
BLK02F	3-SPND STICKLEBK	FISH	C,WB	127	GUN EMPLACEMENT LAKE	07/03/88	O,A
CLK02F	3-SPND STICKLEBK	FISH	C,WB	125	GUN EMPLACEMENT LAKE	07/03/88	O,A
ALK03S		SEDIMENT	I	361	SLUFF LAKE	07/03/88	O,A
BLK03S		SEDIMENT	I	357	SLUFF LAKE	07/03/88	O,A
CLK03S		SEDIMENT	I	389	SLUFF LAKE	07/03/88	O,A
ALK04O		SOIL	I	270	BARE HILL	07/03/88	O,A
BLK04O		SOIL	I	174	BARE HILL	07/03/88	O,A
CLK04O		SOIL	I	222	BARE HILL	07/03/88	O,A
AAT01O		SOIL	I	242	ENGINEER HILL	07/07/88	O,A
BAT01O		SOIL	I	213	ENGINEER HILL	07/07/88	O,A
CAT01O		SOIL	I	162	ENGINEER HILL	07/07/88	O,A
BAT02S		SEDIMENT	I	331	ENGINEER HILL	07/07/88	O,A
CAT02S		SEDIMENT	I	183	ENGINEER HILL	07/07/88	O,A
AAT03O		SOIL	I	250	N END W MASS VALLEY	07/07/88	O,A
BAT03O		SOIL	I	196	N END W MASS VALLEY	07/07/88	O,A
CAT03O		SOIL	I	250	N END W MASS VALLEY	07/07/88	O,A
AAT04S		SEDIMENT	I	279	E SIDE HOGBACK RD	07/07/88	O,A
BAT04S		SEDIMENT	I	313	E SIDE HOGBACK RD	07/07/88	O,A
CAT04S		SEDIMENT	I	251	E SIDE HOGBACK RD	07/07/88	O,A
AAT05O		SOIL	I	228	HENDERSON MARSH	07/08/88	O,A
BAT05O		SOIL	I	278	HENDERSON MARSH	07/08/88	O,A
CAT05O		SOIL	I	154	HENDERSON MARSH	07/08/88	O,A
AAT06S		SEDIMENT	I	289	E MASS VALLEY	07/08/88	O,A
CAT06S		SEDIMENT	I	231	E MASS VALLEY	07/08/88	O,A
AAT07S		SEDIMENT	I	385	UPPER E MASS VALLEY	07/08/88	O,A
BAT07S		SEDIMENT	I	391	UPPER E MASS VALLEY	07/08/88	O,A
CAT07S		SEDIMENT	I	405	UPPER E MASS VALLEY	07/08/88	O,A

Sample ID Number	Species	Tissue/ Matrix	Sample Type	Weight	Collection Site Description	Collection Date	Analysis Requested and Remarks
AAT08S		SEDIMENT	I	395	E MASS VALLEY STREAM	07/08/88	O,A
BAT08S		SEDIMENT	I	365	E MASS VALLEY STREAM	07/08/88	O,A
CAT08S		SEDIMENT	I	403	E MASS VALLEY STREAM	07/08/88	O,A
AAT09O		SOIL	I	196	E MASS VAL BARREL DUMP	07/08/88	O,A
BAT09O		SOIL	I	248	E MASS VAL BARREL DUMP	07/08/88	O,A
CAT09O		SOIL	I	238	E MASS VAL BARREL DUMP	07/08/88	O,A
AAT10S		SEDIMENT	I	271	E MASS VAL TRANS POLE	07/08/88	O,A
BAT10S		SEDIMENT	I	265	E MASS VAL TRANS POLE	07/08/88	O,A
CAT10S		SEDIMENT	I	257	E MASS VAL TRANS POLE	07/08/88	O,A
AAT11O		SOIL	I	210	E BREAKWTR CASCO COVE	07/08/88	O,A
BAT11O		SOIL	I	233	E BREAKWTR CASCO COVE	07/08/88	O,A
CAT11O		SOIL	I	186	E BREAKWTR CASCO COVE	07/08/88	O,A
AAT12O		SOIL	I	334	ASPHALT TANK STREAM	07/09/88	O,A
BAT12O		SOIL	I	318	ASPHALT TANK STREAM	07/09/88	O,A
CAT12O		SOIL	I	290	ASPHALT TANK STREAM	07/09/88	O,A
AAT13O		SOIL	I	268	FUEL PUMPS-ASPHALT STR	07/09/88	O,A
BAT13O		SOIL	I	288	FUEL PUMPS-ASPHALT STR	07/09/88	O,A
CAT13O		SOIL	I	198	FUEL PUMPS-ASPHALT STR	07/09/88	O,A
AAT14S		SEDIMENT	I	347	FUEL TANK VALLEY STREAM	07/09/88	O,A
BAT14S		SEDIMENT	I	291	FUEL TANK VALLEY STREAM	07/09/88	O,A
CAT14S		SEDIMENT	I	307	FUEL TANK VALLEY STREAM	07/09/88	O,A
AAT15S		SEDIMENT	I	257	2 FUEL TANKS-FT STREAM	07/09/88	O,A
BAT15S		SEDIMENT	I	255	2 FUEL TANKS-FT STREAM	07/09/88	O,A
CAT15S		SEDIMENT	I	257	2 FUEL TANKS-FT STREAM	07/09/88	O,A
AAT16S		SEDIMENT	I	287	TRANSF-FUEL TANK VALLEY	07/09/88	O,A
BAT16S		SEDIMENT	I	301	TRANSF-FUEL TANK VALLEY	07/09/88	O,A
CAT16S		SEDIMENT	I	293	TRANSF-FUEL TANK VALLEY	07/09/88	O,A
BAT17S		SEDIMENT	I	221	FUEL TANK VALLEY STREAM	07/09/88	O,A
CAT17S		SEDIMENT	I	291	FUEL TANK VALLEY STREAM	07/09/88	O,A
AAT18O		SOIL	I	378	NEWLY BULLDOZED TOP HILL	07/09/88	O,A
BAT18O		SOIL	I	286	NEWLY BULLDOZED TOP HILL	07/09/88	O,A
CAT18O		SOIL	I	296	NEWLY BULLDOZED TOP HILL	07/09/88	O,A