

**FINAL
FOCUSED FEASIBILITY STUDY REPORT
NMCB BUILDING T-1416 EXPANDED AREA**

**FORMER ADAK NAVAL COMPLEX
ADAK ISLAND, ALASKA**

**Prepared by
URS Group, Inc.
Seattle, Washington**

**Prepared for
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Organization Title: Engineering Field Activity, Northwest
Address: Naval Facilities Engineering Command
19917 Seventh Avenue N.E.
Poulsbo, Washington 98370
(360) 396-0070

Prime Contractor: URS Group, Inc.
Address: 1501 Fourth Avenue, Suite 1400
Seattle, Washington 98101-1616
(206) 438-2700

Navy Project Manager: Mark A. Wicklein, P.E.

URS Program Manager: William L. Rohrer, C.P.G., P.G., L.H.G.

URS Project Manager: Wendy L.S. Oresik, P.E.

EXECUTIVE SUMMARY

To evaluate remedial alternatives that will protect human health and the environment from petroleum-related chemicals released at the Naval Mobile Construction Battalion (NMCB) Building Expanded Area site, the U.S. Navy (Navy) and Alaska Department of Environmental Conservation (ADEC) have agreed to conduct a Focused Feasibility Study (FFS). This FFS report integrates results of previous site investigation activities and presents results of human health and ecological risk assessments conducted for the site. These risk assessment activities are used to determine whether existing institutional controls are sufficient to protect human health and the environment while natural attenuation processes are reducing chemical concentrations, or whether remedial actions may be necessary at the site to reduce risks to acceptable levels. Based on risk assessment results, remedial actions are determined to be necessary at this site.

The purpose of this FFS is to document the process of identifying, developing, and evaluating remedial action alternatives for the NMCB Building Expanded Area site and provide the basis for selecting the most appropriate and feasible cleanup remedy. Identification of institutional controls is an integral part of this process. The objective of this FFS is to provide decision makers sufficient information to facilitate selection of appropriate, cost-effective remedial alternatives for the site that protect human health and the environment, and that can be implemented at the earliest possible time.

BACKGROUND

To facilitate petroleum-contaminated site investigation and cleanup activities at the former Adak Naval Complex, the Navy, as lead agency, entered into the 1993 Federal Facilities Agreement (FFA) with the U.S. Environmental Protection Agency (EPA) and the Alaska Department of Environmental Conservation (DEC), and the 1994 State-Adak Environmental Restoration Agreement (SAERA) with the Alaska DEC. Pursuant to the FFA and the SAERA, the Navy, the EPA, and the Alaska DEC have agreed to site-specific interim remedial actions for free-product recovery petroleum sites on the former Adak Naval Complex. As specified in the record of decision (ROD) for Operable Unit A (OU A), upon achieving the remedial endpoints for the interim action of free-product recovery, the subject sites are to undergo additional evaluation to determine a final remedy, as needed. To the extent petroleum-contaminated sites require remediation, cleanup decisions will be made in accordance with Alaska State regulations.

Confirmed petroleum release sites must undergo a process of investigation, remedy selection, and cleanup to achieve standards established in the *Alaska DEC Oil and Other Hazardous*

Substances Pollution Control Regulations (18 Alaska Administrative Code [AAC] 75). Environmental investigations conducted at the NMCB Building Expanded Area site have identified petroleum-related chemicals in soil and groundwater at concentrations above Alaska DEC soil and groundwater cleanup levels established in 18 AAC 75.

To reduce potential human exposure to petroleum-related chemicals until concentrations are lower than established cleanup levels, institutional controls have been implemented for the downtown area on Adak Island, including the NMCB Building Expanded Area site, through the Interim Conveyance document and the Final Institutional Control Management Plan (ICMP). These institutional controls include the following equitable servitude restrictions: notification requirements for intrusive soil excavation activities and groundwater restrictions that prohibit use of the downtown aquifer as a drinking water resource. Institutional controls are intended to remain in place until the property owner petitions the Navy for release of institutional controls at the site. Alaska DEC must concur that environmental conditions at the site warrant release of the institutional controls prior to their release by the Navy.

SITE DESCRIPTION

The NMCB Building Expanded Area site consists of a large lowland area in downtown Adak, between the north shore of Sweeper Cove and the southern end of Runway 18-36. The site extends from the East Canal of the Airport Ditch system on the northwest south to Sweeper Cove and east approximately 2,000 feet (ft).

The land that makes up the NMCB Building Expanded Area has been extensively altered since the military first arrived on Adak Island during World War II. The portion of the site located south of Seawall Road, that bisects the site in an east-west direction, was part of Sweeper Cove prior to military arrival. The shoreline in the vicinity of the site was rapidly extended to its current location during the Island's conversion to military use.

Topography at the NMCB Building Expanded Area is generally flat with elevations less than 20 ft above mean lower low water (MLLW). The ground surface south of Seawall Road is paved with compacted gravel or occupied by buildings. The ground surface north of Seawall Road, and in the western portion of the site, is composed of native grasses dominated by beach ryegrass. The shoreline of Sweeper Cove is covered with large boulders (riprap) placed there to protect the shoreline from erosion.

The primary physical features on the site north of Seawall Road consist of the Vehicle Storage Building (Building 42069) and the Fish and Wildlife Building. The primary physical features on the site south of Seawall Road include the NMCB Building (Building T-1416), the Pre-

Engineered Building (PEB), the former Building T-1421 (now a concrete pad), a vehicle wash rack (42094) located between Building T-1416 and Building T-1421, and the riprap-covered breakwater. A utility corridor containing an underground storm sewer and overhead utilities is present along the southern edge of Seawall Road. An east-west trending sanitary sewer line is present south of Building T-1416. This sewer line servicing the site connects to Sewage Lift Station No. 11 located at the western margin of the site.

Since the early 1940s the site has been used for industrial purposes. Docks, constructed prior to 1945, were formerly located at the southern margin of the site. Fuel Dock No. 7 was also formerly located at the eastern limit of the NMCB Building Expanded Area site. All of the former docks have been removed. The site and surrounding area continued to be used primarily for industrial purposes up to the military drawdown at Adak. The NMCB Building Expanded Area is crossed by several former underground fuel transfer pipelines. These fuel pipelines have been closed in place.

Future land use at the NMCB Building Expanded Area site is designated for one of three reuses by the Adak Reuse Corporation (ARC). The largest portion of the site is designated for commercial reuse. The portion of the site northwest of the Main Road is classified for aviation reuse. The western portion of the site between the Main Road and Sweeper Cove as well as the portion of the site containing the U.S. Fish and Wildlife building are designated for public facilities' reuse.

Two surface water bodies are located in the vicinity of the site, the East Canal of the airport drainage ditch system and Sweeper Cove. The East Canal is an engineered diversionary structure designed to collect surface runoff from the airfield. The only surface connection between the airport drainage ditch system and navigable waters is through pump turbines that isolate the drainage ditch system from South Sweeper Creek. Sweeper Cove is a marine environment that forms the southern boundary of the site.

Subsurface soils include fill placed during conversion to military use, and unconsolidated sand and sandy silt beneath the fill material to the maximum depth explored. The subsurface materials have variable permeability, and the saturated subsurface has a high water-bearing capacity.

Groundwater is found as a regional water table aquifer beneath the site at approximately 4 to 15 ft below ground surface (bgs). Near-shore groundwater in the vicinity of Sweeper Cove is tidally influenced. Pumping of water from the airport ditches artificially lowers groundwater elevations near the East Canal. Groundwater flow in the area is bi-directional. Typically, groundwater flow is toward Sweeper Cove. However, flow in the northwestern portion of the site is toward the East Canal. Because of the proximity of the site to Sweeper Cove, saltwater

intrudes into the nearshore groundwater at depth. The regional aquifer beneath the NMCB Building Expanded Area site is not currently being used as a source of drinking water and is not reasonably expected to be used as a potential future source of drinking water.

RELEASE HISTORY

During September 1990, an abandoned JP-5 fuel line located near the southeast corner of Runway 18-36 was uncovered during installation of a new fuel line adjacent to the Main Road. The abandoned fuel line was reported to be the source of a subsurface fuel release, and residual product was observed in the excavated trench. Subsequent site investigation activities indicated the presence of petroleum hydrocarbons in subsurface soil and groundwater over a large area extending from the southern end of Runway 18-36 to Sweeper Cove near the NMCB Building. Measurable quantities of free product have been periodically observed in groundwater monitoring wells located between Seawall Road and Sweeper Cove.

There have been no documented releases of chlorinated solvents at the NMCB Building Expanded Area. Solvent contamination observed at the site is likely the result of past practices that caused surface spillage during ship or vehicle maintenance, woodworking, or machine shop activities.

REMOVALS AND CLEANUP ACTIVITIES

Former Underground Storage Tank (UST) T-1416-A and UST 42482-A were removed as part of the environmental cleanup at the former Adak Naval Complex. The chemical analysis of soil samples collected from beneath UST T-1416-A identified diesel-range organics (DRO) at concentrations above its Alaska DEC soil cleanup level. Further excavation of petroleum-affected soils was not conducted during UST removal activities due to the presence of underground utilities adjacent to the location. Chemical analyses of 11 soil samples collected during removal of UST 42482-A identified concentrations of DRO below its Alaska DEC soil cleanup level in 10 of the 11 samples analyzed. Groundwater was encountered at a depth of approximately 8 ft bgs at this location. A heavy sheen was observed on the groundwater surface.

An assessment of fuel transfer pipelines crossing the site included the removal of a valve pit along the pipeline trace north of Seawall Road. Chemical analyses of one soil sample collected during this valve pit removal identified concentrations of DRO below its Alaska DEC soil cleanup level.

FREE-PRODUCT OCCURRENCE AND RECOVERY

Between September 1997 and December 2004, monitoring wells within the vicinity of the NMCB Building Expanded Area site have been gauged periodically for the presence of free product. During this time, free product has been detected in 15 of the 49 wells installed at the site. The maximum measured thickness of free product reported at the site was 2.33 ft, in well 02-300 on May 11, 2002. Based on free-product recovery information obtained from September 1997 through November 2004, free-product recovery activities at the NMCB Building Expanded Area site have not yet achieved practicable endpoint criteria. Recovery information for December 2004 was not available at the time of submittal of this FFS report. Free product recovery will continue at the site until the endpoint criteria are achieved.

The extent of residual free product at the site was estimated for three monitoring periods: November 1992 through June 2000, January 2001 through November 2002, and August through December 2004. The extent of free product estimated for the initial monitoring period shows a product extent of approximately 128,000 square feet (ft²). This is the largest extent of residual free product estimated at the site for these three monitoring periods. The extent of free product decreased from this initial estimate to approximately 54,700 ft² for the period between January 2001 and November 2002. Evaluation of product thickness measurements obtained from August through December 2004 results in a further reduction in the estimated free product extent to approximately 24,000 ft². The maximum product thicknesses observed in most wells were reported during the 2001 through 2002 monitoring period. Monitoring conducted during 2004 indicates a declining maximum product thickness observed in each well between the 2001 through 2002 period and the August through December 2004 period.

Free product recovery has been conducted at the NMCB Building Expanded Area site from September 1997 through July 1998, May through July 2000, May through November 2001, May through October 2002, and from August through November 2004. Approximately 201 gallons total of free product were recovered at the site during these periods. The great majority of this product (189 gallons) was recovered during 2001 and 2002.

POTENTIAL EXTENT OF CONTAMINATION

From 1990 to 2003, several environmental field investigations have been performed at or in the vicinity of the NMCB Building Expanded Area. Results of these investigations indicated that petroleum-related chemicals and selected volatile organic compounds (VOCs) were confirmed in samples of subsurface soil, groundwater, sediment and surface water collected from several locations at the NMCB Building Expanded area site.

The initial contaminant release at the site was into shallow subsurface soils. Petroleum-related chemicals and certain VOCs and semivolatile organic chemicals (SVOCs) subsequently moved downward into the regional groundwater aquifer and have since migrated laterally toward Sweeper Cove to the south and the East Canal to the northwest. The potential extent of contamination at the NMCB Building Expanded Area site is based on a review of analytical results for petroleum-related chemicals, VOCs, and SVOCs in samples collected at the site between 1993 and 2003.

The area of potential concern in soil at the site is evaluated by comparing analytical results to the most stringent applicable Alaska DEC Method 2 soil cleanup criterion established for the over 40 inches of rainfall zone (18 AAC 75.341(c)); specifically migration to groundwater criterion. The site area estimated to contain detected concentrations of chemicals in soil at concentrations greater than Method 2 Alaska DEC soil criteria is approximately 10 acres.

Since domestic groundwater use in the downtown area on Adak is prohibited by the Interim Conveyance document, and saltwater was shown to intrude into near-shore groundwater in the vicinity of the NMCB Building site rendering the groundwater unfit for use as a drinking water source, Alaska regulation 18 AAC 75.345(b)(2) specifies that groundwater cleanup criteria can be established at 10 times the concentrations established for groundwater used as a drinking water source. However, the Navy understands that these less-stringent cleanup levels are not acceptable to Alaska DEC for use as screening criteria. Therefore, the more-stringent cleanup levels established for groundwater used as a drinking water source are used to estimate the area of potential concern in groundwater. The site area estimated to contain detected concentrations of chemicals in groundwater at concentrations greater than the respective Alaska DEC groundwater cleanup criteria for groundwater used as a drinking water source is approximately 13 acres.

Analyses of sediment and surface water samples collected from Sweeper Cove indicate the presence of petroleum-related chemicals in marine sediment and surface water in the vicinity of the site. DRO, 3- and 4-methylphenol, phenol, and 13 polycyclic aromatic hydrocarbons (PAH) compounds were detected in marine sediment samples. Gasoline-range organics (GRO) and benzene, toluene, ethylbenzene, and xylene (BTEX) compounds were detected in 1998 surface water samples. PAH compounds were not detected in the 1998 surface water samples.

BTEX compounds collectively constitute total aromatic hydrocarbons (TAH), while PAH compounds in combination with BTEX compounds collectively constitute total aqueous hydrocarbons (TAqH). The TAH and TAqH concentrations reported in marine surface water samples collected during 1998, nominally exceed the water quality criteria established for these chemicals by 18 AAC 70. Since PAH compounds were not detected in the 1998 marine surface water samples, reported TAqH concentrations result from summed BTEX concentrations.

To evaluate if TAH and TAqH concentrations have decreased in marine surface water since the 1998 sampling event, BTEX concentration trends in near-shore groundwater were evaluated. Review of BTEX concentration data in groundwater samples collected between 1998 and 2002 indicate that degradation of these chemicals in near-shore groundwater is occurring. Because BTEX compounds collectively constitute the TAH and TAqH concentrations in marine surface water, the observed degradation of BTEX compounds in near-shore groundwater have likely resulted in a corresponding reduction of TAH and TAqH concentrations in downgradient marine surface water of Sweeper Cove.

Laboratory results for the analyses of sediment and surface water samples collected from the East Canal indicate the presence of petroleum-related chemicals in sediment and surface water of the Canal. DRO, fluoranthene, pyrene, and total lead were detected in the sediment samples collected from the East Canal. DRO, BTEX, and cis-1,2-dichloroethene were detected in surface water samples collected from the East Canal.

SUMMARY OF CLEANUP CRITERIA

As part of the final remedy selected for petroleum sites on Adak Island, soil and groundwater cleanup levels are established based on Alaska regulation 18 AAC 75. Cleanup levels specified for soil are based on Alaska DEC Method Four criteria [18 AAC 75.340(f)]. Under Method Four alternative cleanup levels (ACLs) are proposed based on site-specific risk assessment. The ACLs are established at concentrations such that risks from hazardous substances do not exceed the cumulative carcinogenic risk standard of 1 in 100,000 and the cumulative non-carcinogenic hazard index (HI) of 1.0 (18 AAC 75.325(h)).

Cleanup levels specified for groundwater are based on the use of groundwater as a drinking water source [18 AAC 75.345(b)(1)], or 10 times these levels if the groundwater is not a current source of drinking water, or is not reasonably expected to be used as a drinking water source [18 AAC 75.345(b)(2)]. As previously discussed, groundwater cleanup levels have been proposed for the NMCB Building site based on 10 times the concentrations for groundwater used as a drinking water source since domestic use of groundwater is prohibited in the downtown area and saltwater is known to intrude into groundwater beneath the site.

Alaska regulation 18 AAC 70 establishes water use classes (and subclasses) for the water bodies of the state. Waters of Sweeper Cove and the lower reaches of South Sweeper Creek fall within the marine water class, and the water supply aquaculture, secondary recreation, and growth and propagation of fish, shellfish, other aquatic life, and wildlife subclasses. The water quality standards established for this use class (and these subclasses) specify TAqH in the water column may not exceed 15 µg/L. TAH in the water column may not exceed 10 µg/L. There may be no

concentrations of petroleum hydrocarbons, animal fats, or vegetable oils in shoreline or bottom sediments that cause deleterious effects to aquatic life. Surface waters and adjoining shorelines must be virtually free from floating oil, film, sheen, or discoloration [18 AAC 70.020(b)(17)(A)(i), 18 AAC 70.020(b)(17)(B)(ii), and 18 AAC 70.020(b)(17)(C)].

The canals of the airport ditch system fall within the fresh water class, and the secondary recreation subclass. The water quality standards established for this use class (and subclass) specify that petroleum hydrocarbons, oils and grease may not cause a film, sheen, or discoloration on the surface or floor of the water body or adjoining shorelines, and surface waters must be virtually free from floating oils [18 AAC 70.020(b)(5)(B)(ii)].

NATURAL ATTENUATION PARAMETER MONITORING

To evaluate the potential for natural processes to attenuate petroleum- and non-petroleum-related chemicals at the NMCB Building Expanded Area site, natural attenuation parameter monitoring was conducted. This monitoring indicates both aerobic and anaerobic conditions are present at the site to degrade petroleum- and non-petroleum-related chemicals.

SUMMARY OF RISK ASSESSMENTS

A baseline human health risk assessment and baseline ecological risk assessment were conducted for the NMCB Building site. A risk assessment workplan was prepared in accordance with current Alaska DEC and EPA guidelines. The workplan was approved by Alaska DEC and the risk assessments were prepared according to the workplan. The risk assessments follow available science where appropriate regulatory guidance is not available to accommodate site-specific conditions. Where information is incomplete, conservative assumptions are made so that risk to public health and the environment is not underestimated.

HUMAN HEALTH RISK ASSESSMENT

The human health risk assessment (HHRA) evaluated whether potential health risks were present if people encountered chemical-impacted materials in their environment according to the risk assessment procedures specified by Alaska DEC. Nineteen chemicals were selected as chemicals of potential concern (COPCs) in groundwater and 15 chemicals were selected as COPCs in soil. Current and future human exposures to chemicals in soil and groundwater at the NMCB Building Area were evaluated for potential construction workers and building workers occupying the building. Ingestion of groundwater is considered an incomplete pathway for all

receptors because institutional controls are currently in place which restrict the use of groundwater as drinking water. The following exposure pathways were selected for quantitative evaluation under current and future conditions:

- Construction workers potentially disturbing soil in the course of construction activity could be exposed through incidental ingestion, dermal contact, and inhalation of fugitive dust and volatile chemicals in soil (to a depth of 15 ft).
- Construction workers conducting intrusive subsurface work could be exposed to chemicals in shallow groundwater (less than 15 ft bgs) through dermal contact and inhalation of volatile chemicals.
- On-site building workers occupying the site building could be exposed to volatile chemicals in groundwater by inhalation of chemicals migrating through the soil into the building.

Alaska DEC target health goals for cancer chemicals are no more than a 1×10^{-5} chance of developing cancer and target health goals for non-cancer chemicals are a hazard quotient (HQ) of 1. The results of the human health risk characterization are summarized as follows:

- The cumulative risks and hazards for the construction worker scenario (exposure to both groundwater and soil during construction) for the non-total petroleum hydrocarbon (TPH) chemicals were 1×10^{-5} and 1 (for cancer and noncancer effects), while the total petroleum hydrocarbon (TPH) chemical noncancer hazards were 2. Therefore, the risks and hazards for the non-TPH chemicals were equal to, but did not exceed, target health goals. However, the hazards due to the TPH chemicals did exceed the target health goal of 1.
- Health risks for the on-site worker inhaling vapors in indoor air did not exceed Alaska DEC target health goals with an estimated total non-total petroleum hydrocarbon (TPH) hazard of 0.03 and TPH hazard of 0.01 for the non-cancer chemicals and cancer risks of 2×10^{-7} .
- Measurable thicknesses of free product have been observed in monitoring wells at the NMCB Building Area site during groundwater monitoring activities conducted since August 2004. While exposures to free product cannot be quantitatively evaluated in risk assessments, exposures to free product may represent an unacceptable health risk although significant risks are unlikely due to the limited extent of the remaining product. In the event that free product is

encountered by construction workers performing subsurface activities, the appropriate measures should be taken to minimize contact and exposure.

Because TPH chemicals in soil exceeded target health goals and because there is sufficient free product remaining at the site that direct contact with free product could constitute a health risk, action-based ACLs were calculated for both GRO and DRO in soil as allowed under 18 AAC 75.340, although the risk driver is GRO. The proposed action-based ACLs are 1,700 mg/kg for GRO and 31,000 mg/kg for DRO. Fifteen locations had detected concentrations of GRO or DRO greater than their respective action-based ACLs.

Neither GRO nor DRO concentrations in soil individually exceeded target health goals. Combined exposures to GRO and DRO just barely exceeded the target health goal of a HQ of 1 for construction workers; however, the majority of the hazard is due to GRO exposures. Current DRO exposures are not a health hazard. Thus, the remedial alternatives discussed in this FFS report focus on GRO and free product as the risk drivers at the NMCB site.

Site-specific cleanup levels for groundwater were not calculated; rather, recent analytical data collected from monitoring wells at the site were compared to the proposed groundwater cleanup levels. The proposed groundwater cleanup levels for NMCB are the Alaska DEC cleanup levels established for groundwater not currently used for, or not reasonably expected to be used for drinking water, because institutional controls currently restrict the use of groundwater as a drinking water source, and the water is not potentially potable (i.e., saltwater intrusion makes the water undrinkable). In addition, benzene, DRO, and GRO are the only COPCs that exceed the Alaska DEC cleanup levels in the most recent round of groundwater monitoring.

ECOLOGICAL RISK ASSESSMENT

In accordance with Alaska DEC risk assessment guidance, the NMCB Building Expanded Area site was determined to require a quantitative, detailed ecological risk assessment because:

- The potential presence of state or federally designated sensitive environments, critical habitats, or sensitive species at NMCB
- The potential presence of complete exposure pathways at NMCB that result in the ecologically significant exposure of ecological receptors to site contaminants

An ecological checklist was completed, describing the location and characteristics (e.g., environmental setting, land use, environmental fate-and-transport, ecological receptors) of specific environments within the boundaries of the NMCB Expanded Area site. Through this

exercise, it was determined that critical habitat for anadromous salmonids is present at the site. An ecological conceptual site model (CSM) was also prepared, describing the completeness and significance of exposure pathways by which ecological receptors may potentially be exposed to site contaminants. The CSM revealed that the following complete exposure pathways exist at the NMCB Building Site that result in the ecologically significant exposure of ecological receptors to site contaminants: aquatic receptors may be exposed to site contaminants in marine waters and sediments; and terrestrial receptors may be exposed to site contaminants in surface soil 0 to 6 ft bgs.

A screening level ecological risk assessment was conducted to determine whether any of the contaminants detected in these media onsite might present an unacceptable risk to ecological receptors. Ecological risk at the site was estimated only for contaminants in surface soil, marine sediment and marine surface water. HQs were derived for the detected contaminants; chemicals with HQs greater than or equal to 1.0 were retained as contaminants of potential ecological concern (COPECs). COPECs identified during the screening level risk assessment were forwarded to the baseline ecological risk assessment. Two marine sediment contaminants were identified as COPECs (3,4-methylphenol and DRO); and 2 surface soil contaminants were identified as COPECs (DRO and GRO).

In the risk characterization phase of a baseline risk assessment, to calculate HQs the 95% upper confidence limit on the mean (UCL95) of the COPEC is compared to the respective RBSC rather than the maximum detected concentration (MDC). The risk characterization phase of the baseline ecological risk assessment did not identify any chemicals detected in marine sediment as having the potential to pose a significant, unacceptable risk to benthic biota (i.e., all HQs less than 1.0). The only potentially significant ecological risk, which could be quantified during the baseline ecological risk assessment, was exposure of terrestrial wildlife to GRO in soil (HQ of 3.9). No other chemicals of concern (COCs) were identified in soils of the NMCB site in the baseline risk assessment of terrestrial wildlife.

Based on these data, a potential ecological threat exists to terrestrial wildlife from GRO in soil at the NMCB site. Site COPECs in marine surface water and marine sediments do not pose significant quantifiable risks to any ecological receptor. The ecological risk-based screening concentration (RBSC) for soils of 1,840 mg/kg was selected as the ACL for GRO. However, the human health ACL for GRO of 1,700 mg/kg was lower than that determined for the ecological assessment (EcoRA). As such, the human health ACL would be expected to be protective of ecological receptors.

POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Chemical-specific ARARs are generally risk-based concentration limits or discharge limits for specific chemicals. Chemical-specific ARARs for the NMCB Expanded Area site include the following:

- 18 AAC 75, Oil and Other Hazardous Substances Pollution Control regulations: This is the primary ARAR for soil and groundwater impacted by petroleum-related chemicals released to the environment within the State of Alaska.
- 18 AAC 70: Water quality standards are relevant and appropriate for fresh and marine surface waters within the State of Alaska.
- 33 United States Code (USC) 1314, Clean Water Act (CWA): The ambient water quality criteria (AWQC) are relevant and appropriate for surface water that could be impacted by plume migration.

Location-specific ARARs are those requirements that relate to the geographic position or physical condition of the site. These requirements may limit the type of remedial activities that can be implemented or may impose additional constraints. There are no potential location-specific ARARs for the NMCB Expanded Area site because remedial actions are not proposed in sensitive environments and because ecological hazards from exposure to sediment and surface water in Sweeper Cove were found to be below target goals (i.e., a HQ less than 1).

Action-specific ARARs generally set performance, design, or other similar action-specific controls or restrictions on particular kinds of activities. Potentially applicable action-specific ARARs for the alternatives include the following:

- Alaska Air Quality Control (18 AAC 50.300 through 50.380)
- Resource Conservation and Recovery Act (RCRA) regulations (40 Code of Federal Regulations [CFR] Parts 261, 262, 268)
- Alaska Hazardous Waste Disposal Regulation (18 AAC 62)
- Alaska Oil and Hazardous Substances Pollution Control (18 AAC 75.325 through 375)
- Alaska Water Quality Standards (18 AAC 70.20)

- Federal Clean Water Act – National Pollution Discharge Elimination System (NPDES) Program (40 CFR Part 131)
- Federal Clean Water Act – Pretreatment (40 CFR Part 403)

The following to be considered (TBC) materials have been identified for the site:

- Handbook for Conducting Cleanups of Contaminated Sites and Regulated Underground Storage Tanks under the Voluntary Cleanup Program
- EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9200.4.17P, use of Monitored Natural Attenuation (MNA)
- Soil Treatment Facility Guidance (Alaska DEC, November 2002)
- Recommended Practices for Monitoring Well Design, Installation, and Decommissioning (Alaska DEC, April 1992)

REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) are proposed that provide protection of human health and the environment assuming commercial, aviation, and public facilities land reuses at the NMCB Expanded Area, as proposed by the ARC. RAOs were developed for the protection of human health at the NMCB Expanded Area site to:

- Prevent human exposure to petroleum hydrocarbons in soil that would result in adverse health effects,
- Reduce petroleum hydrocarbons in groundwater to concentrations less than or equal to the Alaska DEC groundwater cleanup levels established for groundwater not currently used for drinking water, and
- Minimize exposure to free-phase petroleum product.

The necessity for RAOs to protect ecological receptors was evaluated on the basis of ecological hazards resulting from exposure to petroleum hydrocarbons released at the site. Based on the risk analysis conducted for this site, no ecological RAOs were found to be necessary for the protection of ecological receptors at the NMCB Expanded Area site.

Action-based ACLs were established for soil at the NMCB Expanded Area based on the results of the risk assessment as allowed by Alaska DEC regulations (18 AAC 75.340(a)(4) and 18 AAC 75.340(f)). ACLs have been defined for both GRO and DRO although the risk driver is GRO. Their ACLs are 1,700 mg/kg for GRO and 31,000 mg/kg for DRO. Remedial actions for soil exceeding these action-based ACLs are evaluated to reduce the site risks to below target health goals.

The Alaska DEC groundwater cleanup levels will be achieved using passive treatment technologies (i.e., MNA) as the remedy selected in the Operable Unit A Record of Decision (OU A ROD). The OU A ROD also specified that the downtown groundwater body would be addressed as one entity regarding development of remedial alternatives and comparison of the resulting alternatives. As a result, a reanalysis of groundwater treatment technologies for the NMCB Expanded Area is unnecessary.

The OU A ROD established the criteria for cessation of free-product recovery based on achievement of the technically practical endpoints. These criteria, based on the operational performance of recovery systems that are not dependent on water table depression (automated skimmers), are as follows:

When the monthly volume of recovered product averaged over the most recent 6 months (6-month moving average) is less than 5 gallons of product recovered per month, the technically practicable endpoint for recovery has been reached. If this endpoint criterion has been met for a period of 12 months of product recovery, the system is considered to meet the technically practicable endpoint and recovery can be discontinued.

As required in 18 AAC 75.345(f), groundwater that is closely connected hydrologically to nearby surface water may not cause a violation of the water quality standards in 18 AAC 70 for surface water or sediment. Comparison of concentrations of petroleum-related chemicals reported in surface water samples from Sweeper Cove in the vicinity of the NMCB Building Expanded Area site identified maximum concentrations of TAH and TAqH at, or just above, water quality standards. All other contaminants of concern were detected at concentrations less than the water quality standards. Therefore, periodic groundwater and surface water monitoring, as necessary, will be conducted to track future conditions.

Three separate areas of the NMCB site were identified as containing soil with COC concentrations exceeding the ACLs. These three areas encompass a total of approximately 120,000 ft². This excludes the area of riprap adjacent to the shoreline. Because surface water and sediment concentrations in Sweeper Cove result in ecological hazards below target health goals, the riprap area is assumed to be uncontaminated. Soil exceeding the ACLs was found in

these areas between 4 and 11 ft bgs, generally near the groundwater surface. The volume of soil exceeding ACLs was assumed to extend to the minimum groundwater elevation (i.e., the maximum depth to water measured during groundwater monitoring). The volume of soil in the areas identified as exceeding ACLs from ground surface to the maximum measured depth to groundwater is approximately in-place 44,000 cubic yards (cy).

Groundwater in three separate areas potentially exceed Alaska DEC criteria established for groundwater not used as a drinking water source. These areas total approximately 130,000 ft², and include groundwater located beneath the rip rap adjacent to the Sweeper Cove shoreline. During 2004, measurable thicknesses of free product were detected in three areas. These three areas total approximately 24,000 ft².

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGY TYPES AND PROCESS OPTIONS

Remedial technology types and process options were identified and screened first for the downtown sites as a group, because focused feasibility studies will be prepared for four downtown Adak petroleum sites (NMCB Expanded Area, South of Runway, solid waste management unit [SWMU] 17, and SWMU 62) that have similar characteristics. This approach was taken to streamline the process by reducing the number of process options and technologies potentially applicable to downtown petroleum sites prior to screening these process options and technologies for each individual downtown site. Then, the technology types and process options determined to be applicable to the downtown petroleum sites (i.e., the “short list”) were evaluated using site-specific information to identify those applicable to the NMCB Expanded Area. This evaluation was conducted with respect to protectiveness, ability to meet cleanup levels, and implementability, which are the three criteria identified in Alaska DEC guidance (Alaska DEC 1999b). Process options were retained for unsaturated soil, aquifer media (saturated soil) and free-phase product. The retained process options were selected for inclusion in the remedial alternatives.

CANDIDATE REMEDIAL ALTERNATIVES

The technologies and process options that passed the screening steps were combined to form candidate remedial alternatives for the NMCB Expanded Area. These candidate remedial alternatives represent the most effective combination of actions for meeting the RAOs. A conceptual design for each alternative was developed and used to estimate capital, operation and maintenance, and present worth costs for each alternative.

Brief descriptions of the candidate remedial alternatives, including costs, are as follows:

- **Alternative 1 – No Action:** No action or monitoring would be implemented.
Cost: \$0
- **Alternative 2 – Institutional Controls, Free-Phase Product Recovery, and MNA:** Includes institutional controls for soil and groundwater, free-phase product recovery for 2 years using passive skimmers in 7 wells, and MNA for groundwater for 40 years.
Cost: Capital - \$210,000, Annual operation and maintenance (O&M) for recovery - \$180,000,
Annual O&M for MNA - \$80,000, Total Present Worth Cost - \$1.9 million
- **Alternative 3—Hot Spot Soil Excavation and MNA:** Includes excavation and thermal treatment of 8,300 cy of soil in the target hot spot treatment areas to meet soil ACLs, backfill of treated soil, groundwater treatment using an oil/water separator, settling tanks and carbon adsorption to treat water pumped during dewatering of the excavation, MNA for groundwater for 20 years, and institutional controls.
Cost: Capital - \$8.5 million, Annual O&M for MNA - \$76,000,
Total Present Worth Cost - \$9.5 million
- **Alternative 4—Hot Spot Soil Excavation, *In Situ* Soil/Aquifer Media Treatment, and MNA:** Includes excavation and thermal treatment of 8,300 cy soil in the target hot spot treatment areas to meet soil ACLs, backfill of treated soil, groundwater treatment using an oil/water separator, settling tanks and carbon adsorption to treat water pumped during dewatering of the excavation, *in situ* biological treatment of soil/aquifer media for 5 years, MNA for groundwater for 10 years, and institutional controls.
Cost: Capital - \$14 million, Annual O&M for *in situ* treatment - \$140,000,
Annual O&M for MNA - \$76,000, Total Present Worth Cost - \$15 million

EVALUATION OF CANDIDATE REMEDIAL ALTERNATIVES

Each alternative for the NMCB Expanded Area was evaluated individually against the five criteria of 18 AAC 751: protectiveness; practicability; short- and long-term effectiveness; and regulations. Public input as a criterion will be evaluated after receipt of the public comments on the proposed plan and will be presented in the decision document. Each remedial alternative was

assessed and assigned a rating of poor, fair, good, excellent, or superior for each evaluation criteria.

Following individual evaluation, the four remedial action alternatives underwent a comparative evaluation to identify their relative advantages and disadvantages and to assess which alternative best meets the evaluation criteria. This comparative evaluation will also be used to identify the alternative for the NMCB Expanded Area that represents the most appropriate and feasible cleanup remedy that can be implemented at the earliest possible time. Based on the evaluation of the individual criteria, each alternative was given an overall rating (poor, fair, good, excellent, or superior).

Alternative 2 was given an overall rating of good, because it provides superior implementability, excellent short-term effectiveness, and good protectiveness and long-term effectiveness at a relatively low cost. Because residual risks remain at the site after active cleanup (free-phase product recovery), this alternative only obtained a rating of good for long-term effectiveness. However, this alternative minimizes short-term risks and therefore obtained an excellent rating for short-term effectiveness. Although it was rated fair for time to achieve cleanup goals and for meeting regulations because it would take a long time to achieve cleanup goals, Alternative 2 is protective of human health during the period of time required to achieve the cleanup goals (given the implementation of institutional controls and groundwater monitoring). However, it is not protective of the environment during this period of time.

Alternative 3 was given an overall rating of good, because it provides superior long-term effectiveness and protectiveness, good time to achieve cleanup goals, excellent compliance with regulations, and fair implementability and cost effectiveness. This alternative is capable of achieving the cleanup goals significantly quicker than Alternative 2, and is protective of both human and ecological receptors once soil excavation is complete. However, there are additional short-term risks and costs associated with this alternative when compared to Alternative 2.

Alternative 4 was given an overall rating of fair. This alternative was rated lower than Alternatives 2 and 3 because of the difficulty of implementing this complex alternative, the high cost, and the additional short-term risks associated with this alternative. This alternative received superior ratings for long-term effectiveness and regulations, an excellent rating for protectiveness and a good rating for time to achieve cleanup goals. Although this alternative provides superior long-term effectiveness, it achieves that through additional remedial actions which have additional short-term risks and costs.

Alternative 1 was given a rating of poor. This alternative received poor ratings for time to achieve cleanup goals, regulations, protectiveness and long-term effectiveness. Although this

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alternative would be easy to implement and would cost nothing, the alternative would not be protective of human health and the environment.

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ABBREVIATIONS AND ACRONYMS

1CFOR	one compartment first order
AAC	Alaska Administrative Code
ACL	alternative cleanup levels
ACS	American Cancer Society
ADEC	Alaska Department of Environmental Conservation
AET	apparent effects threshold
AFCEE	Air Force Center for Environmental Excellence
ARAR	applicable or relevant and appropriate requirement
ARC	Adak Reuse Corporation
ATSDR	Agency for Toxic Substances and Disease Registry
AWQC	ambient water quality criteria
BCF	bioconcentration factor
bgs	below ground surface
BTAG	Biological Technical Assistance Group
BTEX	benzene, toluene, ethylbenzene, and total xylenes
C _a	chemical concentration in an animal
C _w	chemical concentration in water
CBR	critical body residue
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESARs	Chemical Evaluation Search and Retrieval System
CFR	Code of Federal Regulations
CMP	Comprehensive Monitoring Plan
COC	chemical of concern
COCs	contaminants of concern
COPC	chemical of potential concern
COPEC	contamination of potential ecological concern
CSL	cleanup screening level
CSM	conceptual site model
CT	central tendency
CWA	Clean Water Act
DEC	Department of Environmental Conservation (State of Alaska)
DO	dissolved oxygen
DPE	dual-phase extraction
DRO	diesel-range organics
DSWB	downgradient surface water bodies

ABBREVIATIONS AND ACRONYMS (Continued)

Ecology	Washington State Department of Ecology
EcoRA	ecological risk assessment
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ERL	effects range low
ERM	effects range median
FDEP	Florida Department of Environmental Protection
FFA	Federal Facilities Agreement
FFS	focused feasibility study
GPR	ground-penetrating radar
GRA	general response action
GRO	gasoline-range organics
HEAST	Health Effects Assessment Summary Tables
HHRA	human health risk assessment
HI	hazard index
HMW	high molecular weight
HPAH	high molecular weight polynuclear aromatic hydrocarbons
HQ	hazard quotient
HSDB	Hazardous Substance Database
ICMP	Institutional Control Management Plan
I_p, I_s	ingestion rate
IRIS	Integrated Risk Information System
iSOC™	in situ submerged oxygen curtain by Inventures Technologies Incorporated
J-E Model	Johnson and Ettinger Mode
K_e	chemical elimination rate constant
K_{oc}	organic carbon partition coefficient
K_{ow}	octanal-water partition coefficient
K_u	chemical uptake rate constant
LNAPL	light non-aqueous phase liquid
LOAEL	lowest-observed-adverse-effect
LPAH	low molecular weight polynuclear aromatic hydrocarbons
MADEP	Massachusetts Department of Environmental Protection
MDC	maximum detected concentration
MDEP	Massachusetts Department of Environmental Protection
MDL	method detection limit

ABBREVIATIONS AND ACRONYMS (Continued)

MLLW	mean lower low water
MNA	monitored natural attenuation
MRL	minimum risk level
NAF	Naval Air Facility
Navy	U.S. Navy
N _c	number of carbons in the alkane
NCEA	National Center for Environmental Assessment
NCPAH	non-carcinogenic polynuclear aromatic hydrocarbons
NDAA	National Oceanic and Atmospheric Administration
NIOSH	National Institute of Occupational Safety and Health
NMCB	Naval Mobile Construction Battalion
NOAEL	no-observed-adverse-effect
NPDES	National Pollutant Discharge Elimination System
OHM/TAD	Oil and Hazardous Materials/Technical Assistance Database
O&M	operation and maintenance
ORC™	oxygen release compound by Regenesis
OSWER	U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response
OU	operable unit
OU A ROD	Operable Unit A Record of Decision
PAH	polycyclic aromatic hydrocarbons
PC	permeability coefficient
PCB	polychlorinated biphenyls
PCL	protective concentration limit
PEB	Pre-Engineered Building
PEF	particulate emission factor
PEL	probable effects level
PRG	preliminary remediation goals
PSE	preliminary source evaluation
Q/C, Q/C _w , Q/C _{sa}	dispersion coefficient
RAO	remedial action objective
RBSC	risk-based screening concentration
RCRA	Resource Conservation and Recovery Act
RfC	reference concentration
RfD, RfDi, RfDo	reference dose, inhalation reference dose, oral reference dose
RME	reasonable maximum exposure

ABBREVIATIONS AND ACRONYMS (Continued)

ROD	record of decision
RRO	residual-range organics
RTECS	Registry of Toxic Effects of Chemical Substances
S	water solubility
SAERA	State-Adak Environmental Restoration Agreement
SF, SF _i	slope factor, inhalation slope factor
SIF, SIF _{inh} , SIF _{ing} , SIF _{derm}	summary intake factor, summary intake factor for inhalation ingestion, and dermal contact
SMDP	scientific management decision point
SQL	sample quantitation limit
SQS	sediment quality standard
SquiRTs	screening quick reference tables
SVE	soil vapor extraction
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TAH	total aromatic hydrocarbons
TA _q H	total aqueous hydrocarbons
TARA	Tiered Approach to Risk Assessment
TBC	to be considered
TPH	total petroleum hydrocarbon
TPH CWG	Total Petroleum Hydrocarbon Working Group
TRV	toxicity reference value
UCL ₉₅	95% upper confidence limit on the mean
UF	uncertainty factor
URF	unit risk factor
URS	URS Group, Inc. (also URS Consultants, Inc.)
URSG	URS Greiner, Inc. (formerly URS Consultants, Inc.)
USC	United States Code
USEPA	United States Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UST	underground storage tank
VF, VF _W	volatilization factor, volatilization factor from water
VOC	volatile organic compound
WHO	World Health Organization

ABBREVIATIONS AND ACRONYMS (Continued)

UNITS OF MEASURE

atm-m ³ /mol	atmosphere cubic meter per mole
cm	centimeter
cy	cubic yard
ft	feet
ft ²	square feet
g/mol	gram per mole
HP	horsepower
kg	kilogram
kg-day/ms	kilogram day per milligram
L	liter
L/kg	liters per kilogram
L/kg/hour	liters per kilogram per hour
µg	microgram
µg/L	microgram per liter
m ³	cubic meter
m ³ /µg	cubic meters per microgram
m/sec	meters per second
mg	milligram
mg/m ³	milligrams per cubic meter
mg	milligram
mg/kg	milligram per kilogram
mg/L	milligram per liter
mmol/kg	millimoles per kilogram
mph	miles per hour
psi	pounds per square inch
SCFM	standard cubic feet per minute

1.0 INTRODUCTION

Investigation and cleanup of petroleum-contaminated sites at the former Adak Naval Complex have been ongoing since 1986. To facilitate site investigation and cleanup activities, the U.S. Navy, as lead agency, entered into the 1993 Federal Facilities Agreement (FFA) with the U.S. Environmental Protection Agency (EPA), and the Alaska Department of Environmental Conservation (DEC), and the 1994 State-Adak Environmental Restoration Agreement (SAERA) with the Alaska DEC. Pursuant to the FFA, the Navy, the EPA, and the Alaska DEC have agreed to site-specific interim remedial actions for free-product recovery petroleum sites on the former Adak Naval Complex. As specified in the record of decision (ROD) for Operable Unit A (OU A), signed by all parties during 2000, upon achieving the remedial endpoints for the interim action of free-product recovery, the subject site is to undergo additional evaluation to determine a final remedy, as needed.

Subsequent to the signing of the ROD for OU A, the Navy, EPA, and Alaska DEC agreed to amend the FFA and SAERA. These amendments specify that to the extent these free-product recovery petroleum sites require remediation in the future, cleanup decisions will be made in accordance with Alaska State regulations. Therefore, the Navy, EPA, and Alaska DEC signed an amendment to the OU A ROD on September 4, 2003. This amendment removes from the OU A ROD 48 petroleum sites that have final remedies and 14 free-product recovery petroleum sites that were selected for interim remedies. Because free-phase petroleum product has been observed on the groundwater at the NMCB Building T-1416 Expanded Area site, free-product recovery was designated as the interim remedy for the site in the ROD for OU A. The NMCB Building site is one of the 14 free-product recovery petroleum sites removed from the ROD for OU A by the ROD amendment.

During September 2000, the federal government entered into a land transfer agreement with the Aleut Corporation, as documented in the Interim Conveyance document issued by the United States to The Aleut Corporation. This agreement resulted in conveyance of approximately 47,000 acres of the former Adak Naval Complex property to The Aleut Corporation during March of 2004. The land transfer includes all of the downtown area, including the NMCB Building T-1416 Expanded Area site. This transferred land has institutional controls currently in place as part of remedy requirements specified in the OU A ROD and the Interim Conveyance document.

Pursuant to the 2003 ROD amendment, the Navy and the Alaska DEC have agreed that the identification and selection of additional remedial actions for the sites removed from the OU A ROD, including applicable institutional controls, will follow the cleanup process established by

Alaska State regulations. The ROD amendment clearly establishes 18 AAC 75 as the basis for regulatory procedures and requirements for future petroleum cleanup decisions at these sites.

According to the Alaska State regulations, confirmed petroleum release sites must undergo a process of investigation, remedy selection, and cleanup to achieve standards established in the *Alaska DEC Oil and Other Hazardous Substances Pollution Control Regulations* (18 Alaska Administrative Code [AAC] 75). This process is outlined in the Alaska DEC *Guidance on Decision Documentation Under the Site Cleanup Rules “18 AAC 75.325–18 AAC 75.390”* (ADEC 1999a) and summarized in Figure 1-1. The process includes performing the following activities, as appropriate: site characterization activities, conducting interim removal actions, developing proposed cleanup levels, screening cleanup technologies, constructing cleanup alternatives, and implementing site cleanup. The steps identified in this site investigation process that are addressed by this *Focused Feasibility Study (FFS)* are indicated with bolded text in Figure 1-1.

The petroleum release site on the former Adak Naval Complex designated as the NMCB Building T-1416 Expanded Area (hereinafter referred to as the “NMCB Building Expanded Area”) has progressed through this process, as described in the following documents:

- Initial site investigation activities were summarized in the *Draft Site Investigation Report, NMCB Building Area, T-1416 Expanded Area* (URSG 1998a).
- Site characterization activities were summarized in the *Final Site Summary Report for Free-Product Petroleum Sites* in the section “NMCB Building Area, T-1416 Expanded Area” (URSG 1999a).
- Free-product recovery was identified as an interim removal action at the NMCB Building Area site in the *Final Focused Feasibility Study for Petroleum Sites* (URSG 1998b).
- Target cleanup goals for affected media at petroleum release sites on the former Adak Naval Complex and institutional controls instituted to limit the potential for human exposure to petroleum-related chemicals until cleanup goals are achieved were specified in the ROD for OU A (U.S. Navy et al. 2000).

These environmental investigations have identified petroleum-related chemicals in soil and groundwater at the site at concentrations above Alaska DEC soil and groundwater cleanup levels established in 18 AAC 75. To reduce potential human exposure to petroleum-related chemicals, institutional controls specified in the ROD for OU A have been implemented for the downtown

area on Adak Island, including the NMCB Building Expanded Area site through the Interim Conveyance document and the Final Institutional Control Management Plan (U.S. Navy 2004). These institutional controls include: land use restrictions, primarily restricted to areas designated for commercial/industrial use; equitable servitude, that reserves specified rights and uses; permit requirements for intrusive soil excavation activities; and groundwater restrictions that prohibit use of the downtown aquifer as a drinking water resource.

Institutional controls are intended to remain in place until the property owner petitions the Navy for release of institutional controls at the site. Alaska DEC must concur that environmental conditions at the site warrant release of the institutional controls prior to their release by the Navy. Site inspections and reporting of the effectiveness of institutional controls have been conducted on an annual basis since 2001.

To evaluate remedial alternatives that will protect human health and the environment from petroleum-related chemicals released at the NMCB Building Expanded Area site, the Navy and Alaska DEC have agreed to conduct an FFS. This FFS report documents the results of that focused feasibility study. The FFS integrates results of previous site investigation activities and presents results of human health and ecological risk assessments for the site. These risk assessment activities are used to determine whether institutional controls are sufficient to protect human health and the environment while natural attenuation processes are reducing chemical concentrations, or whether remedial actions may be necessary at the site to reduce risks to acceptable levels. Based on risk assessment results, remedial actions are determined to be necessary at this site. Therefore, this FFS identifies remedial action objectives, proposes preliminary remediation goals, and develops remedial action alternatives that can achieve these goals and objectives.

Site characterization information presented in this document is current through November 2004, representing knowledge of the site up to that date. This includes site information collected for remedial design purposes during 2001 and 2002, and near-shore sediment sampling activities conducted in Sweeper Cove adjacent to the site during 2003. A summary of field activities conducted during these investigations is included in Appendix A.

1.1 PURPOSE

The purpose of this FFS is to document the process of identifying, developing, and evaluating remedial action alternatives, as necessary, for the NMCB Building Expanded Area site and provide the basis for selecting the most appropriate and feasible cleanup remedy that can be implemented at the earliest possible time. The remedial action alternatives developed for this FFS ensure that concentrations of petroleum-related chemicals at the site pose no unacceptable

risk to human health or the environment while the selected remedy reduces contaminant concentrations to levels below risk-based alternative cleanup levels (ACLs). Institutional controls are an integral part of this process. Land use restrictions, excavation permit requirements, and groundwater restrictions limit the future types of activities that can be located at the site, thus controlling the nature and duration of the human exposure to petroleum-related chemicals at the site.

1.2 OBJECTIVE

The objective of this FFS is to provide decision makers sufficient information to facilitate selection of appropriate, cost-effective remedial alternatives for the NMCB Building Expanded Area site that protect human health and the environment, and that can be implemented at the earliest possible time. This FFS was conducted to evaluate remedial alternatives and support selection of the final remedy and comply with Alaska State Regulations (18 AAC 75.325 through 18 AAC 75.390).

The detailed analyses of remedial alternatives presented in this FFS report are presented in accordance with the five criteria specified in the *Alaska DEC Guidance on Decision Documentation Under the Site Cleanup Rules* (Alaska DEC 1999a). These five criteria include the following:

- Protectiveness
- Practicability
- Short- and Long-term effectiveness
- Regulatory compliance
- Public comment

Protectiveness, practicability, short- and long-term effectiveness, and regulatory compliance are criteria that will be used during the detailed evaluation of remedial alternatives. Public comments (submitted on the Proposed Plan) will be considered as modifying criteria during selection of the final remedial alternative. The final selected remedial alternative will adequately protect human health and the environment at the NMCB Building Expanded Area site while providing the Navy with an alternative that is implementable and practicable.

1.3 REPORT ORGANIZATION

This FFS report is organized as follows:

- Section 2 presents a brief description of the site including the physical and ecological setting, site history and proposed site reuse, and site geology and hydrogeology.
- Section 3 summarizes the environmental history of the site including release history, removals and cleanup activities, and nature and extent of petroleum contaminants released at the site based on comparisons to soil and groundwater criteria specified in 18 AAC 75.
- Section 4 presents results of the human health risk assessments conducted for the site. Results of the risk assessment are the basis for performing remedial actions at the site.
- Section 5 presents results of the ecological risk assessments conducted for the site. Results of the risk assessment are the basis for performing remedial actions at the site.
- Section 6 presents the potential ARARs that steer the remedial decision-making process for the site (to be provided following Agency review of site characterization and risk assessment information).
- Section 7 discusses the development of remedial action objectives (RAOs) (to be provided following Agency review of site characterization and risk assessment information).
- Section 8 summarizes the identification, evaluation, and screening of remedial technologies that may be used to accomplish RAOs (to be provided following Agency review of site characterization and risk assessment information).
- Section 9 develops candidate remedial alternatives (to be provided following Agency review of site characterization and risk assessment information).
- Section 10 evaluates each of the candidate remedial alternatives relative to four of the five criteria specified in the Alaska DEC guidance (protectiveness, practicability, short- and long-term effectiveness, and regulatory compliance) (to

be provided following Agency review of site characterization and risk assessment information).

- Section 11 presents a comparative evaluation of each candidate remedial alternative relative to the other alternatives (to be provided following Agency review of site characterization and risk assessment information).
- Section 12 lists the documents referenced in this report.

2.0 SITE DESCRIPTION

The NMCB Building Expanded Area site is located in downtown Adak on the north shore of Sweeper Cove. It consists of a large lowland area situated southeast of the southern end of Runway 18-36. The site extends from the East Canal of the Airport Ditch system on the northwest south to Sweeper Cove and east approximately 2,000 feet (Figure 2-1). To the west this site adjoins to another large petroleum release site; the South of Runway 18-36 Area.

The Seawall Road bisects the site in an east-west direction. The primary physical features on the site south of Seawall Road include the NMBC Building (Building T-1416), the Pre-Engineered Building (PEB), the former Building T-1421 (now a concrete pad), and a vehicle wash rack (42094) located between Building T-1416 and Building T-1421. The primary physical features on the site north of Seawall Road consist of the Vehicle Storage Building (Building 42069) and the Fish and Wildlife Building. A riprap-covered berm associated with a breakwater is present along the southern edge of the site at Sweeper Cove. A utility corridor containing an underground storm sewer and overhead utilities is present along the southern edge of Seawall Road. An east-west trending sanitary sewer line is present south of Building T-1416. This sewer line connects to Sewage Lift Station No. 11 located approximately 125 feet west-southwest from the former Building T-1421.

Four additional petroleum release sites, administered under the State Adak Environmental Restoration Agreement (SAERA), were identified in the vicinity of the NMCB Building Expanded Area site. These sites are:

- NMCB Building Area (UST T-1416-A)
- Sewage Lift Station No. 11 (UST 42484-A)
- South of Runway 18-36 Area
- SA 79, Main Road Pipeline.

The NMCB Building Area (UST T-1416-A) site is a small waste oil tank that was formerly located along the north wall of the NMCB Building. This site was designated part of the larger NMCB Building Expanded Area site in the OU A ROD for remedy selection purposes. Sewage Lift Station No. 11 (UST 42484-A) was determined to require no further action in the OU A ROD. The Navy is evaluating remedial alternatives for the South of Runway 18-36 area. Remedy evaluations for this site will be presented in a FFS report to be completed during 2004. Limited groundwater monitoring was identified as the selected remedy at SA 79, Main Road Pipeline because petroleum-related chemicals were identified in groundwater between the

extreme southern end of the pipeline and Sweeper Cove. This area of the pipeline identified for limited monitoring is situated south of South Sweeper Creek.

2.1 LAND USE

2.1.1 Historical Land Use

The land that makes up the NMCB Building Expanded Area has been extensively altered since the military first arrived on Adak Island during World War II. This area was part of Sweeper Cove prior to military arrival. The downtown area on Adak Island was converted to a military airstrip, and fuel receipt and distribution center to support the United States' Aleutian campaign during World War II. The NMCB Building Expanded Area is crossed by several former underground fuel transfer pipelines.

Building T-1416 and former Building T-1421 were constructed during the early 1940s and were initially used as a woodworking shop and supply depot, respectively. Another former building constructed during the early 1940s east of Building T-1416, was used as a machine shop for overhauling ships. This building was removed from the site by the end of 1947. The T-1416 Building recently housed the Naval Mobile Construction Battalion (NMCB), a group responsible for maintaining the vehicle motor pool. The parking area east of Building T-1416 was used for equipment storage and vehicle parking from 1979 through 1995 (EMCON 1996). The PEB, located east of Building T-1416, was constructed during 1994; Building T-1421 was removed concurrent with this construction. The site and surrounding area continued to be used primarily for industrial purposes up to the military drawdown at Adak (URSG 1998a).

Docks, formerly located at the southern margin of the site, were constructed prior to 1945. These docks, which were associated with site operations, were identified as Barge Ways, Crane Dock No. 1, Crane Dock No. 2, and the Small Ship Dock (EMCON 1996). Fuel Dock No. 7 was also located at the eastern limit of the NMCB Building Expanded Area site. All these docks have been removed.

The Fish and Wildlife Building, located north of Seawall Road, houses the administrative functions of the U.S. Fish and Wildlife service (USFWS).

2.1.2 Proposed Reuse

Future land use at the NMCB Building Expanded Area site is designated for one of three reuses by the Adak Reuse Corporation (Figure 2-2). The largest portion of the site is designated for commercial reuse. The uses of this category are oriented toward serving the commercial needs

of residents. The portion of the site northwest of the Main Road is classified for aviation reuse. The intent of this category is to provide for aviation or aviation-related commercial/industrial activities. The western portion of the site between the Main Road and Sweeper Cove as well as the portion of the site containing the Fish and Wildlife building are designated for public facilities' reuse. This category is intended to provide for and protect areas of public lands or facilities for public uses. This includes roads and harbor facilities present in the vicinity of the NMCB Building Expanded Area (ARC 2000).

2.2 PHYSICAL AND ECOLOGICAL SETTING

Topography at the NMCB Building Expanded Area is generally flat. Elevations in this area are generally less than 20 feet above mean lower low water (MLLW). Seawall Road and the riprap-covered breakwater along the southern margin of the site represent local topographic highs.

The site has been extensively re-engineered since the military arrived on Adak Island during World War II. The ground surface south of Seawall Road is graded flat, and paved with compacted gravel or occupied by buildings. This type of ground surface is of low value for wildlife habitat. The vegetated areas north of Seawall Road, and between the Main Road and Sweeper Cove in the western portion of the site consist of tundra meadow, composed of native grasses dominated by beach ryegrass. Such vegetation provides habitat for birds such as the Lapland longspur and snow bunting, and terrestrial invertebrates. Small mammals such as the Norway rat are likely to forage on or around the site. The shoreline of Sweeper Cove is covered with large boulders (riprap) placed there to protect the shoreline from erosion. The rocky nature of the shoreline does not encourage growth of typical beach vegetation.

Two surface water bodies are located in the vicinity of the site, the East Canal of the airport drainage ditch system and Sweeper Cove. Figure 2-3 shows the position of these surface water bodies in relation to the site. The East Canal is an engineered diversionary structure designed to collect surface runoff from the airfield. It is lined with tundra grasses and other soft-stemmed plants. The only surface connection between the airport drainage ditch system and South Sweeper Creek is through pump turbines that isolate the drainage ditch system from anadromous fish (such as pink and coho salmon) that occur in South Sweeper Creek. Sweeper Cove is a marine environment that forms the southern boundary of the site. Gulls, upland birds (including fledgling snow bunting), and marine invertebrates have been noted along the shoreline. Gulls, seabirds, harbor seals, sea otters, fish, and invertebrates used the nearshore marine habitat and nearby ledges (USFWS 1995).

2.3 GEOLOGY AND HYDROGEOLOGY

Prior to the military use of Adak Island during World War II, the western portion of the downtown area was occupied by a back-beach lagoon. The lagoon was separated from Kuluk Bay by a series of sand dunes. The lagoon was filled with sand from dune deposits by the military forces to construct the airfield. The area occupied by the NMCB Building Expanded Area site was formerly a portion of Sweeper Cove. Based on historical photographs, most of the site south of Seawall Road is underlain by fill material, which was placed as the original shoreline was extended outward and straightened during construction (EMCON 1996).

During site investigations at the NMCB Building Expanded Area site, 104 soil borings were drilled, 49 of these were completed as groundwater monitoring wells, nine hand auger borings were dug, 25 test pits or excavations were installed, and sediment and/or surface water samples were collected from 13 locations. Figure 2-4 shows the locations of these borings, wells, test pits and surface water/sediment samples. Subsurface soils encountered beneath the fill material are described as unconsolidated sand and sandy silt. The subsurface materials have variable permeability, and the saturated subsurface has a high water-bearing capacity.

Depth to groundwater was measured on several occasions in monitoring wells in the vicinity of the NMCB Building Expanded Area between June 1997 and December 2004. Groundwater elevations calculated from these depth-to-groundwater measurements and surveyed elevations of well casings are provided in Appendix A. Table 2-1 summarizes these depth-to-groundwater measurement data for each well, including ground surface elevations, total depth of well, total number of depth-to-groundwater measurements for each well, minimum groundwater elevation, maximum groundwater elevation, and average groundwater elevation.

Groundwater is found as a regional water table aquifer beneath the site. The regional water table is encountered approximately 4 to 15 feet bgs. When combined with elevation survey data for the monitoring wells, the elevation of the groundwater surface is calculated to range between 8.24 and -0.4 feet above mean lower low water (MLLW). Average groundwater elevations calculated for data from individual wells installed at the site and shown in Table 2-1, range from 1.28 feet above MLLW at NMCB-06 (located adjacent to the East Canal) to 3.96 feet above MLLW at 02-487 (located east of the Fish and Wildlife Building).

Groundwater elevations, calculated for monitoring wells at the site where depth to groundwater was measured at least 10 times, showed a range of fluctuation of the groundwater surface of between 0.7 and 7.2 feet (Table 2-1). Near-shore groundwater in the vicinity of Sweeper Cove is tidally influenced. Wells installed near the Sweeper Cove shoreline typically produced the largest variability in groundwater elevations including the site maximum (7.2 feet in well

02-455). The pumping of water from the airport ditches into South Sweeper Creek influences groundwater elevations near the East Canal. The lowest groundwater elevation measured in well NMCB-06, installed adjacent to the East Canal, is 1.19 feet above MLLW. This well also exhibited the smallest variability in groundwater elevations (0.2 feet based on 3 measurements) at the site. Because the NMCB Building Expanded Area site is situated adjacent to Sweeper Cove and the East Canal, groundwater fluctuations observed at the site are most likely caused by tidal influence from Sweeper Cove or controlled water levels in the East Canal.

Groundwater flow in the area occupied by the site is typically bi-directional, resulting in a northeast-southwest trending groundwater divide at the site (URSG 1998a). Figure 2-5 presents the inferred groundwater flow, based on depth-to-groundwater measurements collected from monitoring wells in the vicinity of the site on April 1, 2002. Typically, groundwater flow is toward Sweeper Cove. However, flow in the northwestern portion of the site is to the northwest and is largely controlled by the water level in the East Canal.

Because of the proximity of the site to Sweeper Cove, saltwater intrudes into the nearshore groundwater at depth (URSG 2001). Tidally influenced groundwater levels have been observed in monitoring wells located near the shoreline. The tidally-induced variations in groundwater levels are unlikely to result in reversals of the hydraulic gradient across the site, but transient gradient reversals probably occur in the immediate vicinity of the shoreline (URSG 1999a).

The regional aquifer beneath the NMCB Building Expanded Area site is not currently being used as a source of drinking water and is not reasonably expected to be used as a potential future source of drinking water. Although restrictions on the use of groundwater as a drinking water source are in place for the downtown groundwater body on Adak Island, this aquifer could potentially be used as a source of drinking water in the future. However, the potential for saltwater intrusion into a hypothetical water supply well would restrict the development of groundwater in this area as a drinking water source.

The hydraulic gradient in the groundwater aquifer is estimated based on the calculated groundwater elevation values presented in Figure 2-5. The gradient is estimated to be 0.004 foot/foot between wells 02-301 and NMCB-06 (flow toward the East Canal) and 0.002 foot/foot between wells 02-301 and 02-453 (flow toward Sweeper Cove).

2.4 SURFACE WATER HYDROLOGY

Because of the bi-directional groundwater flow in the vicinity, East Canal, South Sweeper Creek, and Sweeper Cove are all considered to be downgradient surface water bodies (DSWBs). Each of these DSWBs is discussed in this section.

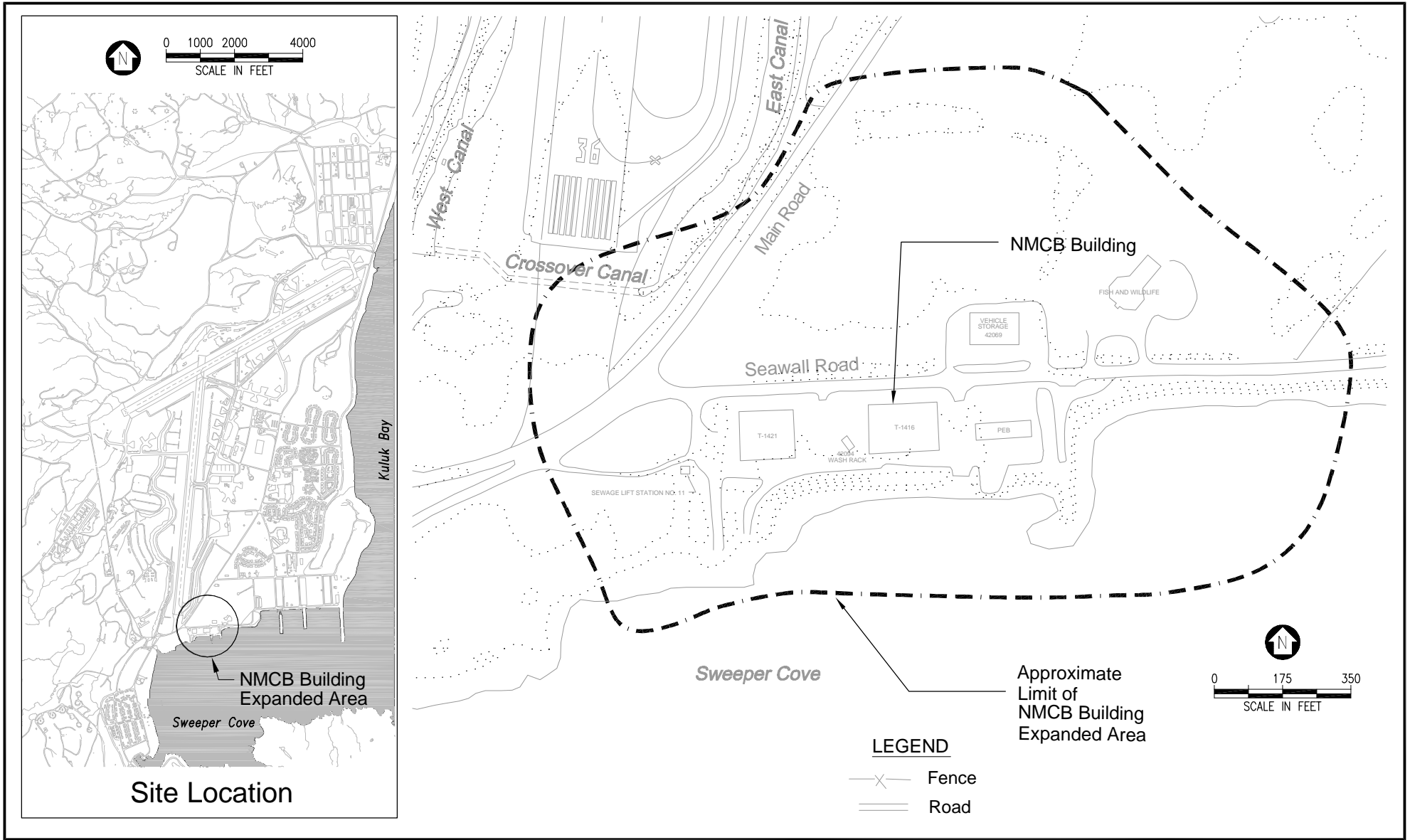
The East Canal of the airport ditch system is a steeply sloped, manmade channel lined with tundra grass. Water in the East Canal flows through the Crossover Canal, which is totally contained in underground culverts, into the West Canal, where it is transferred through turbine pumps into South Sweeper Creek rendering the East Canal an isolated, intrastate, and non-navigable waterway. The canals provide drainage and water level control surrounding Runway 18-36 (Figure 2-3). The Airport ditch system receives surface water and groundwater from a large portion of the downtown area including the entire surface of Runway 18-36. A review of Figure 2-3 shows that there are more than 7,500 linear feet of ditch within the East Canal. The canal receives water along its' entire length through overland flow during rainfall events and through groundwater discharge. Conversely, approximately 300 to 400 feet of the East Canal receives overland flow and groundwater discharge from the NMCB Building Expanded Area site. If we assume overland flow and groundwater flux into the East Canal occurs at a constant rate along its' entire length, then approximately 1/18 of the total volume of water entering the ditch originates from the NMCB Building site. The canals contain fresh water year round. Because the engineered drainage canals of the airport ditch system are isolated from South Sweeper Creek, they are not considered navigable waters of the United States, and therefore do not fall under the jurisdiction of the Clean Water Act. These surface water bodies are considered waters of the State of Alaska and are subject to the Alaska Water Quality Standards (18 AAC 70).

According to EPA ecological risk assessment guidance (USEPA 1998), sound and explicit linkages between measures of effect and assessment endpoints are needed to identify an ecologically sensitive environment. Given that the East Canal functions to collect surface runoff from the airfield and receives surface and groundwater from a large portion of the downtown area on Adak, and given the relatively small portion of water potentially entering the East Canal from the NMCB Building Expanded Area site, establishing a cause-and-effect relationship between groundwater impacts at the NMCB Building site and surface water impacts in the East Canal carries a high degree of uncertainty. This is further confounded by the lack of ecological receptors and habitat of significance in the manmade airport ditch system. For these reasons, only South Sweeper Creek and Sweeper Cove are considered ecological points of exposure for aquatic receptors of petroleum-related chemicals released at the NMCB Building Expanded Area site.

South Sweeper Creek, located approximately 1,400 feet from the NMCB Building (Building T-1416), is considered the closest ecological exposure point for aquatic organisms potentially exposed to petroleum-related chemicals that were released at the site and transported to the East Canal. South Sweeper Creek receives surface water and groundwater from approximately 30 percent of the Sweeper Cove drainage basin, including storm-water runoff collected by the

airport drainage ditch system. The outlet of South Sweeper Creek forms a sandy estuary where it empties into Sweeper Cove. As a result of the cycling tides, saltwater periodically moves beneath the freshwater flow as a wedge along the bottom of the creek. Salinity infiltration occurs in South Sweeper Creek, and has been traced as far north as the mouth of Yakutat Creek, approximately 4,500 feet upstream from Sweeper Cove (URSG 1999a).

Sweeper Cove is a large saltwater inlet off Kuluk Bay. It is a moderately high-energy marine environment with its northern and western shorelines bounding the downtown areas on Adak. The original shorelines were altered significantly by construction during World War II. The shoreline is sandy near the discharge area for South Sweeper Creek, but lined with riprap and boulders along the rest of its northern and western shoreline (URSG 1999a).

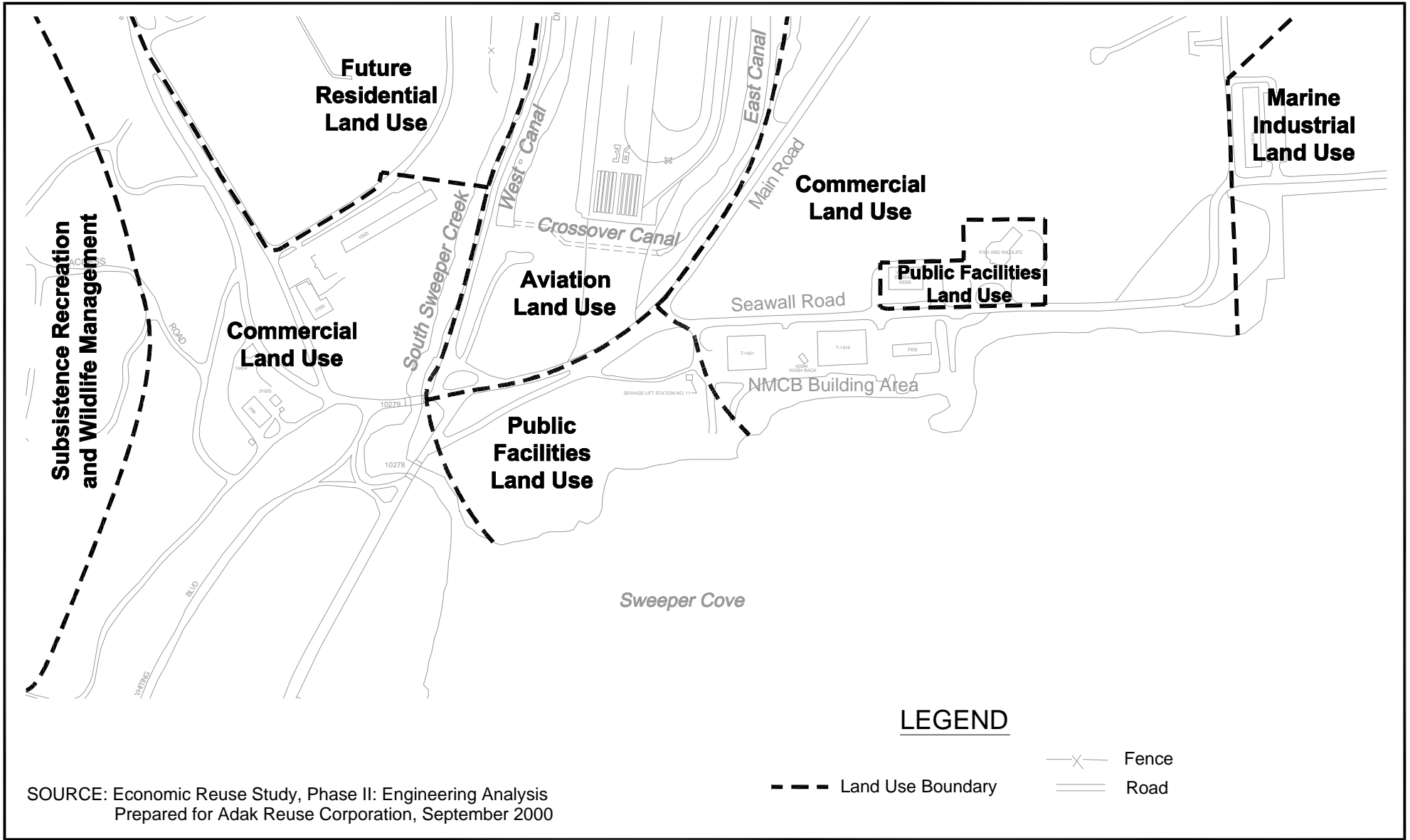


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SCALE: AS SHOWN

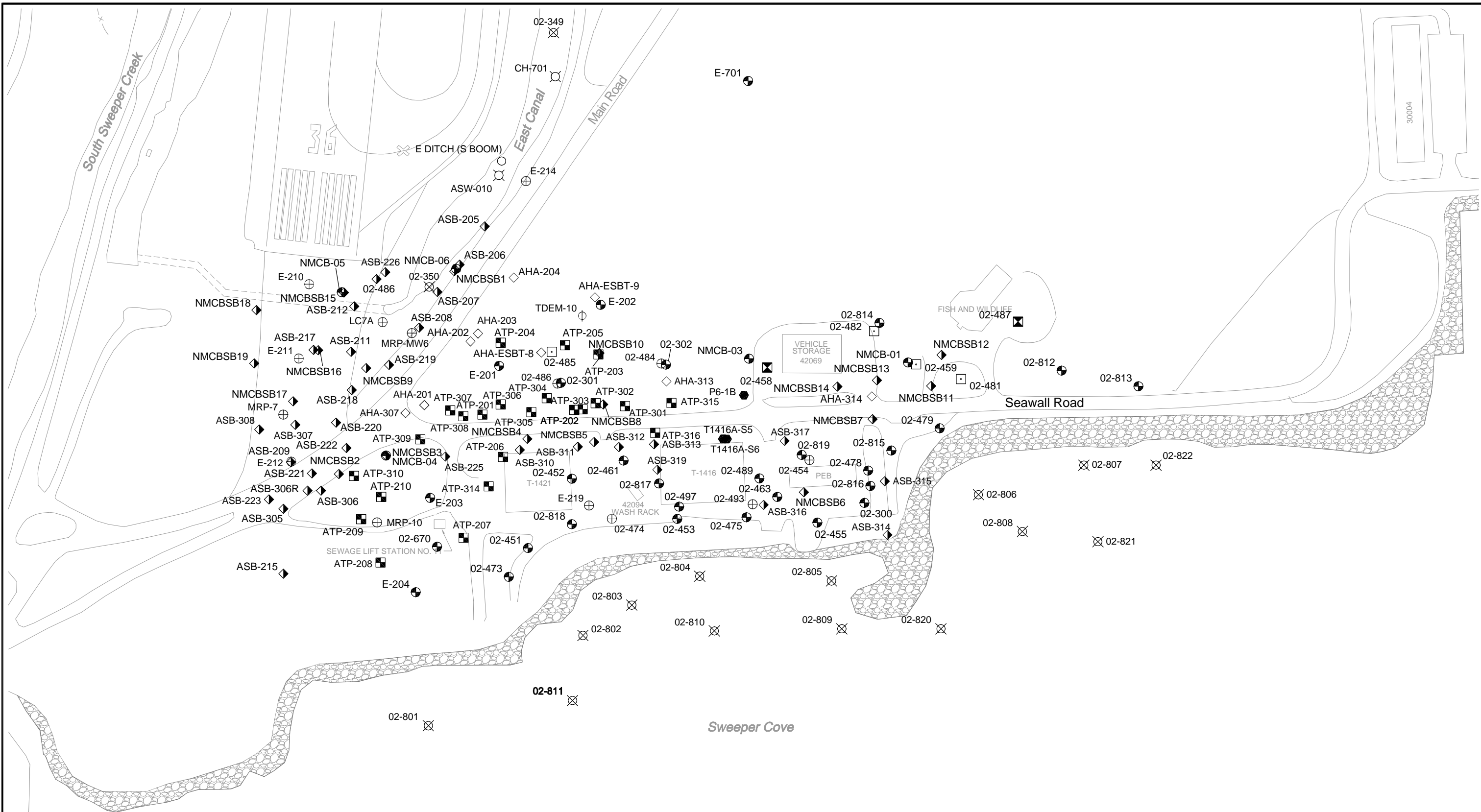
**Figure 2-1
Site Location and Vicinity
NMCB Building T-1416 Expanded Area**

Delivery Order 0037
Adak Island, AK
**FOCUSED FEASIBILITY
STUDY**



<p>U.S. NAVY</p>	<p>SCALE IN FEET</p>	<p align="center">Figure 2-2 Proposed Future Land Use NMCB Building Area, T-1416 Expanded Area</p>	<p align="center">Delivery Order 0037 Adak Island, AK FOCUSED FEASIBILITY STUDY</p>
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LEGEND

- | | |
|--------------------------------------|--------------------------------------|
| ● Monitoring Well | ◇ Hand Augar |
| ⊕ Abandoned/
Lost Monitoring Well | ◆ Bore Hole |
| ⊠ Geoprobe Well | ■ Test Pit |
| □ Geoprobe Boring | ⊗ Sediment and Surface Water Samples |
| ● Ground Surface Sample | ⊗ Surface Water Sample |
| ⊕ Groundwater Grab Sample | ○ Sediment Sample |
| | ▨ Approximate Extent of Riprap |

U.S. NAVY

Delivery Order 0037
 Adak Island, AK
 FOCUSED FEASIBILITY
 STUDY

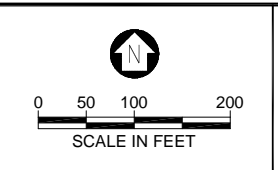


Figure 2-4
Sampling Locations
NMCB Building Area, T-1416 Expanded Area

Table 2-1
Groundwater Elevation Summary,
NMCB Building Area, T-1416 Expanded Area

Monitoring Well	Ground Surface Elevation (feet above MLLW)	Total Depth of Well (feet below ground surface)	Number of Measurements	Minimum Groundwater Elevation (feet above MLLW)	Maximum Groundwater Elevation (feet above MLLW)	Average Groundwater Elevation (feet above MLLW)
02-300	9.91	14	426	-0.41	5.7	2.32
02-301	12.24	16.5	17	0.64	3.92	2.84
02-302	14.76	19.5	15	2.6	4.21	3.27
02-451	8.67	NA	87	1.46	4.26	2.87
02-452	9.36	NA	114	2.08	4.1	2.72
02-453	8.98	NA	111	1.52	6.38	2.88
02-454	10.11	NA	8	2.81	4.21	3.40
02-455	11.09	NA	158	0.78	7.95	2.80
02-458	13.59	NA	11	1.75	5.72	3.65
02-461	9.79	NA	56	0.83	4.06	2.75
02-463	9.81	NA	284	1.32	4.54	2.81
02-473	7.07	NA	59	2.22	5.04	3.56
02-474	8.9	NA	65	0.92	4.49	2.90
02-475	8.68	NA	72	0.13	4.42	2.97
02-478	10.5	NA	114	1.69	4.97	2.85
02-479	13.47	NA	94	1.76	7.33	3.47
02-484	15.07	NA	14	2.61	4.19	3.34
02-486	12.29	NA	12	2.1	3.61	2.96
02-487	18.42	NA	9	2.91	5.61	3.96
02-489	10.06	NA	38	2.08	4.17	3.02
02-493	9.48	NA	6	2.32	2.79	2.54
02-497	9.6	NA	443	-0.44	5.13	2.58
02-670	10.03	16.75	6	2.33	3.33	2.77
02-812	17.04	NA	10	2.37	3.59	3.0
02-813	16.33	NA	7	1.83	3.45	2.71
02-814	17.47	NA	11	3.1	3.82	3.35
02-815	13.26	NA	200	1.07	4.21	2.69
02-816	10.14	NA	44	1.74	6.66	2.80
02-817	9.6	NA	95	2.05	3.75	2.72
02-818	8.89	NA	337	0.93	4.02	2.48
02-819	10.43	NA	47	1.53	4.03	2.93

Table 2-1 (Continued)
Groundwater Elevation Summary,
NMCB Building Area, T-1416 Expanded Area

Monitoring Well	Ground Surface Elevation (feet above MLLW)	Total Depth of Well (feet below ground surface)	Number of Measurements	Minimum Groundwater Elevation (feet above MLLW)	Maximum Groundwater Elevation (feet above MLLW)	Average Groundwater Elevation (feet above MLLW)
E-201	12.68	NA	22	1.96	7.64	2.96
E-202	15.12	NA	20	2.27	4.22	3.0
E-203	10.73	NA	20	2.41	4.19	3.19
E-204	9.35	NA	35	2.31	8.24	3.66
E-210	7.09	NA	8	1.09	2.81	2.06
E-211	8.66	NA	10	1.88	3.48	2.62
E-212	12.56	NA	8	2.44	3.89	3.16
E-214	12.56	NA	5	1.77	2.08	1.97
E-701	18.89	NA	18	2.56	5.21	3.47
LC7A	7.68	10	13	1.78	3.39	2.59
MRP-6	10.16	19	14	1.84	6.15	2.83
MRP-7	10.53	17	13	0.48	3.63	2.57
MRP-10	10.2	16	16	2.56	4.23	3.30
NMCB-01	17.5	20.4	3	3.07	3.29	3.19
NMCB-03	12.7	15.1	3	2.88	3.17	3.07
NMCB-04	10.5	15.5	3	2.31	2.72	2.51
NMCB-05	6.4	12	3	1.31	1.69	1.50
NMCB-06	11.1	15.5	3	1.19	1.38	1.28