PRELIMINARY ASSESSMENT REPORT

NAS Seattle (Sand Point)
King County, Washington

DERP-FUDS NO. F10WA0031

Prepared for

U.S. Army Corps of Engineers – Seattle District
Environmental Management Branch

September 2016

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4735 East Marginal Way South
Seattle, Washington 98134-2385

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Executive Summary

The U.S. Army Corps of Engineers has completed a preliminary assessment (PA) of the former Naval Air Station (NAS) Seattle (Sand Point). The objectives of a PA conducted within the Defense Environmental Restoration Program-Formerly Used Defense Sites (DERP-FUDS) are to: 1) eliminate from further consideration those eligible properties, or areas of an eligible property, that pose little or no threat to human health or the environment; 2) determine if there is any potential need for removal actions; 3) set priorities for site inspections at eligible FUDS projects; and 4) gather data useable for any future U.S. Environmental Protection Agency (EPA) Hazard Ranking System (HRS) evaluation. PAs also evaluate former DoD structures and determine if they are inherently hazardous and present a clear and present danger. An assessment is also conducted of the potential presence of military munitions.

The former NAS Seattle property is located in Seattle, Washington, along the western shoreline of Lake Washington. The former NAS comprised approximately 536 acres, including five noncontiguous parcels encompassing approximately 26 acres. The former installation is currently surrounded on its non-lake sides by residential areas. NAS Seattle has existed in various capacities since the early 1920s. By the end of 1975 approximately 340 acres had been surplused and transferred to non-DoD entities. This acreage encompasses the DERP-FUDS eligible property. Remaining acreage was eventually conveyed under Base Realignment and Closure authorities after the remaining base was closed in 1995. Property has been transferred to a number of entities, including the City of Seattle, National Oceanic Administration Agency, and the University of Washington.

Activities conducted at NAS Seattle included: aircraft repair/overhauls; aircraft engine overhauls; fueling; torpedo maintenance/modification/repair; bomb sight maintenance; outfitting of escort carriers; armed aircraft training missions (ceased in 1941); and, munitions storage. Significant property improvements across the entire installation included: underground and above ground fuel storage tanks of combined capacity of at least . 175,000 gallons; 7,275 feet (ft) of underground aviation gas (avgas) distribution pipeline; multiple hangar facilities; electrical transformers, two boiler plants; machine gun and small arms ranges; torpedo shop, dry cleaner, seven magazines; 8 runways of up to 3,700 ft in length; wastewater treatment plant; trap and skeet ranges; barracks; and more than 65 buildings to support operations. At peak operations during WWII, nearly 8,000 combined military and civilian personnel were either stationed or worked at NAS Seattle.

The PA identifies the following areas of the former NAS Seattle property as potentially having environmental contamination at levels warranting further assessment:

- Waste Oil Burn Pits (DERP-FUDS eligible). Located along the eastern Lake Washington shoreline. Initial sampling identified volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), and metals.

- Garbage Pits (DERP-FUDS eligible). Located along the Lake Washington shoreline. Items disposed are unknown. Contaminants of potential concern (COPCs) include metals, VOCs, and SVOCs.
- Former Incinerator (DERP-FUDS eligible). Located along the Lake Washington shoreline. Undocumented waste management practices. COPCs include metals.
- Machine Gun and Small Arms Ranges (DERP-FUDS eligible). Located on the southernmost portion of the installation; lead is the COPC. This area is part of Magnuson Park and adjoins a residential area.
- Hangars Nos. 1, 32, and 33 (DERP-FUDS eligible). Activities conducted in these hangars would have been consistent with depot level maintenance. No previous environmental sampling is indicated to have been conducted. COPCs include VOCs, SVOCs, and avgas fuel constituents.
- Transformer House (Bldg 226) (DERP-FUDS eligible) . It is unknown how suspect polychlorinated biphenyls (PCB) transformers were managed at his location.
- Water Tower (Disposal Parcel No. 28) (DERP-FUDS eligible). Painting operations conducted on the water tower is expected to have contributed lead bearing paint to surface soils proximate to the water tower.
- Boiler Plant and Coal Storage (Bldg 186) (DERP-FUDS ineligible). Located in the southwestern portion of the installation; potential leaching of metals to soil. COPCs include metals.
- Stormwater Discharge Points and Lake Washington Sediments (located on both DERP-FUDS eligible and ineligible acreage). Bioassay sampling conducted in 1995 identified three locations where Washington Department of Ecology (Ecology) sediment management standards were exceeded.
- Assembly and Repair Shop (Bldg 2) and Hangar 30 (DERP-FUDS ineligible). Ecology has required long term groundwater monitoring of metals.
- Wastewater Treatment Plant (Bldgs 110 thru 113) (DERP-FUDS ineligible). Potential for mercury to have been released through either normal operations or the demolition of the plant by improper management of the trickling filter mercury seal.
- Laundry Facility (Bldg 137) (DERP-FUDS ineligible). The former Laundry is located west and adjacent to Bldg 5. Stoddard Solvent is present at a depth of 12 ft below grade. Additional dry cleaning agents potentially used include carbon tetrachloride, perchloroethylene and trichloroethene (TCE). Ecology has required implementation of land use controls for subsurface soil beneath the laundry facility's slab foundation.
- Service Bay (Bldg 345) (DERP-FUDS ineligible). Located adjacent to the Auto Hobby Shop (Bldg 310); is reported to have petroleum contaminated soil beneath the building. Ecology requires that upon building removal, sampling is to be conducted and

contaminated soil removed if indicated to be a threat to the environment or to human health.

An assessment was also conducted of the likelihood that human exposures to potentially released contaminants could occur through the groundwater, surface water, and soil exposure pathways. The assessment concluded the following:

- Groundwater Pathway. Exposure to contaminated groundwater via domestic wells is assessed as not being a possible route of exposure due to there being no documented domestic groundwater wells providing potable water within a 4-mile radius of the NAS Seattle property. Additionally, groundwater flow is towards Lake Washington, away from the adjacent residential population.
- Surface Water Pathway. Surface soil contamination subject to being conveyed to Lake Washington via overland flow is assessed as not present, except for the possibility of lead impacted soil potentially located in the vicinity of the former machine gun and small arms ranges. Direct discharge of contaminated groundwater to Lake Washington may have occurred and/or may be occurring as the property is located adjacent to the lake and groundwater gradients result in shallow groundwater being discharged into the lake. Additionally, Lake Washington has been directly impacted from both skeet/trap range use directed over the lake and the fuel transfer operations that occurred at Pier 1.
- Soil Pathway. A recreational user of Magnuson Park can be exposed to surface and/or near surface soils potentially containing elevated lead concentrations in the areas of the former machine gun and small arms ranges, and the former water reservoir tower. The former coal storage yard presents the possibility of elevated surface soil metal concentrations resulting from metals leaching from either stockpiled coal and/or fly ash. Other soil contamination either known or suspected to exist is described as below grade and inaccessible; however, a construction worker performing subsurface work could potentially encounter subsurface contamination along the avgas distribution pipeline and near locations where former NAS operations may have released Comprehensive, Environmental Response, Compensation, and Liability Act hazardous substances.
- Air Exposure Pathway. Inhalation exposures to VOCs may occur via vapor intrusion (VI) into occupied buildings. Subsurface VOC contamination is potentially present due to past releases of avgas and dry cleaning agents. Although solvents were likely used for degreasing and parts cleaning, Navy performed environmental studies have not reported the presence of such solvents in monitored groundwater. Regarding VI exposures resulting from avgas releases, published literature suggests that such VI exposures is a relatively rare occurrence.

Acknowledgements

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1.0 Introduction

Under the authority of the Defense Environmental Restoration Program (DERP) (10 USC §§ 2701 et seq.), and its policies and procedures relating to Formerly Used Defense Sites (DERP-FUDS), including United States Department of Defense (DoD) Management Guidance for the DERP dated September 28, 2001, and Engineering Regulation 200-3-1, Environmental Quality, FUDS Program Policy (USACE, 2004), the U.S. Army Corps of Engineers (USACE), by using Kansas City District personnel and the contractor Herrera Environmental Consultants (Herrera), has completed a Preliminary Assessment (PA) of the property upon which the former Naval Air Station (NAS) Seattle is located in King County, Washington, within the borders of the City of Seattle.

The objectives of a PA conducted within the DERP-FUDS program are to: 1) eliminate from further consideration those eligible properties, or areas of an eligible property, that pose little or no threat to human health or the environment; 2) determine if there is any potential need for removal actions; 3) set priorities for site inspections at eligible FUDS projects; and 4) gather data useable for any future U.S. environmental Protection Agency (EPA) Hazard Ranking System (HRS) evaluation. PAs also evaluate former DoD structures and determine if they possess any of the following qualities: inherently hazardous and present a clear and present danger; likely to cause, or having already caused, death or serious injury to a person exercising ordinary and reasonable care. The likelihood of military munitions being present is also assessed by the PA.

This PA addresses the property-wide NAS Seattle FUDS, including both DERP-FUDS eligible and ineligible parcels. A FUDS property is defined as a facility or site that was under the jurisdiction of the Secretary of Defense and owned by, leased to, or otherwise possessed by the United States at the time of actions leading to contamination by hazardous substances. A property that is eligible for inclusion into the DERP is one that was transferred from DoD control prior to 17 October 1986.

Tasks conducted in support of this PA include interviews, researching historical records, collecting receptor information within the property's potential range of influence, and determining general physical characteristics of the property. The USACE Seattle District contractor, Herrera, conducted the site visit, interviews, historical records research, and development of the initial Draft PA. The USACE Kansas City District completed the PA using much of the initial information obtained by Herrera.

2.0 Previous Investigations

The following USACE investigations/studies have been conducted:

- *Findings and Determination of Eligibility Magnuson Park (Sand Point Naval Air Station), Seattle, Washington, Project No. F10WA003100, February 28, 1990*. The USACE, Seattle District, completed the findings and determination of eligibility (FDE) for that portion of the former NAS Seattle property used as Magnuson Park. The FDE's findings are:

    - Sand Point Naval Air Station encompassed 518.28 acres; 195.60 acres were conveyed to the city of Seattle (for use as Magnuson Park) through a quitclaim deed dated 19 December 1975; prior to 1975, 170.92 acres (to be addressed in a separate report) were conveyed to several recipients including the National Oceanic and Atmospheric Administration; and, Navy retained 151.76 acres for continued use (USACE, 1990).

    - The FDE went beyond its scope and also identified as findings of fact that three subterranean munitions storage bunkers and an aboveground pyrotechnic magazine remained on the property deeded to Seattle, and concluded that they do not constitute a hazard to park visitors or staff, and that there is no evidence of unsafe structures or debris, hazardous or toxic waste or unexploded ordnance resulting from DoD use of the site. The FDE states "…[the site] to have been formerly used by the Navy. However, there is no evidence of unsafe conditions resulting from Navy use of the site. Therefore it is determined that an environmental restoration project is not an appropriate undertaking within the Defense Environmental Restoration Program" (USACE, 1990).

- *Memorandum, Subject: Sand Point Naval Air Station (NAS) – Magnuson Park, (F10WA0031) – Change in Eligible Acreage, 18 June 2015.* The USACE, Kansas City District, authored the subject memorandum to correct discrepancies in the original FDE dated 28 February 1990. This memorandum describes 339.889 acres as DERP-FUDS eligible and 196.8982 acres as DERP-FUDS ineligible. The June 2015 memorandum is provided in Appendix G.1.

The City of Seattle has conducted the following investigations/reports:

- *Sand Point Magnuson Park Drainage, Wetland/Habitat Complex and ports Fields/Courts Project - Final Environmental Impact Statement, Seattle Department of Parks & Recreation, July 2002.*

- *Sand Point Magnuson Park Drainage, Wetland/Habitat Complex and ports Fields/Courts Project - Final Supplemental Environmental Impact Statement, Seattle Department of Parks & Recreation, May 2003*.

- *Environmental Sampling Report Magnuson Park, Seattle, Washington, HWA Project No. 2004-119-22, April 2005*. The city, during a shoreline restoration project located north of the Magnuson Park swimming beach, discovered an area of soil petroleum hydrocarbon contamination. Sampling and analysis reported concentrations of petroleum hydrocarbons, polynuclear aromatic hydrocarbons, and heavy metals. Concentrations of benzene, methyl tertiary butyl ether (MTBE), gasoline, and lubricating oil exceeded the Washington Model Toxics Control Act (MTCA) cleanup levels for unrestricted land use. Excerpts of the report and tabulated data are provided in Appendix G.2.

- *Environmental Assessment Technical Memorandum, Magnuson Park Shoreline Renovation, September 2005*. This technical memorandum is a follow-up to the city's April 2005 report and provides the results of additional sampling. The former locations of an incinerator, oil burn areas, and garbage disposal pits are also identified in this report. Appendix G.3 provides the excerpted report figure depicting these areas.

During the 1970s, the Navy conveyed approximately 367 acres as surplus. The retained property, subsequently excessed under Base Realignment and Closure Act (BRAC), is depicted on Figure 3-5. The Navy conducted a number of investigations on the retained property and the following are referenced in the Navy's *Environmental Baseline Survey, Naval Station Puget Sound (NAVSTA PS), Seattle*, revision date of 1 March 1996:

- *Preliminary Assessment Report Naval Station Puget Sound NEESA, March 1988*. The Navy Energy and Environmental Support Activity conducted the PA which provided a broad overview of the environmental status of Naval Station Puget Sound (NAVSTA PS, 1988).

- *Site Inspection Study Site 1 – Former Gasoline Storage Area*, Hart Crowser, *15 May 1991*. This investigation assessed conditions in a former automobile gasoline (mogas) storage area located near Building 98 (two underground storage tanks). Total petroleum hydrocarbons (TPH) were detected in a subsurface soil sample at an elevated concentration. Contaminated soil was subsequently excavated (US Navy, 1996).

- *Preliminary Assessment PSNS-NAVSTA Puget Sound, Sand Point, URS, 10 Oct 1991*.

- *Site Inspection Report NAVSTA PS Seattle, URS, 7 Oct 1993*. The SI addressed areas of concern identified in two previous PAs. Areas addressed include polychlorinated biphenyls (PCB) transformer locations (33 identified), dry cleaning facility (Bldg 137), hangar (Bldg 2), pesticide tank (Bldg 206), vehicle maintenance and garage (Bldg 67), aviation gas (avgas) storage and distribution network, auto hobby shop (Bldg 310), and underground storage tanks (17 identified). It is noted that this report was supplemented with an addendum that is also dated 1993. The results of this investigation are summarized in the Environmental Baseline Survey (EBS) report, dated March 1996.

- *Draft Technical Memorandum Environmental Gasoline Survey for Transfer Avgas Lines and 100,000-Gallon Underground Storage Tank*, URS, *21 Oct 1993*. The avgas line had a total length of 7,275 feet (ft) of which 5,340 ft was on then current Navy property. The pipeline had been abandoned "by the early 1960s and was cleaned by the Navy in 1995". Soil samples were collected at discrete locations along the pipeline and analyzed for TPH and lead. Field screening results indicate that TPH is present along most of the avgas lines west of Bldg 27 (US Navy, 1996).

- *Technical Memorandum Sampling Results for the Avgas Line and 100,000-Gallon Underground Storage Tank,* URS, 13 Jan 1994. Soil in vicinity of the 100,000-gallon underground storage tank (UST) associated with the former boiler plant (Bldg 12) was sampled; results indicated that soil around the UST was not impacted by petroleum hydrocarbons. Soil and groundwater located beneath the UST was also sampled; no petroleum hydrocarbons were detected. The UST was closed in-place in 1995 (US Navy, 1996).

- *Draft Technical Memorandum Sampling Results for the Avgas Line and Auto Hobby Shop Excavation, URS, 5 Apr 1994.* Field screening results indicated that TPH is present along most of the avgas lines west of Bldg 27. Elevated concentrations of TPH were detected at the former tank farm which resulted in the excavation and disposal of 3,800 cubic yards (cy) of contaminated soil (Navy, 1996).

- *Draft Technical Memorandum Summer 1994 Sampling Results, Buildings 2, 30, and 137, Avgas Tank Farm, Asphalt Roofs, Ballfield*, URS, 24 Oct 1994. Soil sampled from beneath Bldg 2 acid tanks is reported to have had metal concentrations exceeding MTCA B levels. Bldg 30 is reported as not having had a release to the environment. Bldg 137, the former dry cleaning facility, was reported as having petroleum hydrocarbons (drycleaning agents) exceed MTCA A cleanup levels in soils at one location where an underground storage tank was formerly located that had been used for drycleaning solvents. Two roofing samples were reported to contain PCBs.

- *Base Realignment and Closure (BRAC) Cleanup Plan*, URS*, 13 Jan 1995.*

- *Underground Storage Tank Closure Report for 2,000-Gallon Gasoline UST at Steam Plant, URS, 9 May 1995.* Reports upon the in-place closure of UST tank no. 12D located at the steam plant. The closure occurred in January 1995.

- *Underground Storage Tank Closure Report for 100,000-Gallon Fuel Oil UST, URS, 9 May 1995*. Reports upon the 1994 closure of the UST that had been associated with the boiler plant (Bldg 12).

- *Interim Remedial Action Report for the Former Avgas Tank Farm, URS, 9 May 1995*. Reports upon the excavation of contaminated soils at the former avgas tank farm.

- *Draft Technical Memorandum Sampling Results From the Groundwater and Soil Monitoring, URS, 7 Sep 1995*. Groundwater sample results in vicinity to Bldg 137 (dry cleaning facility) identified no petroleum hydrocarbons exceeding Washington State Department of Ecology (Ecology) MTCA cleanup levels.

- *Final Environmental Baseline Survey (EBS), Naval Station Puget Sound (NAVSTA PS), Seattle CTO 0104, Revision Date: March 1, 1996.* The baseline survey identified the following:

    - lead based paint present in 18 of 19 buildings surveyed;

    - asbestos present in 73 non-housing buildings surveyed (friable asbestos in 12 of the buildings had been abated);

    - PCBs present in some roofing materials but no abatement required;

    - dry-cleaning petroleum hydrocarbon soil concentrations exceeding MTCA A cleanup levels near Bldg 137 (former dry cleaner); however, no hydrocarbons were detected in nearby groundwater monitoring wells;

    - Bldg 2 has metals exceeding MTCA B cleanup levels beneath its floor slab;

    - avgas tank farm groundwater monitoring indicate diesel slightly exceeding MTCA A cleanup levels; and,

    - the Sand Point shoreline, located near the National Oceanic and Atmospheric Administration (NOAA) campus, will be restricted to current uses.

Navy investigations conducted after the 1996 EBS include:

- *Final Site Characterization and Removal Action Report for Response Action for Contaminated Soils at Former Sand Point Naval Station Source Areas 1 and 2 Seattle Washington, October 2009*. In July and August 2009, 4,059 tons of contaminated soil was removed from the vicinity of Hangar No. 193 located on the southeastern portion of the property, which had been conveyed to the city after NAVSTA PS was closed in 1995. Contaminated soil contained TPH as diesel range organics (DRO), TPH as heavy oils, and metals at concentrations exceeding MTCA cleanup levels. Soil removal extended from the FUDs ineligible portion of NAS Seattle onto the eligible portion (site location map is provided in Appendix G.4).

- *Final Radiological Remedial Investigation Report*, May 2011. Summarizes the radiological remedial investigation conducted during 2010. Radiological contamination requiring cleanup was identified at the following locations: in and around the instrument shops in Bldg 2; within the south shed of Bldg 27; within piping associated with Bldgs 2 and 27; in the catch basins associated with Bldg 27; and in soil adjacent to Bldgs 2, 12, and 27.

- *Final Action Memorandum Time-Critical Removal Action (TCRA)*, 24 May 2013. The TCRA provides for the cleanup of radiological contamination consisting of radium-266, cesium-137, and/or strontium-90 located at Building 27 (South Shed), Building 2, and areas outside of Buildings 2, 12, and 27.

Weekly reports for the radioactive contamination cleanup conducted in accordance with the TCRA. Reports are available at:

http://www.navfac.navy.mil/navfac_worldwide/atlantic/fecs/northwest/about_us/northwest_documents.html.

3.0 Property Description, Acreage, and Land Use

3.1 Location

The former NAS Seattle property is located in Seattle, Washington, along the western shoreline of Lake Washington, in portions of Sections 2, 3, 10, and 11, Township 25 North, Range 4 East, of the Willamette Meridian. The former NAS comprised a total of 536.7872 acres, including contiguous parcels on a peninsula on the western shore of Lake Washington known as Sand Point and five noncontiguous parcels located to the north, west and southwest of the contiguous property. The property is located at Latitude 47° 40’ 52.92”, Longitude of -122° 14’ 59.7732 and is in EPA Region 10 and Washington State Congressional District 7 (National Atlas, 2008). Figure 3-1 depicts the property location.

3.2 FUDS Eligible Property

A FUDS eligible property is defined by FUDS program policy, Engineering Regulation 200-3-1, May 2004, as a property (or portion thereof) that was under the jurisdiction of the Secretary of Defense and owned by, leased to, or otherwise possessed by the United States at the time of actions leading to contamination by hazardous substances which has been transferred from DoD jurisdictional control prior to 17 October 1986. A FUDS eligible property may receive DERP funding for projects addressing environmental, military munitions, aboveground and/or underground storage tank closures/cleanups, and hazards related to former DoD structures (USACE, 2004).

The FUDS eligible portion of the NAS Seattle property is defined as being a total of 339.889 acres by the CENWK memorandum “Sand Point Naval Air Station (NAS) – Magnuson Park, (F10WA0031) – Change in eligible Acreage”, dated 18 June 2015 (Appendix G.4). The remaining 196.8982 acres is FUDS ineligible (CENWK, 2015). The approximate 300 acres encompassing runways, tarmac and three hangars were transferred from DoD ownership in 1974 and 1975 (the noncontiguous parcels were transferred earlier); the remaining acreage encompassing hangars, support facilities, and housing were transferred in 1998 and 1999. Figures 3-2 through 3-4 depict the DERP-FUDS eligible portions of the property and Figure 3-5 depicts the property which the Navy owned after 1977.

3.3 Land Use and Ownership History

<u>Pre-DOD Ownership</u>

Prior to 1855, Sand Point Peninsula had likely been inhabited by Native Americans. The “hloo-weelth-AHBSH” peoples inhabited three longhouses along Wolf Bay, immediately south of Sand Point. In 1855 the U.S. Government Land Office surveyed Sand Point and Euro-American settlement of the peninsula is reported to have commenced in 1868 by the homesteading of 81 acres by William Goldmyer. Commercial development occurred in the northwestern part of the peninsula in 1914 when the Pontiac Brick and Tile Company, a shipyard, and the Pontiac Post Office were established. The Pontiac Brick and Tile Company is reported to have closed in 1914.

Between 1910 and the early 1920's, four families resided in the northwest portion of Sand Point (University of Washington[1]).

In the late 1910s to early 1920s, King County commissioners began acquiring property on the Sand Point peninsula with the intent of creating an airport. Historical accounts of Sand Point land use indicate that King County property purchases were based upon the Navy having an interest in establishing a Navy station at Sand Point[2]. In either 1917 or 1918 property owner Morgan Carkeek donated a reported 25 acres (located in the current northwestern part of Manguson Park) to the City of Seattle for park use. This acreage remained as a park until 1926[3].

DOD Ownership

A groundbreaking ceremony for the creation of an airport is reported to have been held on 19 June 1920 by local and Navy officials. On January 1921, a Congressional report stated that Sand Point was the best choice as a Navy base for heavier-than-air equipment. The Navy is reported as having accepted on 13 July 1922 a 268 acre 10-year lease at $1 per year from King County[2]. Army Reserve Officer Training Corps cadets from the University of Washington were training at the airfield by 1922 (Grant, et. al., 1996). In 1923 the U.S. Army is reported to have acquired a sublease from the Navy and erected a sheet iron hanger (identified then as Building 1, see Figure 3-6). The base complement at this time is reported to have been the University of Washington Army ROTC Jenny airplane and six Navy Reserve airplanes[2].

Congress, on 4 March 1925, enacted legislation which authorized the Secretary of the Navy to accept lands as a site for a Naval air station at Sand Point. The Chief of Naval Operations formally established a Naval Air Reserve squadron at Sand Point on 11 May 1925. King County formally conveyed title of approximately 411 acres of Sand Point Peninsula property to the Secretary of the U.S. Navy for development of a Naval Air Station (Seattle, 2008). In 1926, Sand Point had a dirt runway and the station commander worked out of a farm house along with the assistance of three reserve officers and aviation cadets were billeted in a chicken house. Through the 1920s it is reported that the facility's principal mission was to train reservists. Aerial mapping of Alaska and Washington was conducted by some of Sand Point's reservists. Most aircraft operations were by amphibious and float plains as the dirt runway was often unusable. By 1931 the full-time complement is reported to have been 31 Marines and eight Naval personnel who operated 14 airplanes[2].

Many of the station's major buildings were built in the late 1930s prior to World War II. In 1939, five active Navy patrol squadrons, each with six multi-engined flying boats capable of long-range reconnaissance and attack, were assigned to the base. More than 600 sailors were stationed at Sand Point. Construction initiated in July 1940 included additional gasoline storage, barracks, storehouses, and an assembly and repair shop. By June 1941, NAS Seattle had four-month aviation service schools which were training future radiomen, aviation metal smiths, and machinists. Additional acreage acquired during 1941-42 brought total NAS Seattle acreage to

[1] http://courses.washington.edu/fm328/Fieldtrip Material/Peninsulahistory_PublicComps.pdf
[2] http://www.historylink.org/index.cfm?DisplayPage=output.cfm&file_id=2249
[3] http://www.seattle.gov/parks/magnuson/timeline/euro-settlement.htm

approximately 540 acres. Runways were also paved during this time. The installation served as a Naval Air Reserve Training facility until December 7, 1941, at which time it became a naval air station (Grant, et. al., 1996).

During World War II, NAS Seattle supported air transport and ship outfitting personnel for the Alaskan and Western Pacific theaters of operation. Transport squadron personnel operated cargo flights to Alaska and the Aleutian Islands, supplying air stations such a Sitka, Kodiak, Dutch Harbor, Adak, and Attu. Outfitting personnel handled the preparation of escort carriers and seaplane tenders built in Tacoma and Vancouver, Washington, prior to departure for fleet duty. One hundred and fifty shops at the NAS Seattle provided repair and overhaul services for fleet aircraft[4]. The station also hosted several headquarters functions including a weather center, a communications center, and an overseas terminal for the Naval Air Transport Service. In 1945, at the peak of its activities, the facility is reported to have supported between 7,000 and 8,000 Navy/Marine Corps and civilian personnel[4,5].

After WWII, by June 1946 the combined military and civilian staff decreased to about 3,000. Repair and overhaul of aircraft continued through the 1940s. With the onset of the Korean conflict, NAS Seattle implemented 6-day work weeks to support the overhauling and modifying of aircraft; the training of reservists; support operations at Whidbey Island; and, supplying the fleet. In 1953 when the Korean conflict ended, NAS Seattle ceased being responsible for aircraft overhaul and the station reverted back to being a Naval Reserve training base. The number of civilian employees is reported to have also dropped from 1,800 to 200[4].

From 1945 to 1970, the station maintained Naval Reserve squadrons for supplementing active duty forces, both in the continental United States and abroad. Aviation activities officially ceased on June 30 1970, and NAS Seattle was decommissioned. On July 1, 1970, NAS Seattle was redesignated Naval Support Activity, Seattle. Three years later, the Navy surplused much of the property (approximately 314 acres). The remainder of the base, which included most of the significant buildings and support structures, was retained by the Navy. From 1970 until April 1982, the base provided logistic services to the 13th Naval District, U.S. Department of Defense, and other federal agencies (Grant, et. al., 1996).

In April 1982, Naval Support Activity, Seattle, was redesignated Naval Station, Seattle, and on October 10, 1986, was redesignated Naval Station Puget Sound, Seattle (Sand Point). Until September 1995, the base functioned as a support and billeting facility for the Northern Pacific Fleet. Sand Point was partially closed and realigned under the Base Closure and Realignment Act of 1988 and then the entire facility was closed in September 1995 under the Defense Base Closure and Realignment Act of 1990 (Navy, 1996). The remaining acreage was eventually transferred to the City of Seattle (additional park acreage), the University of Washington (housing), and the U.S. Department of the Interior (existing Western Fisheries Research Center) (Herrera, 2009).

[4] http://www.historylink.org/index.cfm?DisplayPage=output.cfm&file_id=2249
[5] http://www.sandptnavsta.org/_NASHeritageAward/Historical-Support.php

Post-DOD Ownership

Of the property declared surplus in 1973, NOAA received 100 acres which included one-third of the runways and 3,500-ft of waterfront property; the City of Seattle received approximately 198 acres comprising the southeast portion of the base, including approximately 1 mile of waterfront property. The city property became Magnuson Park in 1977. Property conveyed under BRAC authorities are now owned by the City of Seattle, University of Washington, Department of Interior, and a number of private entities (USACE, 2015).

The Magnuson Park property is currently divided between three institutions. The City of Seattle (Seattle Parks) owns the majority of land and buildings within the park and rents office and other spaces to a variety of not-for-profit civic, arts, environmental, athletic and recreational organizations. The University of Washington owns land and five buildings which provide temporary storage for Suzzallo Library books, medical records storage for the University of Washington Medical Center, and studios for students in the College of Architecture and Urban Planning. Solid Ground manages low-income and transitional homeless housing in six buildings. Adjacent to the Park on former Navy property is the NOAA campus. The Department of Interior (Headquarters for the Western Fisheries Research Center, 6505 NE 65th Street, Seattle Washington 98115) owns property located on the southern portion of the former contiguous installation. Figure 3-7 depicts current Manguson Park land usage.

Non-contiguous former NAS Seattle property consists of: the former RACON site (Disposal Item No. 25) now occupied by Moorland Park and Moorland’s Elementary School (Figure 3-8); the former Low Frequency Navigational Aid (Disposal Item No. 26) now developed as a residential area (Figure 3-9); the former transmitter site (Disposal Item No. 27) now occupied by the Burke-Gilman Playground Park and by a Ronald McDonald House (Figure 3-10); the former water tower (Disposal Item No. 28) appears to generally be vacant land except for a structure centrally located and is surrounded by residences (Figure 3-11); a former warehouse (Disposal Item No. 30) now owned by General Services Administration (GSA) and occupied by the National Archives and Records Administration (NARA) along with property formerly associated with the warehouse (Figure 3-12); and the former Shearwater Housing tracts (Disposal Item No. 40) is now occupied by the Thornton Creek School (Figure3-13).

A total of seven buildings remain on eligible portions of the property. The only DoD buildings remaining on the NOAA property are two hangars; both in good condition and remain in use by NOAA. Four magazines remain on the eligible portion of park property owned by the City of Seattle. On a parcel west of Sand Point Way, a large DoD warehouse building is occupied by the NARA, under ownership of the General Services Administration (GSA). The State register lists one site of historical significance (Round the World Flight Site) located on DERP-FUDS ineligible property which had been conveyed under BRAC (DAHP, 2008).

3.4 Adjacent Land Use

The approximate western boundary of the contiguous NAS Seattle property is the street ‘Sand Point Way’, also referred to as State Highway 513. Adjacent property is predominantly urban.

The 2010 Census Tracts encompassing an approximate mile and a half radius centered from the property (census tracts 002200, 002400, 003900, 004000, 004100, and 004200) reports a total population of 31,899. Census tract data is provided in Appendix G.5. Herrera reports in their draft PA that 382,596 people reside within a 4 mile radius of the property (Figure 3-14) (2000 census data).

A number of child day care facilities and schools are located within an approximate 2 mile radius of the property. The closest school is Sand Point Elementary School which is located within a half mile of the property; the closest day care, Little Anchor Child Care, is adjacent to the property. Table 3-1 lists the identified day care facilities and schools along with their respective address. Figures (Google Maps) depicting the location of day care facilities, elementary and high schools are provided in Figures 8-4 through 8-6 of Section 8.0.

Future land use of both the former NAS Seattle property and adjacent properties appear to be stable. The city of Seattle has made a long term investment in Magnuson Park. There is no indication that adjacent land use is likely to change from being residential.

3.4.1 Physical Property Characteristics

The former NAS Seattle property is located approximately 6 miles northeast from downtown Seattle on the western shore of Lake Washington. The lake is the significant natural resource located near the property and provides opportunities for outdoor recreation as well as a variety of habitats for animals and plants. Lake Washington is a fresh water lake and is categorized as Class AA under the Washington water quality standards (WAC 173-3021A-120) (Seattle, 2002).

3.4.2 Topography and Hydrology

The original topography was primarily undulating forested land, with low knolls reaching up to about 50 ft above the elevation of the lake, and some lower lying marsh lands in some locations. When the Sand Point peninsula was developed into the navy installation, most of the peninsula was filled, graded, and paved. This has resulted in highly compacted soils and a relatively flat site. The lack of significant slope across the site promotes winter ponding in minor depressions, and the unplanned establishment of wetland-like conditions in some areas that impound water or sustain long periods of saturated conditions (Seattle, 2002).

The property drains gradually, with an average slope of less than 1 percent, from west to east towards Lake Washington. Surface elevations range from approximately 90-ft near the NE 65th entrance to Magnuson Park, to approximately 20-ft (referenced to the North American Vertical Datum of 1988) at the shoreline along Lake Washington[6]. The hillside area of Promontory Point, located on the property, reaches elevations greater than 100-ft. Off-site terrain rises considerably on the west of Sand Point Way, reaching an elevation of nearly 400-ft on top of View Ridge (Seattle, 2003).

[6] Seattle North, WA 2014 Quadrangle.

3.4.3 Regional Hydrogeology

The former NAS Seattle property is located within the Puget-Willamette Lowland aquifer system. The Puget-Willamette Lowland aquifer is composed of alluvial, glacial, and interglacial sediments of Quaternary age. The lateral extent of the aquifer system generally is delineated by the extent of the glacial drift of the youngest glaciations, the Fraser Glaciation. Excluding large lakes, of the Quaternary deposits present at land surface, alluvial deposits underlie 1,570 square miles (sq. mi.), fine-grained deposits underlie 3,320 sq. mi. and coarse-grained deposits underlie 2,293 sq. mi. The coarse-grained deposits and alluvial deposits generally compose aquifer units, and the fine-grained deposits compose semi-confining to confining units. An alternating pattern of coarse- and fine-grained deposits occurs from land surface to depths locally of more than 3,300-ft. Tertiary and older rock units define the lateral and basal boundaries of the aquifer system, and together these units are called the basement confining unit (USGS, 1998).

Groundwater movement is from topographic highs to topographic lows. The direction of groundwater flow is predominantly lateral in aquifer units and vertical in the other semi-confining and confining units. Vertical gradients generally are downward, except near streams, rivers, and saltwater bodies, where they generally are upward. Groundwater in the uppermost aquifer unit occurs under water-table conditions, and groundwater in deeper units becomes increasingly confined with depth. Flow within aquifer units indicates the existence of predominantly subregional flow systems. These systems are controlled by topography, the basement confining unit, and the extent of saltwater bodies; under the present hydrologic stress, there is no regional flow system (USGS, 1998).

Horizontal hydraulic conductivity of aquifer units generally ranges from about 10 to 700-ft per day, and median values are in the range of 15 to 50-ft per day. The vertical hydraulic conductivity of the glacial tills is estimated to range from about 0.001 to 0.01-ft per day, and the vertical conductivity of the fine-grained clayey interglacial units is on the order of 0.0001-ft per day (USGS, 1998).

The quality of water in the aquifer system is suitable for most uses. Dissolved solids generally are less than 150 milligrams per liter. Dissolved nitrate generally is less than 1 milligram per liter; locally large concentrations are attributed to land-use practices. Seawater has intruded some aquifers near the coast (USGS, 1998).

3.4.4 Site Specific Hydrogeology

The former NAS Seattle site is underlain with glacial till ranging from a gravely sandy silt to a silty sand, with varied quantities of scattered cobbles and boulders. At the area once encompassing Mud Lake, peat was typically first encountered at depths between 8 and 9-ft; however, one boring encountered peat at a depth of 5-ft (Seattle Department of Parks & Recreation, 2002).

Groundwater conditions across the property varies seasonally and is strongly influenced by upgradient infiltration and hydraulic head originating from the hills of View Ridge, located west of the property. Certain Navy monitoring wells have been reported to be under artesian conditions along the western margins of the existing interior portion of the property. In addition to the artesian influences, Lake Washington's water level (controlled by the Hiram M. Chittenden Locks) affects the groundwater level along the shoreline causing it to be approximately 2-ft higher in summer than winter (Seattle, 2002).

Mud Lake was filled-in during the 1930s and early 1940s to allow expansion of the air strip. In the former area of Mud Lake, borings encountered up to approximately 25-ft of fill material overlying peat deposits. The peat deposits ranged in thickness from two to four-ft. Underlying the fill and/or peat layer is a silty sand or sandy silt layer. Groundwater was encountered in all borings located in the former Mud Lake location and ranged from 5.0 to 12.5-ft below ground surface (bgs) (NAVFAC, 2009). Figure 3-15 depicts the location Mud Lake on the Sand Point Peninsula with respect to the proposed 1927 layout of the naval air station.

3.4.5 Climate

Basic climate data was obtained from the website www.usclimatedata.com for the Seattle zip code 98164 and the duration 1961 through 1990. Figure 3-16 provides both a tabular and graphical representation of this information.

The average high temperature ranges from 45°F (January) to 73°F (August) and the average low temperature ranges from 36°F (January) to 55°F (August). Precipitation in the form of rain appears to be the dominant climatic feature, with the months averaging the greatest amounts of precipitation being October through March. The annual average precipitation is 34.1 inches which typically occurs across 152 days per year.

3.4.6 Threatened and Endangered Species

No federally threatened and/or endangered species is identified in the immediate vicinity of the former NAS Seattle property. The Bald Eagle nests in the Lake Washington environment; however, the bald eagle was removed from the list of federally threatened and endangered species on August 9, 2007 (U.S. Fish and Wildlife Service[7]). The endangered species Orcinus orca (southern resident orca) is known to utilize Puget Sound which is located within the 15 mile surface water target distance limit (TDL) (Figure 8-2) of the property[8]. Several federally listed threatened species use surface waters within the 15 mile TDL, including Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*), Puget Sound steelhead (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*) (WDFW 2006b). Critical habitat for the Puget Sound Chinook salmon includes Puget Sound nearshore (70 Code of Federal Regulations [CFR] 52630), which is also located within the 15 mile TDL.

[7] http://www.fws.gov/midwest/eagle/

[8] http://ecos.fws.gov/tess_public/profile/speciesProfile;jsessionid=158089844648DC8C5F4362E06FB038F2?spcode=A0IL

3.4.7 Flora and Fauna

The NOAA property contains upland meadow and non-native trees (primarily Lombardy poplars) that provide prey production and perch sites for owls and other raptors. The complex of former naval station buildings has structures in which barn owls are known to breed. Promontory Point located to the south of the property has a mixed native forest of older age than that present on Magnuson Park. Habitats within the park are quite variable, however most of those within the project site are reduced in habitat value because they support simple vegetation communities, they lack structural diversity and complexity, and the vegetation community types are relatively young (they are all early successional stages of recovery, having established subsequent to removal of the airfield) (Seattle, 2002).

At least 156 species of birds have been observed within Sand Point Magnuson Park. Approximately 28 species of birds are year-round residents of the park, including waterfowl such as Canada geese and mallards; passerines such as robins and wrens; and five non-native species: rock dove, European starling, house sparrow, California quail, and ring-necked pheasant. With the exception of the California quail, the introduced species of birds are all habitat generalists able to adapt to a wide range of urban and suburban habitat types, which the park well represents in its existing conditions. Seattle Audubon Society has observed at least 156 species of birds within Sand Point Magnuson Park and have also observed 27 bird species breeding within the park and the adjacent NOAA property (Seattle, 2002).

In 2002 the Final EIS reported that approximately 33 species of mammals were expected to use the area. Although coyotes were removed in 1996, repopulation of the area is expected to occur. Additional mammals inhabiting the area include voles, mice, and introduced mammal species such as the Norway rat, opossum, house mouse, and eastern grey squirrel. The park does not provide sufficient forage habitat for beaver, muskrat, and river otter (Seattle, 2002).

Garter snakes and lizards were expected to inhabit the site, particularly around abandoned buildings and debris piles that provide cover, forage, and basking areas. Land use disturbance and domestic cats may have reduced or eliminated these populations. Amphibian use of the site is limited by the shallow, ephemeral nature of the wetlands and lack of suitable upland forest habitat for winter and summer hiding and foraging. Pacific tree frogs are easily heard during spring breeding season around a small, seasonally flooded wetland known as "Frog Pond." A chain-link fence had been constructed around this wetland to keep dogs and human intruders from disturbing the breeding tree frogs. The tree frogs can also be heard calling occasionally during fall and winter from shrub thickets, meadow, and savannah habitats. The long-toed salamander may also be present on the site, as it breeds in shallow wetlands and requires a very small home range and little forest cover. Terrestrial salamanders such as the Ensatina and western red-backed salamander may be present in the forest area at Promontory Point; their small home range allows them to persist in small forest fragments, where they can be found living in down logs and small mammal burrows (Seattle, 2002).

4.0 Historical Property Summary

4.1 Chronological Property Summary

Section 3.3 describes property ownership and land use during time periods preceding, during and subsequent to DoD property ownership. The following information provides a more detailed description of the Navy's development of the property. The historic information provided has been largely obtained from the University of Washington, City of Seattle, and the Navy. Appendices G.1 thru G.3 provide copies of the source material from which the following narrative has been derived and Appendix H provides a number of photos of the air station during its early development. The following subsections summarize property development from the 1920s and subsequent decades.

Mid 1920s - 1939[9,10]

Congress, on 4 March 1925, enacted legislation which authorized the Secretary of the Navy to accept land as a site for a Naval air station at Sand Point. The Chief of Naval Operations formally established a Naval Air Reserve squadron at Sand Point on 11 May 1925. King County Commissioners, in September 1925, authorized the clearing of a landing strip 500-ft wide and 2,640-ft long, followed by grading, leveling and grass sowing. During 1926, Sand Point is reported to have consisted of a series of farms, a dirt runway, a farm house (Imbree residence) from which the station commander worked out of, and a chicken house in which naval aviation cadets were billeted.

King County formally conveyed title of approximately 411 acres of Sand Point land to the Secretary of the Navy as a site for a naval air station via a quitclaim deed dated 5 April 1926. The plan sheet titled "Aviation Base, Sand Point Wash. North West Portion of Field", revision B, 8 March 1927 (Figure 3-6), depicts structures that were likely removed as the base expanded. Notable structures depicted in this 1927 plan sheet are the oil storehouse (Bldg 4), paint storehouse (Bldg 5), blacksmith shop (Bldg 8), and carpenter shop and storage (Bldg 9).

During 1928-29, the construction of Buildings 2 (utility bldg), 5A through 5D (storehouses), 9 (carpenter shop and storage), and 20 (torpedo shop) were completed. The central steam plant (Bldg 12) was completed in 1930. Construction during 1936-39 included buildings: 6, 15, 18 (firehouse and garage), 25, 26, 27 (sea plane hangar), 29, 30 (hangar and office bldg), 31 (boat house), 41 (ships' service gasoline station), 330, 331, 332, and the expansion of Bldg 9.

Most of the grading of the peninsula occurred as a Works Progress Administration project during the early to mid-1930s. Approximately 1.5 million cy of fill were utilized. Mud Lake and Pontiac Bay (3 acres) were filled in. Building 27 and the tarmac are where Pontiac Bay previously existed.

[9] http://www.historylink.org/index.cfm?DisplayPage=output.cfm&file_id=2249; http://www.seattle.gov/parks/Magnuson/timeline/airfield.htm
[10] http://courses.washington.edu/fm328/Fieldtrip%20Material/Peninsulahistory_PublicComps.pdf

1940 - 1949[11,12]

Runways were paved during 1940-41 and the munitions storage buildings/bunkers No. 54 and 55 were also likely built. In November 1941 the station was reported as being 459.62 acres. Many barracks were constructed during 1941 and it is also likely that Buildings 173-176, 177-184, and Building 185 were constructed. During 1941 and 1942, construction of additional barracks, the recreation center, motor shop (Bldg 67), and gatehouse/brig (Bldg 138) occurred and it is likely that the officers bath house (Bldg 53) was also constructed.

During 1942, construction was initiated on the Sand Point Housing Project (located south of NE 65th Street). The main runway was expanded to a length of 5,050-ft in 1943. During 1943-44, buildings 193 (hangar), 40 (paint storage/public works), 141/192, and 222-224 (barracks) were completed. In 1945 the boathouse shed (Bldg 275) was constructed.

During WWII at the height of its activities, NAS Seattle had an installation population of 4,625 Navy and Marine personnel and 2,834 civilian employees. The installation consisted of multiple runways, airplane frame hangars, military barracks and operational buildings, and was the main supply and repair unit for Navy air personnel, their families, veterans and civilians employed by the Navy (Seattle, 2002).

1950 – 2000s[11, 13, 14]

The station was scheduled to be permanently closed on 1 September 1950; however, closure was canceled due to the onset of the Korean conflict. After the Korean hostilities ended, the installation returned to being a Naval Reserve training base. During 1950, the U.S. Fish and Wildlife Service established a research laboratory in surplus Navy buildings south of NE 65th Street, east of 65th Avenue NE. The base was closed except for Naval Reserve activities in 1952.

In 1963 the base is reported to encompass 494.68 acres and in 1966 the base population is reported to be 582 active duty, 1,471 reservists, and 318 civilians. The Coast Guard Air Station relocated from Port Angeles to the base in 1967. And in 1969 the main runway was extended to a total length of 4,800-ft in order to accommodate jet aircraft.

Aviation activities officially ceased on 30 June 1970 and NAS Seattle was decommissioned. The installation was redesignated on 1 July 1970 as Naval Support Activity Seattle (also referred to as Naval Station Seattle [NSS] or Sand Point Naval Station). During the 1970s, the Navy declared approximately 347 acres as surplus property (Seattle, 2002). In 1975, 312.5 acres were surplused, of which about 100 acres were transferred to NOAA and 196 acres were transferred to the City of Seattle to be used as parkland. During the late 1970s approximately 120 acres of runways, tarmac and taxiways were demolished (Seattle.gov).

[11] http://courses.washington.edu/fm328/Fieldrip%20Material/Peninsulahistory/PublicComps.pdf
[12] http://www.seattle.gov/parks/magnuson/timeline/WWII.htm
[13] http://www.seattle.gov/parks/magnuson/timeline/post-war.htm
[14] http://www.historylink.org/index.cfm?DisplayPage=output.cfm&file_id=2249

Construction of the NOAA Western Administrative Support Center occurred during 1980-82. During the mid to late 1980s approximately 40,000 tons of previously demolished runway and earth was used to construct Kite Hill at a location near Sand Point Head. In 1983, 4.48 acres were surplused and conveyed to the Department of Interior to be used by the U.S. Fish and Wildlife Service as the Western Fisheries Research Center (Navy, 1996). In 1985, the Naval Support Facility-Seattle housed the Navy's supervisor of shipbuilding, a recruiting office and a public relations office and its work force consisted of 1,000 military personnel and 1,182 civilians. The base was redesignated as Naval Station Puget Sound in October 1986.

In April 1991, Naval Station Puget Sound was recommended for closure under BRAC. Base closure occurred on 28 September 1995 with a dis-establishment ceremony, after which the property and responsibility for caretaking was transferred to Engineering Field Activity, Northwest. Shortly after base closure the remaining property was transferred to the City of Seattle and to the University of Washington.

Currently, Magnuson Park is divided between three institutions. Seattle Parks owns the majority of land and buildings within the park and rents office and other spaces to a variety of not-for-profit civic, arts, environmental, athletic and recreational organizations. The University of Washington owns land and five buildings which provide temporary storage for Suzzallo Library books, medical records storage for the University of Washington Medical Center, studios for students in the College of Architecture and Urban Planning. Solid Ground manages low-income and transitional homeless housing in six buildings (Seattle.gov).

Adjacent to the Park, also on former Navy property, is property owned by NOAA (north of park) and the Department of Interior (Headquarters for the Western Fisheries Research Center, located south of the park). Noncontiguous former Navy property parcels are where the former locations of the transmitter station (currently the Burke-Gilman Park), Water Reservoir (vacant property in a residential area), the Shearwater Housing tracts (now occupied by Thornton Creek Elementary School), the low frequency navigational aid (now a residential area), and the RACON Station (now a residential area). Magnuson Park recreational facilities include hiking trails, athletic fields, tennis courts, playgrounds, beach areas, and an off-leash dog park. Figure 3-7 depicts usage of the former contiguous NAS property as of 2012.

4.2 Military Operations

Prior to 1941, the primary mission of NAS Seattle was as a Naval Reserve training installation. This included armed training flights up until 1941. In 1939 the station's mission reportedly expanded to include the overhaul of aircraft **(**www.historylink.org**)**. By June 1941, NAS Seattle had four-month aviation service schools which were training future radiomen, aviation metal smiths, and machinists. In 1941, due to encroachment upon the station by the City of Seattle, NAS Seattle was prohibited from arming aircraft with live bombs.

NAS Seattle conducted aircraft repair/overhauls, aircraft engine overhauls, torpedo maintenance/repair, bomb sight maintenance/repair, munitions storage, and had onsite the associated ancillary shops required to support the overhauling of aircraft and engines. In addition to the overhaul operations, other significant operations included armed aircraft training missions (ceased in 1941), the outfitting of escort carriers produced at the Kaiser Shipyards and conducting Alaska resupply operations (Grant et. al., 1996). One hundred and fifty shops at NAS Seattle provided repair and modification services for fleet aircraft. During WWII, the installation's day population is reported to have been up to 8,000, consisting of both military and civilian personnel. The station also hosted several headquarters functions including a weather center, a communications center, and an overseas terminal for the Naval Air Transport Service **(**www.historylink.org**)**. During the Korean conflict (circa early 1950s) NAS Seattle is reported to have had 6-day work shifts in support of overhauling and modifying aircraft. The station's responsibility for overhauling aircraft ended in 1953 at the cessation of the Korean conflict and the number of civilian employees dropped from 1800 to 200 **(**www.historylink.org**)**.

The former NAS Seattle's dominant feature were the 8 runways and associated taxiways which occupied more than half the station's acreage. Munitions magazines were located proximate to the runways. No "cantonment" area is officially identified on any reviewed plan sheet; however, hangars, support facilities, barracks, fuel storage, etc. were generally located in a rectangular area, oriented north-south, between Sand Point Way (located on the west) and the runways (located on the east). A machine gun range was located on the south central border of the station and skeet/trap firing points ringed the installation's north-northeast shoreline.

4.2.1 Operations Involving Military Munitions

Table 4-1 identifies buildings/areas in which operations involving military munitions were either conducted or likely to have been conducted. This table also provides a DERP-FUDS eligibility determination; location coordinates that when used in conjunction with the plan sheet provided in Appendix R identifies the former location of a given operation; and, identifies the parcel in which an operation is located as identified on DERP-FUDS Eligibility Figure 3-2. Munitions related activities broadly include ordnance storage in magazines, small arms firing, machine gun training, torpedo repair and/or armament, and the arming of aircraft with live armament up until 1941. The arming of aircraft with bombs was prohibited in 1941 due to civilian encroachment. The specific activities conducted at the torpedo shop are not known. The plan sheet titled "Map of Naval Air Station Seattle, Washington, Showing Conditions on June 30, 1944" (Appendix R) was used to identify the locations of known or suspected military munitions use.

Munitions related operations were generally located on DERP-FUDS eligible property, except as noted. Magazines were typically located within the acreage utilized for the runways which is now Magnuson Park. The fuse and detonator magazine (Bldg No. 60) is located at the south end of the installation, south of transport hangar (Bldg 193) and is on DERP-FUDS ineligible property. The skeet and trap ranges were located along the north-northeastern shoreline of the property now owned and occupied by NOAA. The torpedo shop (Bldg 20) is on DERP-FUDS ineligible property located near the northwest corner of the installation and is on the west side of the former Shop and Office Building (Bldg 11). The machine gun range is centrally located at the south end of the installation and incorporates both a target shelter and firing shed. Also located at the south end of the contiguous property is the Temporary Gunnery Training Building and indoor shooting range.

Armed Aircraft Training Missions

Records were not reviewed which identified the time frame within which aircraft training with live ammunition occurred. The installation has been in existence since 1924 and armed aircraft training occurred up to 1941. The munitions supplied to training aircraft would have been stored in one or more of the identified magazines.

The USACE Common Operations Report entitled *Fixed Wing Air-to-Ground Weapons Range, RO-21*, USACE, references Army Regulation (AR) 775-25, "Ammunition Allowances, Air Corps Bombs", which provides information on the type and quantity of armaments authorized for use in air to ground bombardment training. Assuming that aircraft stationed at NAS Seattle were of an "Observation Squadron", AR 775-25 (1925 edition) states that annual per pilot allowances were 20 25-pound (lb) bombs, 6 50-lb and 8 25-lb fragmentation bombs.

The 1947 edition of AR 775-10 identifies the following allowance for training per year per pilot (except where noted) for fighter and tactical reconnaissance: 8,000 rounds of .50 caliber machine gun; 48 2.25 inch sub-caliber aircraft rocket; 60 100-lb practice bombs; 40 100-lb practice bombs per plane; 3 cluster, aimable, incendiary per plane; 10 100-lb general purpose bomb per airplane; 6 500-lb general purpose bomb per plane; 2 1,000-lb general purpose bomb per plane; and, 100 2.25 inch SCAR per plane.

Magazines

The 1944 plan sheet identifies Magazine Bldg 16 as having stored dynamite, Bldg 43 as having stored pyrotechnics, and Bldg 60 as having stored fuses and detonators. Remaining magazines are generically identified as having stored either high explosives or no description is provided. The storage of munitions and/or explosives for use in small arms, machine guns, torpedoes and bombs would have been consistent with the types of munitions related operations conducted at NAS Seattle.

Magazines 19, 21, 54, 55, are located adjacent to the runways. Photograph Nos.10, 13, and 14 of the Trip Report (Appendix M) respectively depict Magazine 55 (high explosives), Bldg 43 (pyrotechnics) and Magazine 19 (contents unidentified) as observed during the site visits conducted on 20 August and 15, 19 October 2008. Table 4-1 identifies the location coordinates of the individual magazines identified on the previously cited 1944 plan sheet.

High explosive munition constituents (MC) as used in bombs include: trinitrotoluene (TNT), ammonium nitrate, flaked aluminum, and cyclotrimethylenetrinitramine (also known as Royal Demolition Explosive [RDX]). Bomb fuze MCs are described as consistently being: lead azide, lead styphnate, antimony sulfide, tetryl, black powder, potassium nitrate, and thiocyanate. The explosive charge used in torpedoes is reported as being "torpex", which contains a mixture of 41% RDX, 41% TNT and 18% aluminum (USACE, 2006a; globalsecurity.org). It is not known specifically what pyrotechnics might have been stored at NAS Seattle. Military pyrotechnics have included: illuminating projectiles; trip flares; airport flares (used to light runways); aircraft parachute flares; reconnaissance and landing flares; bombardment flares; and, photoflash flares (used in photoflash cartridges and bombs for nighttime aerial photography). The composition of these pyrotechnics is provided in Appendix F (USACE, 2006a).

Machine Gun Range

The "Machine Gun Range" encompasses Bldgs 63 and 64 and is located at the south central end of the installation on DERP-FUDS eligible property. Based upon the layout of the range depicted in the 1944 plan sheet (Appendix R), it appears to have been a known distance range with fixed firing points and fixed targets. The fixed firing points are interpreted as having been located in the Machine Gun Range Firing Shed (Bldg 64) with fixed targets believed to have been located in the Machine Gun Range Target Shelter (Bldg 63). Design aspects of the target shelter were not present in the documents reviewed for this PA. Firing was done from the west end of the rectangular range at targets located due east. A "dike" is depicted directly behind the target shelter. Shots having a trajectory higher than the dike/berm would likely have entered Lake Washington.

Although the weapons and caliber used at the machine gun range were not specifically identified in reviewed documents, an historic photograph depicts what appears to be Browning 0.50 caliber machine guns being worked upon. It is presumed that the weapon depicted in the referenced photograph would have been fired at the machine gun range. Otherwise, the caliber of round fired would have likely been either .30, .45, or .50. The typical components of the projectile, cartridge case, and propellant can generally be identified as they did not vary greatly between the different calibers of bullet. The projectile would have contained lead, antimony, and perhaps iron. The primer would have typically contained lead thiocyanate, antimony sulfide, along with other constituents. The propellant typically contained nitroglycerine, nitrocellulose, dibutyl phthalate, along with a list of other constituents. A more comprehensive listing of possible constituents contained in fired munitions is provided in Appendix F.

Torpedo Shop

The "Torpedo Shop" (Bldg 20) is located on the east side of Bldg 11, at the northwestern end of the installation on DERP-FUDS ineligible property. Documentation describing the nature of work performed in the "torpedo shop" was not specifically described in reviewed records. However, during the first two years of WWII, torpedoes had a number of defects which very likely would have resulted in their modification during time spent in the torpedo shop. The explosive "Torpex" is identified as having been used as the explosive charge in WWII torpedoes and is reported to contain a mixture of 41% RDX, 41% TNT and 18% aluminum (USACE, 2006a; http://www.globalsecurity.org).

Indoor Shooting Range

The indoor shooting range is identified as Building No. 201 and is on the DERP-FUDS eligible portion of the property. It is located south of East 65th Street and near the machine gun range. No additional information has been collected regarding the indoor shooting range.

Trap/Skeet Shooting

The 1944 plan sheet identifies two skeet range target gun houses (Bldgs 49, 50), four skeet control houses (Bldgs 160 – 163), and five skeet houses (Bldgs 155 – 159). Also identified are eight trap houses (Bldgs 147 – 154). These structures are located along the north-northeast shoreline, between the end of the runway and Lake Washington on DERP-FUDS eligible property. Targets are indicated to have been launched over Lake Washington. Historically, lead pellets have been the munition used for both trap and skeet shooting. It is unknown what the usage rate was for either of these ranges.

Ordnance Material Storage

Building 203, located behind skeet control house Bldg160 and adjacent to Bldg 122 (perhaps having a common wall), is identified as having stored "ordnance materials". Due to its proximity to the skeet/trap ranges, it is suspected that skeet/trap supplies are likely what was stored. It is located on DERP-FUDS eligible property.

Firing Shed

Building No. 199 is identified on the 1944 plan sheet as a "Firing Shed". It is situated to the west of the machine gun range and is on DERP-FUDS eligible property. It is surmised that this could be the firing stations for the outdoor small arms range. If so, downrange is due east.

Temporary Gunnery Training Building

Temporary Gunnery Training Building (Bldg 214) is located adjacent to the south boundary of the machine gun range, near the machine gun firing shed. It is not known what activities took place at the gunnery training building.

4.2.2 Operations Involving Chemical Weapons Munitions

Gas training was conducted in Bldg 191, which is located in the northeast portion of the installation on DERP-FUDS ineligible property. Any reasonably airtight building could have been used for gas training. A chamber of sufficient size to accommodate 12 to 16 men was generally desired. The normal agents used in gas chamber exercises were phenacyl chloride (CN), O-chlorobenzylmalononitrile (CS), and chlorine (CL). The plan sheet does not identify a designated storage area for the training gas vials which likely would have been used (USACE, 2006e).

4.2.3 Operations Involving Hazardous, Toxic, and Radioactive Waste (HTRW)

Operations conducted at NAS Seattle included complete plane and engine overhaul (U.S. Navy, 1947). Many of the same operations described as being conducted at Army Airfield Depots (USACE, 2006d) were present at NAS Seattle: engine overhaul; aircraft repair; engine testing; assembly and repair; bombsight repair, radio repair; maintenance; inflammables storage; boiler/steam plant operation; and, general cleaning and lubrication of equipment. Appendix F.3 identifies a range of substances that would have been available to NAS Seattle to support its mission objectives. These substances include acetone, benzene, carbon tetrachloride, trichloroethylene, toluene, and various solvent containing cleaning compounds (USACE 2006d).

Table 4-2 identifies buildings in which the nature of the operation conducted indicates that TSCA hazardous substances were likely used and/or generated. This table also provides a DERP-FUDS eligibility determination, location coordinates that when used in conjunction with the plan sheet provided in Appendix R identifies the former location of a given operation, and also identifies the parcel in which an operation is located as identified on DERP-FUDS eligibility Figures 3-2 and 3-3. In addition to operations that occurred in buildings, historic photographs identify areas described as “oil burning pits”, “waste disposal pits” (both along the lakeshore) and a waste incinerator, all of which were located along the shoreline on DERP-FUDS eligible property (Anchor, 2005). Not reflected on Table 4-2 are the following buildings identified on a 1926 plan sheet (Figure 3-6): Hangar, utility building, oil storehouse, gasoline pump house, blacksmith shop; and, carpenter shop.

Hangars

Aircraft maintenance activities would have been conducted in one or more of the hangars located on site. Hangar buildings 1, 32 and 33 are on DERP-FUDS eligible property while hangars 27, 30 and 193 are on DERP-FUDS ineligible property. Documents describing the nature of work conducted in NAS Seattle hangers were not discovered during development of this PA; however, a number of sources identifies aircraft overhauls as a primary function of work performed at NAS Seattle. Work typical of that conducted in hangars include: inspections; engine removal and reinstallation; and, radar and radio equipment removal. Repair of fuselage, wings, and landing gear would have been performed in shops located in the aircraft repair hangar/building. Inspections of repaired/overhauled aircraft typically occurred in the hangar portion of the aircraft repair building. Flushing of engine fluids and hydraulic systems would also have been conducted in the hangars (USACE, 2006d). Detailed plan sheets of the NAS Seattle hangar facilities were not acquired during preparation of this report.

Navy conducted a removal action for soil contaminated with TPH as DRO and metals (exceeding MTCA cleanup levels) indicated to be associated with the former Transport Hangar (Bldg 193) (NAVFAC, 2009). Excerpts of this report are provided in Appendix G.4. The contaminants addressed as part of this removal action is assessed to be indicative of the type of contaminants potentially released at one or more of the three DERP-FUDS eligible hangars.

Assembly and Repair Shop (Bldg 2)

The Assembly and Repair Shop is located on DERP-FUDS ineligible property. Although no detailed plan sheets were reviewed, this is the building in which specialized shops would have been located at which parts and assemblies would be repaired. It is one of the buildings that had been contaminated with low level radiological contamination resulting from work conducted in the Instrument Shop involving radioluminescent paint. Although not identified as an “aircraft repair building”, this building’s name suggests that similar work was done, which would include: disassembly, assembly, modification projects, structural repair, machine shops, wood and pattern shops, plating branches, foundry branches, paint branches, sheet metal branches, propeller repair departments and rubber tank sections. Engine overhauls are indicated to have occurred in Bldg 2 due to the proximity of the Engine Test Building (Bldg 17).

Shop & Office Building, Public Works (Bldg 11)

The "Shop & Office Building, Public Works" building is located in the northwestern end of the rectangular area between Sand Point Way and the runway apron. This portion of the installation is DERP-FUDS ineligible and was conveyed under BRAC. A 1945 AAF report entitled "Standards for Aircraft Maintenance Activities defines aircraft shops as follows:

> "Aircraft Shops consist of those buildings and structures on an Army Air Base, equipped with fixed and movable machinery, and other facilities, where Third Echelon aircraft repair and manufactures are conducted, usually there are two or more buildings located in the same vicinity which contain the aero repair section, the fabricating section and the power plant section. (The Armament, Communications, Automotive Repair and Post utilities shops are separate establishments from the Aircraft shops.)" (USACE, 2006d)

Although the above description is sourced from an Army Air Force report ("Standards for Aircraft Maintenance Activities"), it is viewed as being largely applicable to a naval air station as aircraft maintenance activities should be very similar between the two military branches. The Navy's six maintenance classes were roughly equivalent to the echelon system of the AAF and demonstrate that aircraft maintenance activities were similar across various branches of the military (USACE, 2006d). The above described shops are expected to have been present in the Assembly and Repair Shop, Shop and Office Building, and several of the hangars.

Engine/Motor Test Buildings (Bldgs 17, 102) and Semi-Portable Test House (Bldg 212)

Engine/motor test buildings are where repaired/overhauled engines were run-in prior to being reinstalled into aircraft. Engine test buildings were typically located near or adjacent to the engine repair and engine storage buildings (USACE, 2006d). Building 17 adheres to this general description as it is located just south of Bldg 2, the "assembly and repair shop;" however, Bldg 102 is remotely located from Bldg 2, being along the shoreline near the skeet/trap shooting area. Bldg 17 is located on DERP-FUDS ineligible property while Bldg 102 is on eligible property.

During the run-in period, engines are required to be cooled; this is reported to have been accomplished with ethylene glycol. A fueling system would also have been present. Since Bldg 102 is remote from the assembly and repair shop, it is not known if the engine testing operations differed significantly between the two buildings.

Bldg 212, a semi-portable engine test house, was located in the north central portion of the installation, near the trap/skeet ranges, on DERP-FUDS eligible property. Bldg 212 was possibly a "Jacobson" portable engine test building. A Jacobson test building was a compact stand-alone structure which consisted of a control room and a test stand erected outside, normally in remote parts of a base (USACE, 2006d).

Fueling Operations

Aviation gas (avgas) was used from inception of the installation and would have ceased being used either upon deactivation of the air station or when piston aircraft were no longer stationed and/or serviced at NAS Seattle. Aviation gas has been a leaded fuel (tetraethyl lead) since the early 1920s. In addition to the benzene, toluene, ethylbenzene, and xylene constituents of avgas, ethylene dibromide (EDB) acting as a lead scavenger, has been an added constituent since the 1920s. Avgas has only used EDB as a lead scavenger, whereas mogas has also used 1,2-dichloroethane (1,2-DCA) (NGWA, 2004).

Fueling operation components were widely distributed across the installation and generally consisted of storage tanks (both above and below ground tanks), distribution pipelines, control valve pits, and truck loading/unloading racks. The fuel storage tanks identified on the 1944 installation plan sheet are a mix of bulk fuel storage (aviation fuel) and smaller tanks (diesel/heating/emergency power generation) which were located on both DERP-FUDS eligible and ineligible property.

The avgas tank farm (DERP-FUDS ineligible property) is located east of Bldg 11 and approximately 25-ft north of Bldg 98 (15 USTs were in this area). Fuel tanks numbered 70 through 85 and 99 and 100 are present in this area. The fuel system was of a water drain field design, where water was used to lift fuel to the top of the USTs for pumping. Fueling control valve pits are depicted as having been located on DERP-FUDS ineligible property.

Fuel distribution lines were present on both eligible and ineligible property. Plan sheets depicting all distribution line locations were not obtained during development of this PA. Figure 4-1 depicts a portion of the avgas fuel distribution system. The total length of pipeline is 7,275-ft, of which 5,340-ft are located on DERP-FUDS ineligible property transferred under BRAC. The avgas pipeline is described as mostly being beneath 6 to 8 inches of reinforced concrete (Navy, 1996).

A tank truck fueling rack (Bldg 101) had been located just west of Bldg 11 on DERP-FDUS ineligible property. If fueling pits were used, the several “revetments” located adjacent the runways might have been fueling pits not identified as such on the 1944 plan sheet.

The fuel storage tanks identified on Table 4-2 are those identified on the previously cited 1944 plan sheet and does not identify any tanks added subsequent to 1944. It is also noted that the storage tanks are not identified as to being either above or below ground tanks.

The Ecology Toxics Cleanup Program Web Reporting site[15] was accessed for information pertaining to Leaking Underground Storage Tanks, State Cleanup Sites, and No Further Action Site List relevant to the former NAS Seattle property. The web site was queried for properties within the 98115 zip code. Query results are provided in Appendix G.7 and summarized as follows:

[15] https://fortress.wa.gov/ecy/tcpwebreporting/report.aspx

- Regulated USTs, Active Facilities[16]: None are identified for any current property owner of the former NAS Seattle installation.

- Regulated Underground Storage Tanks, Inactive Facilities[17]:
  - U.S. Dept. of Commerce NOAA WASC AFSD. That portion of the former NAS Seattle currently owned by NOAA is identified as having six regulated USTs of which five have been "removed" and one is "exempt". Contents were either diesel or gasoline (one UST with unknown contents) with installation dates of 1981-82 and 1964 for the exempt UST. Tank volumes ranged between 100 to 2,000 gallons.
  - U.S. Navy Station Seattle. Sixteen regulated USTS are identified – twelve installed in 1964; three installed between 1970 and 1975; and one installed in 1988. Seven were closed in place and nine have been removed. One tank is identified as having stored hazardous substances (installation date of 1964), one stored used/waste oil, and the remainder stored fuels (gasoline or diesel).

- Leaking Underground Storage Tank (LUST) List:
  - NOAA started LUST cleanups in 1997 and 2011. The LUST query result appears to state that the 1997 cleanup was reported as having been achieved (cleanup has not been formally reviewed by Ecology). Affected media includes both soil and groundwater.
  - The "Naval Station Sandpoint Closure" started one LUST cleanup in 1995. Affected media is soil.

- No Further Action (NFA) Site List: The former NAS Seattle (Naval Station Seattle Pier 91 Qtrs B) has a NFA site for cleanup site having Identification Number (ID) 8700 (facility ID number 32189519) and also has a NFA for Cleanup Site number 1359 and Facility Number 2214.

<u>Oil Burn Pits</u>

The Environmental Assessment Technical Memorandum prepared for the City of Seattle identifies oil burn pits on a 1969 aerial photograph (Anchor, 2005). This area is located near the lakeshore which is part of Magnuson Park on DERP-FUDS eligible property. Appendix G.3 provides a figure depicting the location of this area.

<u>Garbage Pits</u>

An area described as "garbage pits" is identified on a 1969 aerial photograph provided in the Environmental Assessment Technical Memorandum (Anchor, 2005). This area is located along

[16] active facility: one in which at least one tank with status of "Operational", "Deferred", "Temporarily Closed", or "Red Tag" (per Washington Dept. of Ecology).
[17] Inactive Facility: one with no tanks having status of "Operational", "Deferred", "Temporarily Closed", or "Red Tag" (per Washington Dept. of Ecology).

the lakeshore which is part of Magnuson Park on DERP-FUDS eligible property. Appendix G.3 provides a figure depicting the location of this area.

Incinerator

An “incinerator” is identified on a 1969 aerial photograph provided in the Environmental Assessment Technical Memorandum (Anchor, 2005). This area is located along the lakeshore on DERP-FUDS eligible property which is part of Magnuson Park. Appendix G.3 provides a figure depicting the location of this area.

Petroleum, Oil, Lubricant (POL) and Paint Storage

The 1944 plan sheet identifies: a paint and oil storage structure (Bldg 165) located off the main part of the installation (does not depict its exact location); a paint storage/public works structure (Bldg 40) located directly west of and near Bldg 11 on DERP-FUDS ineligible property; and, an oil storage tank (Bldg 146) located immediately east of the motor test building (Bldg 102) on DERP-FUDS eligible property.

Electrical Substations/Transformer Stations

PCB dielectric insulating oils were widely used in electrical transformers during the 1930s and 1940s and beyond. The EBS (US Navy, 1996) reports that 33 PCB-containing transformers had been located on the BRAC transferred property. The main electric substation (Bldg 42) is located on DERP-FUDS ineligible property adjacent to the installation’s western boundary and west of barracks Bldg 9. A “transformer house” (Bldg 226) is located on DERP-FUDS eligible property at the southwest corner of Hangar Bldg 1. Figure 4-2 depicts 33 PCB-containing transformers that were formerly located on that portion of the installation which had been transferred under BRAC. It is not known how many transformers had been located on the DERP-FUDS eligible portion of the installation.

The Navy began phasing out PCB-containing transformers beginning in 1984 (after the DERP-FUDS eligible portion of the property had been conveyed to non-Navy owners). Former transformer pads (located on DERP-FUDS ineligible property) were sampled for PCBs, resulting with one location at the main electric substation (Bldg 42) requiring cleanup (Navy, 1996). It is not known how the “transformer house” (Bldg 226) transformers were ultimately managed.

Dope Storage Building (Bldg 119)

Building 119, identified as the “Dope Storage Building”, was located adjacent and on the south side of the Assembly and Repair Shop (Bldg 2) on DERP-FUDS ineligible property (Navy, 1944). Aircraft “dope” was utilized by maintenance personnel on fabric which covered wood aircraft surfaces. TM 1-147, entitled “Aircraft Fabric Work and Application of Finishes,” defines dope as: “…a colloid solution of cellulose acetate nitrate. Plasticizers are added to produce a smooth, flexible film…Dope imparts to fabric covers added tensile strength, tautness, and makes them airtight and weatherproof while adding the least possible weight. Although it is applied in a number of coats, each application of dope dissolve all previous coats and forms a single layer or film when dried.” (USACE, 2006d)

Standby Generator Plant

The standby generator plant (Bldg 403) was located on the final acreage which had been redesignated as “Naval Station Puget Sound, Seattle (Sand Point)” prior to being conveyed to non-DOD ownership under BRAC in 1995. The standby generator plant was constructed in 1971 and would have required some type of storage system to store fuel (typically diesel). This unit is not identified on the 1944 plan sheet. No plan sheet or figure has been located which depicts the location of this standby generator plant.

Hazardous Substance Storage

The EBS (Navy, 1996) identifies areas where only storage of hazardous substances or petroleum products has occurred and from which no release, disposal, or migration from adjacent areas has occurred; areas where storage, release, disposal, and/or migration of hazardous substances or petroleum products has occurred, but at concentrations that do not require a removal or a remedial action; and, areas where storage, release, disposal, and/or migration of hazardous substances or petroleum products has occurred, and all remedial actions necessary to protect human health and the environment have been taken (including use of deed restrictions). This information is summarized in the EBS TableES-1 which has been excerpted and provided in Appendix G.9. These buildings/areas are all located on DERP-FUDS ineligible property conveyed to non-DoD owners through BRAC.

Ecology identifies that NAS Seattle has removed a tank which stored hazardous substances. This tank is described as having been installed in 1964 and a capacity between 111 to 1,100 gallons (Appendix G.7.2). Records describing the tank’s exact location and former contents were not discovered during development of this PA.

Bomb Sight Repair Shop

The bomb sight repair shop (Bldg 66) is located immediately south of Hangar 1 on DERP-FUDS eligible property. It is not known what operations and materials were required to repair bomb sights. It is possible that cleaning agents and lubricants were used during recalibration and/or repairs.

Garage, Auto Hobby Shop, Service Bay, and Boathouse

The garage (Bldg 67) is located west of Hangar 2 and immediately east of Sand Point Way on DERP-FUDS ineligible property. It is not known what specific maintenance activities occurred in this facility. The types of materials available for use in the maintenance of Army vehicles is provided in Appendix F.4.

The auto hobby shop was constructed in 1952, modified in 1989, consisted of 4,000 sq. ft, and described as having been for personnel use (Navy, 1996). It had been located on that portion of the installation that had been transferred under BRAC after 1995 (DERP-FUDS ineligible). Petroleum, oil and lubricants would have been used and waste POLs would have been generated, including engine oils, lubricating grease, degreasing agents, and perhaps automotive paints.

The service bay is described in the EBS as being Bldg 345, as having been constructed in 1976, and as having 5,298 square ft. Its location is not described, other than being on that portion of the installation which had been transferred under BRAC (DERP-FUDS ineligible property).

A boat house (Bldg 31) existed alongside Pier No. 1, as depicted on the 1944 plan sheet provided in Appendix R. The EBS identifies a boat house (Bldg 402) as having been constructed in 1949 and consisting of 1,760 square ft. The location of Bldg 402 is not known, other than it having been on that portion of the installation which had been transferred under BRAC (DERP-FUDS ineligible property). Activities conducted at each boat house were not described in reviewed documents.

Boiler Plant (Bldgs 12 and 186)

The installation had two boiler plants identified as Buildings 12 and 186. Boiler plant 12 is located at the air station's northwest area, west of Hangar 2 on DERP-FUDS ineligible property. Boiler plant 12 appears to have been fueled by fuel oil, based upon the proximity of fuel oil reservoir tank no. 44. Gasoline tank no. 127 is also associated with this boiler plant. Boiler plant 186 is located at the south western end of the installation and is also located on DERP-FUDS ineligible property. This plant was coal fired as it had an associated coal storage yard located nearby. Maintenance of each boiler plant would have been accomplished through the use of various POLs and cleaning agents. It is not known how waste coal ash was managed.

Laboratory & Pump House (Bldg 114), Laboratory (Bldg 204)

The laboratory and pump house is located at the sewage treatment plant, at the northwestern end of the installation. Although no records were reviewed which indicated the purpose of the laboratory, it is evident, based upon it being co-located with the sewage treatment plant, that this laboratory was intended for performing analyses associated with operations of sewage treatment plants. The property on which it is located is DERP-FUDS ineligible.

The second laboratory (Bldg 204) was located at the south end of the air station and occupied a building which was previously used as the overseas air cargo terminal (Navy, 1944). The area on which this structure had been located is DERP-FUDS ineligible. The purpose of the laboratory was not described in any of the reviewed historical documents/records; however, the need would exist for some type of chemical assay of the aviation fuels for quality control purposes. This laboratory is reported as having been constructed in 1944 (Navy, 1996).

Skeet/Trap Ranges

Skeet and trap ranges were located along the Lake Washington shoreline on what is now NOAA property (DERP-FUDS eligible). The direction of fire was over Lake Washington resulting in lead shot being deposited into the lake and accumulating in lake sediment. The lead shot likely contained other metals in small amounts such as antimony and arsenic. In addition to lead shot, the clay targets would have contributed polycyclic aromatic hydrocarbons (PAHs) to the lake environment. Prior to 2000, clay targets were manufactured using asphaltic materials or petroleum pitch. No records were reviewed which identified a date when these ranges were created and the rate at which they were used.

Sewage Pump Pit

This sewage pump pit is located on the southeast corner of Hangar 1 and is identified as Bldg 117. Any upstream waste deposited into the sewer line is likely to have passed through this pump pit. Contaminants of potential concern (COPCs) include volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), petroleum hydrocarbons, and metals. It is located on DERP-FUDS eligible property.

Stormwater Discharge Points

The stormwater discharge points encompass an area of the Pontiac Bay portion of Lake Washington and includes both DERP-FUDS eligible and ineligible property. During Navy operations, water/oil separators were sometimes placed in laterals located upstream of the main drain lines. Portions of the aircraft landing and fueling aprons, near the hangar buildings, have stormwater collector trenches that discharge to the lake. A trench collection system is described in the 1996 EBS as remaining at the site of the demolished Building 283 (Construction Equipment Maintenance Shop). This system is described as being connected to an oil/water separator that drained to Lake Washington; however, the current status of the system is unknown (US Navy, 1996). Uncontained spills in areas that drained to the stormwater system would have had a means of being conveyed to Lake Washington.

Miscellaneous Sites

A number of storage sites existed on the installation with the potential for either having stored or used TSCA hazardous substances. These include the foam generator building (Bldg 217), radio receiver building (Bldg 139), radio generator house (Bldg 140), public works storage (Bldg 205), and the boathouse (Bldg 403).

4.3 Map Analysis

Herrera reviewed historical topographic maps, Navy real estate maps, and facility layout plans during early development of this PA (Appendix I). The contractor concluded that use of certain buildings, magazines, ranges, and storage areas changed over time. A 1973 map depicts a lab storage area which was previously used as the machine gun range target shelter; the former fuse and detonator magazine as vacant; disaster control storage where the small arms and pyrotechnic magazine previously existed; and a public works storage occupying where the torpedo shop formerly existed. Ownership of these areas, with the exception of the torpedo shop, was transferred to either NOAA or the City of Seattle by the mid-1970s.

4.4 Aerial Photograph Interpretation

The Environmental Assessment Technical Memorandum prepared by Anchor Environmental, LLC for the City of Seattle provides six aerial photographs dating from 1936 to 1969 (Anchor, 2005). Herrera reports that these photographs depict waste piles and waste disposal pits (Herrera, 2009). The Environmental Assessment Technical Memorandum provides a figure based upon a 1969 aerial photograph that depicts near shoreline locations for an “incinerator”, “garbage pits”, and “oil burn areas” (Appendix G.3). Herrera reports that the technical memorandum also states that “…floating oil containment booms appear offshore of the garbage pit area in 1956 and 1960 photographs, possibly to contain oil or fuel leaching from disposal areas…” Aerial photograph G.14 of Appendix G also appears to depict an oil boom near the shoreline located near the bottom center of the photograph.

5.0 Evaluation of Presence of Military Munitions and Technical Data

The following subsections describe the potential presence of munitions and explosives of concern[18] (MEC), MC[19], and recovered chemical warfare material[20] (RCWM). The primary document from which munitions use was gleaned is the 1944 plan sheet depicting the installation as of June 1944. Records indicate that munitions used and/or stored at NAS Seattle included aircraft armaments, torpedoes, machine guns, small firearms including trap and skeet, dynamite and pyrotechnics. Training in the use of gas masks was also provided at NAS Seattle; this required the use of gasses that mimicked battlefield gasses.

5.1 General Evaluation of Conventional Munitions and Explosives of Concern

A Munitions Response Site Prioritization Protocol (MRSPP) Explosive Hazard Evaluation (EHE) module was prepared for the small arms ranges munitions response site (MRS) (Appendix N). The EHE module was assigned the alternative rating of "No Known or Suspected Explosive Hazard."

The property constituting the former installation has been significantly redeveloped and no reports of MEC are known to have been made. However, it is noted that an interviewee has described observing empty cartridges and shells from small arms while scuba diving along the Magnuson Park shoreline (Appendix J). Munitions of 0.50 caliber and less do not meet the definition of MEC.

Known areas in which munitions and explosive were either managed or potentially managed are: seven separate magazines; torpedo shop; machine gun range; outside shooting range; indoor shooting range; trap and skeet ranges; ordnance material storage; firing shed; and temporary gunnery training building. Table 4-1 identifies these areas and their location coordinates as used on the cited 1944 plan sheet. Prior to the cessation of armed training mission bombing runs in 1941, bombs would likely have been transported from a magazine to an interim holding area prior to the arming of the aircraft.

[18] MEC refers to military munitions that may pose explosive safety risks and include unexploded ordnance (UXO) as defined in 10 U.S.C. §101(e)(5); discarded military munitions (DMM), as defined in 10 U.S.C. §101(e)(2): and, munitions constituents (e.g., TNT, RDX), as defined in 10 U.S.C. §101(e)(3), present in high enough concentrations to pose an explosive hazard (USACE, 2006a).

[19] MC is any material originating from unexploded ordnance, discarded military munitions, including explosive and non-explosive materials, and emissions, degradation, or breakdown elements of such ordnance or munitions (USACE, 2006a).

[20] RCWM is non-stockpile chemical warfare material (CWM) that was previously discarded, buried, or fired and discovered unexpectedly or during planned environmental restoration operations. Includes V- and G- series nerve agent, H-series blister agent, and lewisite in other than munition configurations. Chemical agent identification sets (CAIS) are also considered RCWM. RCWM does not include: riot control agents, chemical herbicides, smoke and flame producing items, or soil, water, debris or other media contaminated with chemical agent (USACE, 2006a).

NAS Seattle was a compact installation in that there was very little open area that could potentially have been used for disposal of off-spec munitions. Portions of the Lake Washington shoreline area present the most apparent available locations for such disposal purposes. The following subsections presents information specific to each known munition management area.

Magazines

Seven magazines existed at NAS Seattle. The 1944 plan sheet identifies Magazine Bldg 16 as having stored dynamite, Magazine Bldgs 54 and 55 as having stored high explosives, Magazine Bldgs 19 and 21 as being arch type magazines, Magazine Bldg 60 as having stored fuses and detonators, and Bldg 43 as having been a "ready locker" for the storage of pyrotechnics (Navy, 1944). The storage of munitions and/or explosives for use in small arms, machine guns, torpedoes and bombs would have been consistent with the types of munitions related operations conducted at NAS Seattle.

Four of the munitions storage magazines remain intact on Magnuson Park property (high-explosive magazines 54 and 55, pyrotechnics magazine 43/312, and magazine 19); all other storage magazine buildings have been removed. The Seattle Parks Department is reported as having used these remaining magazines for storage (Herrera, 2009). Due to aircraft training missions with live bombs being discontinued in 1941 , it is likely that the aircraft armament (bombs) inventory was either used up or relocated to NAS Whidbey Island where armed training missions continued to operate.

Torpedoes were present at NAS Seattle since the installation had a "Torpedo Shop." Because torpedoes contained a high explosives charge, they are expected to have been stored in a "high explosives" magazine. A Bureau of Ordnance Publication "Torpedoes Mark 14 and 23 Types", dated 24 March 1945, states that "…normally the war head, fitted with a protecting ring on its joint ring, is stowed with the exploder mechanism removed, and requires relatively little attention other than routine inspection…" This is interpreted to indicate that torpedo war heads could have been separated from torpedo body and subsequently stored with their explosive charge minus the exploder mechanism. However, records specifically addressing the management of torpedoes at NAS Seattle were not discovered for this PA.

It is unknown as to how and where the dynamite identified as being stored in Magazine No. 16 would have been used. Munitions stored in the magazines after 1941 are expected to have been equal to or less than 0.50 caliber, torpedoes, and dynamite. It is not known if ammunition greater than 0.50 caliber (such as that used for aircraft cannons) had also been managed at NAS Seattle; however, no record has been found to indicate that munitions greater than 0.50 caliber had been managed.

Machine Gun Range

The Machine Gun Range, which also includes a firing shed (Bldg 63) and target shed (Bldg 64), is located at the south central end of the property and is DERP-FUDS eligible. Although the weapons and caliber used at the machine gun range were not identified in reviewed documents, the caliber of rounds fired would have likely been either .30, .45, or .50 (USACE, 2006a).

Photograph No. G.13 (Appendix G) depicts what appears to be Browning 0.50 caliber machine guns being worked upon by NAS Seattle Ordnance Department personnel. It is possible that the machine gun range was used to test fire repaired machine guns. Munitions used at the machine gun range, if found, would not qualify as MEC since MEC is a munition greater than 0.50 caliber. The fired bullets had a make-up of lead, antimony and iron (USACE, 2006a).

Torpedo Shop

The torpedo shop was constructed in 1937 as a freestanding building; however, by 1944, Bldg 11 surrounded it on three sides. The torpedo shop's construction is described as being a poured concrete foundation supporting a poured concrete structure having brick cladding. The Torpedo Shop (Bldg 20) is intact and is part of the Seattle Historic District at Sand Point.

At the onset of WWII, the two primary torpedoes used by the U.S. military were the Mark 13 and Mark 14 models. A number of critical defects existed with the Mark 13 and 14 as initially used[21]. It is presumed that a major component of the torpedo shop's mission was to modify torpedoes to correct known deficiencies (depth control apparatus, impact detonator, magnetic influence detonator, etc.) in addition to performing routine depot level torpedo maintenance. It took 21-months after Pearl Harbor to identify the last major torpedo defect. (UnderseaWarfare – The Official Magazine of the U.S. Submarine Force, Winter 2012 Issue No. 47).

Reviewed records did not indicate how the inventory of torpedoes to be worked on were to be managed. It is expected, due to the high explosive contained within the warheads, that torpedoes were stored in either one or both of the high explosives magazines. The explosive compound in torpedoes was "Torpex", a mixture of 41% RDX, 41% TNT and 18% aluminum (USACE, 2006a; globalsecurities.com). No records were retrieved indicating that the explosive charge would be separated from the warhead shell at any time.

Skeet/Trap Ranges

Skeet and trap ranges were located along the shoreline in the area now occupied by NOAA. Munitions used at the skeet and trap ranges are not categorized as MEC as these were less than 0.50 caliber.

Temporary Gunnery Training Building (Bldg 214)

The temporary gunnery training building was located along the southwestern corner of the machine gun range. It is expected that the machine gun range was used to complement the classroom training. No records were found verifying that training also consisted of live round firing.

Indoor Shooting Range (Bldg 201)

The indoor shooting range was located north of the machine gun range's northeast corner. The small arms caliber which would have been used at the indoor firing range is not categorized as MEC.

[21] http://www.ww2pacific.com/torpedo.html

Firing Shed (Bldg 199)

The firing shed was associated with a second outdoor range located north of the machine gun range's eastern one-third acreage. Based upon its size, it appears that this had been a small arms range. Therefore potentially remaining munitions would not be categorized as MEC.

Ordnance Material Storage (Bldg 203)

The ordnance material storage building had been located near the skeet control houses situated along the Lake Washington shoreline. None of the reviewed records described the types of materials stored in the ordnance material storage building. Based upon this storage unit being located near the skeet and trap ranges, it is expected that the ordnance stored was likely in support of the trap and skeet ranges. It is therefore assessed as being unlikely that munitions greater than 0.50 caliber had been stored at this location.

5.2 General Evaluation of MC Presence

No information has been reviewed which indicates that the presence of MC has been quantitatively assessed by previous environmental investigations. The areas most likely to exhibit MC contamination are the impact areas associated with the former machine gun range and the apparent small arms range located near the machine gun range. The munitions previously stored in the magazines are assessed as having had a minimal likelihood of having released their explosives to the environment as it would have been self-contained within either the shell or casing of the munition. The dynamite stored in Magazine No. 16 is also assessed a low likelihood for having had a release into the environment.

Magazines

The former storage of munitions and/or explosives of the type used in small arms, machine guns, torpedoes and bombs would be consistent with the types of munitions related operations conducted at NAS Seattle. Munitions previously stored in specific magazines have been described in Section 5.1 of this PA. In addition to these munitions, dynamite is also identified as having been stored in Magazine 16.

Constituents contained in high explosives as used in bombs include: TNT, ammonium nitrate, flaked aluminum, RDX. Bomb fuzes are consistently described as containing: lead azide, lead styphnate, antimony sulfide, tetryl, black powder, potassium nitrate, thiocyanate. The explosive charge used in torpedoes is reported as containing either TNT or Torpex, a mixture of 41% RDX, 41% TNT and 18% aluminum (USACE, 2006a). Pyrotechnics is a generic term and it is not known what specific pyrotechnics might have been stored. Military pyrotechnics have included: illuminating projectiles; trip flares; airport flares (used to light runways); aircraft parachute flares; reconnaissance and landing flares; bombardment flares; and, photoflash flares (used in photoflash cartridges and bombs for nighttime aerial photography). The composition of these pyrotechnics is provided in Appendix F.1 (USACE, 2006a). Dynamite detonator caps in use prior to and during WWII widely utilized mercury fulminate. After WWII, fulminate was replace by lead azide and nitrogen tetrasulphide (http://corrosion-doctors.org/Elements-Toxic/Mercury-explosives.htm).

Historical records do not indicate that the high explosive charges contained within the bombs and torpedoes managed at NAS Seattle were separated from their casings. However, Magazine No. 16 is identified as having been used to store dynamite and it is not known how this dynamite was eventually used. It is assessed that there was minimal opportunity for high explosive constituents to have been released into the environment.

Machine Gun Range

Although the weapons and caliber used at the machine gun range were not identified in reviewed documents, the caliber of rounds fired would have likely been either 0.30, 0.45, or 0.50. Photo No. H.13 (Appendix H) depicts an apparent 0.50 caliber Browning machine being repaired at NAS Seattle. The typical components of the projectile, cartridge case, and propellant can generally be identified as they did not vary greatly between the different calibers of bullet. The projectile would have contained lead, antimony, and perhaps iron. The primer would have typically contained lead thiocyanate, antimony sulfide, along with other constituents. The propellant typically contained nitroglycerine, nitrocellulose, dibutyl phthalate, along with a list of other constituents. A more comprehensive listing of possible constituents contained in fired munitions is provided in Appendix F.2 (USACE, 2006a).

Based upon the layout of the machine gun range, the direction of fire appears to have been from west to east – from the firing shed (Bldg 64) to the target shelter (Bldg 63). The 1944 plan sheet depicts a berm and “dike” behind the target shelter. The status of this berm is unknown, as the former machine gun range was not addressed by the site inspection conducted by Herrera in 2008. The berm appears to have been present in order to ‘catch’ errant machine gun fire. Bullet fragments contained in the berm constitute a potential health and environmental hazard. It is not known to what extent (if any) the berm or dike may have been regraded and incorporated into the recontoured landscape. It is also not known what became of the expended bullets fired into the target shelter.

Torpedo Shop

Torpedo warheads contained a charge of either TNT or Torpex, which was poured into the shell in the molten state. Warheads loaded with Torpex had a small charge of TNT in the nose of the head. The later torpedo models MK 16-1 and Mk 16-4 had a “topping charge” of TNT which filled the space between the end of the Torpex charge and the after bulkhead of the war head (Navy Department Bureau of Ordnance, 1948). The handling of torpedoes is not expected to have released Torpex and/or TNT to the environment.

Skeet/Trap Ranges

The skeet and trap ranges were located along the Lake Washington shoreline on what is now NOAA property. The direction of fire was over Lake Washington. Lead shot would have been deposited into the lake and would have accumulated in lake sediment. The lead shot may also contain other metals in small amounts such as antimony and arsenic. The targets would also have fallen into Lake Washington and depending upon the material used to make the target, have the potential for releasing polycyclic aromatic hydrocarbons into the water. No records were reviewed which identified a date when these ranges were created and the rate at which they were used.

Temporary Gunnery Training Building (Bldg 214)

No records were located which describe the nature of training provided in the temporary gunnery training building. It is likely that classroom training was supplemented with live machine gun firing at the nearby machine gun range. The MC generated was previously discussed under the subheading “Machine Gun Range”.

Indoor Shooting Range (Bldg 201)

No records were located that addressed the caliber and type of weapons utilized at the indoor shooting range. Small arms ammunition includes that used for pistols (.22-caliber, .32-caliber, .38-caliber, and.45-caliber); rifles and carbines (.22-caliber, .30-caliber, 7.62-mm, and 5.56-mm); automatic rifles (.30-caliber); submachine guns (.45-caliber); machine guns (.30-caliber, .50-caliber, and 7.62-mm); and shotguns (12-gauge). The projectiles from these various weapons were typically a lead bullet which also included one or more of the following metals in small amounts: antimony, arsenic, copper, brass. (USACE, 2006a)

The associated chemical constituents of the standard ammunition components included nitrocellulose, diphenylamine, graphite, dinitrotoluene (DNT), lead styphnate, barium nitrate, antimony sulfide, aluminum, pentaerythrite tetranitrate (PETN), tetracene, nitroglycerin, ethyl centralite, potassium nitrate, potassium chlorate, mercury fulminate, black powder, polyester adipate, strontium peroxide, calcium resinate, strontium oxalate, strontium nitrate, magnesium powder, barium peroxide, yellow phosphorus, lead thiocyanate, TNT, dibutyl phthalate, diphenylamine, n-nitrosodiphenyl-amine, Prussian Blue dye, gum tragacanth, gum arabic,and RDX **(**USACE, 2006a**).**

It is not known what type of maintenance and/or house cleaning practices were used at the indoor range. Lead and other metal bullet constituents could be expected to have accumulated dependent upon the degree of house cleaning conducted during use of the indoor shooting range. Upon comparing a Google Map aerial image (Figure 5-1) of the area to the 1944 plan sheet, it appears that the indoor shooting range building has been removed. It is not known what precautions, if any, were taken to address potential lead dust during building demolition.

Firing Shed (Bldg 199)

The firing shed is located between the machine gun range and the indoor shooting range on DERP-FUDS ineligible property. No information was collected regarding the types of weaponry that had been fired at this location. Due to the size of the apparent range, it appears to have been a small arms training range. The direction of fire was from east to west, and the impact area was a continuation of the machine gun range berm. Lead is the significant MC that would have been released to the environment at the downrange berm. The dates of use and rate of use are unknown and therefore it cannot be estimated what mass of lead might have been deposited into the berm. Figure 5-1 depicts the area once occupied by Bldg 199 and its associated range.

Ordnance Material Storage (Bldg 203)

The Ordnance Material Storage building had been located on DERP-FUDS eligible property adjacent the inert storage building (Bldg 122), which is located on the backside of the skeet range firing points. It is unknown what materials were stored in the ordnance materials storage building. Due to its proximity to both the skeet and trap shooting area, it is suspected that stored materials were related to both the skeet and trap ranges. It is assessed that during storage the ordnance materials had a low likelihood of being released into the environment.

5.3 General Evaluation of RCWM Presence

The 1944 plan sheet identifies a "gas training building" (Bldg 191), located in the northwestern portion of the property, west of Sea Plane Hangar No. 27. Gas training buildings were used to test fitment of chemical gas masks. The normal agents used in gas chamber exercises were CN, CS, and/or CL (USACE, 2006e). The gas chamber could be a permanent structure or a temporary structure such as a tent. A chamber of sufficient size to accommodate 12 to 16 men was typical (USACE, 2006e). Training beyond the use of the gas chamber, such as a gas obstacle course or gas identification training, are not indicated to have been present at NAS Seattle – the 1944 plan sheet does not depict any such areas.

6.0 Evaluation of Hazardous Toxic Radioactive Waste

This section addresses the potential presence of HTRW contamination at the property which would be regulated under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Hazardous constituents associated with MEC are discussed in Section 5.2 and contamination associated with petroleum, oil, or lubricants is addressed in Section 7.0.

6.1 General Evaluation of HTRW

The following operations conducted at NAS Seattle either used, generated, or had the potential of generating CERCLA hazardous substances: flightline operations consisting of inspections, fueling/defueling, and surface treatments such as deicing and cleaning; field and depot maintenance which includes the overhauling of aircraft and engines, structural repair, and hydraulics repair; engine testing/run-in; instrument repair/maintenance; metal fabrication; plating operations; electronics equipment maintenance and repair; steam generation (boiler house); and, wastewater treatment. The following list of operations identifies the types of substances approved for accomplishing a given operation (USACE, 2006d):

- Wood Aircraft Structural Repair. This entailed the use of glues to bond wood joints; gloss enamels or camouflage paints to finish exterior surfaces; sealers applied to interior surfaces of wood (including enclosed surfaces of wings); and, dope[22] that was applied to the surface of fabric for the purpose of adding tensile strength

- Fuel Tank Repair. Before repair could be initiated, tanks had to be cleaned and old sealing compound removed. Steam was the typical cleaning agent used. Following steam cleaning and removal of old sealant, aliphatic naptha, ethyl acetate, or lacquer thinner was used to ensure that a bare metal surface existed where old sealant had been removed.

- Hydraulics repair. Used hydraulic fluid would be replaced, lines flushed, and hydraulic pumps overhauled (disassembled and inspected for scoring and excessive wear). Hydraulic brake fluid, specific to the system being worked upon, is the primary component used in this operation.

- Plating Operations.
    - Paints, organic coatings, zinc, and cadmium electroplates were most commonly used for protective plating (protection against rusting and corrosion) – copper, nickel and chromium were also used for protective purposes; special surface

[22] Dope was either: a mixture of cellulose dissolved in nitric acid, called nitrate dope; or cellulose dissolved in butyric acid called butyrate dope; in later years a combination of nitrate and butyric dopes was used. (https://www.faa.gov/). Butyric dope was developed during WWII (http://aircraftspruce.com)

plating included tin for solderability, rhodium for reflectance, silver and rhodium for electrical properties, and gold for electrical contact; nickel, chromium iron, copper, lead, silver, gold and tin were used for either their mechanical or chemical properties.

- Cleaning prior to plating. Steps in the cleaning process include: pickling (gross scale removal); mechanical preparation (polishing, buffing); acid dipping; and, rinsing. Degreasing of parts was most commonly accomplished through the use of vapor degreasing with either perchloroethylene (PCE) or trichloroethylene (TCE). The use of TCE was generally restricted during the 1940s to depots and stations specifically authorized for such use. As such, it appears that TCE could have been used at NAS Seattle.

- Engine Overhaul.
  - Engine Removal. Engines would be removed from the aircraft for overhaul while in a hangar. Typically, engines were removed prior to exterior cleaning.
  - Exterior Engine Cleaning. Typically engine cleaning would occur inside a dedicated engine cleaning building, located as close as possible to the base engineering shop. Cleaning of an engine's exterior of grease, oil, and soil involved the use of steam and a steam cleaning compound (Specification No. MIL-C-6135). NAVAER 01-1A-506 recommends using solvent-emulsion compound (Specification No. MIL-C-7122) to remove exterior engine preservation compounds, oil grease, and soil. Relatively clean or recently cleaned engines only required a solvent spray or wipe down with dry cleaning solvent (Specification NO. P-S-6621b) or mineral spirits (Specification No. TT-T-291) or mineral spirits.
  - Interior Engine Cleaning. Engine oil would have been drained into drainage pits and the engine would then be flushed with dry cleaning solvent (Federal Specification No. P-S-661A) at a rate of 200 gallons per minute at 15 to 25 pounds per square inch for approximately 3 minutes. It is not stated what nominal volume of solvent was actually recirculated through the engine.
  - Engine Parts Cleaning. This step was accomplished only after engine disassembly occurred. Several different methods of engine parts cleaning have been identified in records reviewed by USACE: spray method; bath method; washing machine; and TCE vapor condensation method. The first three methods used either kerosene conforming to Federal Specification No. VV-K-211 or cleaning solvent conforming to Federal Specification NO. P-S-661. Photograph H.12 (Appendix H) depicts parts cleaning during 1944 at NAS Seattle.
  - Engine Preservation. Preservatives were applied to metal surfaces on which corrosion would impair the usefulness of the part or assembly, but were not used on all parts. A list of approved preservatives is provided in Appendix F.4.
  - Engine Testing. Reassembled engines were "run-in" prior to being reinstalled into an aircraft. NAS Seattle had two engine test buildings (Motor Test Building,

Bldg 102; Semi-portable Engine Test House, Bldg 212). Reciprocating engines needed to be provided with sufficient air flow for cooling purposes and needed a fuel supply (external fuel storage tank). Oil was also on hand to be added to the engine as needed.

- Electrical Supply/Distribution. The installation existed during the time period when PCB dielectric insulating oil was commonly used in transformers.

- Boiler Plant Operation. Fuel storage in associated with a boiler plant would provide for the opportunity for releasing hazardous constituents into the environment.

The majority of NAS Seattle operations occurred on FUDS ineligible property; however, the following facilities, which may have either used or generated CERCLA hazardous substances, are located on DERP-FUDS eligible property: Hangars No. 1, No. 32 and No. 33; Sewage Pump Pit; transformer house; bomb site repair shop; motor test building; celestial navigation training building; storage buildings; and one of two boiler plants that also had an associated coal storage area. Areas located near the shoreline have also been identified as having "oil burn pits", "garbage pits", and an "incinerator" (Anchor, 2005).

6.2 Property Specific Locations

6.2.1 DERP-FUDS Eligible Locations

Lake Shoreline Area – Oil Burning Pits, Garbage Pits, and Incinerator

In response to hydrocarbon odors detected during the removal of two concrete slabs located near the eastern shoreline of Magnuson Park in 2004, environmental sampling of the area was conducted. This sampling identified gasoline, diesel and jet fuel present in soil at concentrations exceeding MTCA Method A cleanup criteria and unrestricted land use criteria for Simplified Terrestrial Ecological Evaluation (STEE) (HWA, 2005). An environmental assessment, also conducted in 2005, identified oil burn pits, garbage pits, and an incinerator which had been present on the eastern shoreline during DoD control of the property. Sampling conducted as part of the assessment identified heavy oil-range petroleum hydrocarbons, cadmium, lead, and mercury exceeding unrestricted land use MTCA Method A cleanup criteria (Anchor, 2005). Sample results and figures depicting the general locations of these areas of concern are provided in Appendices G.2. and G.3.

Hangars No. 1, No. 32, and No. 33

The specific activities conducted in each of these three hangars were not identified in reviewed records. However, consistent with depot level aircraft maintenance activities conducted at NAS Seattle, the following activities may have been conducted in one or more of these hangars: engine removals, exterior engine degreasing, aircraft surface cleaning, structural repairs, and hydraulic system flushing (this is not an all-inclusive list).

Navy conducted a removal action for TPH and metals contaminated soil indicated to have been associated with the former Transportation Hangar (Bldg 193) (NAVFAC, 2009). The contaminants addressed as part of this removal action are assessed to be indicative of the type of contaminants potentially released at one or more of the three DERP-FUDS eligible hangars.

Bomb Sight Repair Shop (Bldg 66)

Building 66 had been located adjacent to Hangar No. 1's south side. Bomb sight repair/maintenance consisted of exterior inspection, followed by instrument calibration and adjustments to the gyroscope motor. An abbreviated description of field maintenance activities is provided in Appendix G.8. It is expected that field maintenance procedures would be different than the maintenance procedures performed at NAS Seattle. It is not known if the maintenance conducted at NAS Seattle would have used CERCLA hazardous substances. It is noted; however, that elemental mercury could be used to calibrate the bomb sights, as described in the first-hand account of an improvised field calibration procedure (Appendix G.8).

Transformer House (Bldg 226)

The transformer house is located at the southwest corner of Hangar No. 1. The EBS states that NAS Seattle phased out PCB-containing transformers beginning in 1984 with the last shipment of PCB transformers occurring in 1988 (NAVFAC, 1996). Installation Public Works personnel are reported to have stated that there may have been spills or fires at some of the 33 former transformer stations located on that portion of the property transferred under BRAC (NAVFAC, 1996). It is not known if a release or fire had ever occurred at the transformer house (Bldg 226). The property on which the transformer house is located had been transferred to the City of Seattle prior to the Navy phase-out of PCB transformers. No reviewed documents addressed the environmental sampling for PCBs and management of transformers which might have been present on the DERP-FUDS eligible portion of the installation.

Engine/Motor Test Buildings (Bldg 102) and Semi-Portable Test House (Bldg 212)

Engine Test Buildings 102 and 212 were situated across the taxiway on the backside of the skeet houses (northeastern shoreline). Engine/motor test buildings are where repaired/overhauled engines were run-in prior to being reinstalled into aircraft (USACE, 2006d).

During the run-in period, engines required to be cooled. Air cooled motors needed the test building to have good ventilation while liquid cooled engines required ethylene glycol. A fueling system including a fuel tank for the storage of aviation fuel would have been associated with each structure. In addition to fuel, lubricating oil would also have been available.

Sewage Pump Pit (Bldg 117)

Sewage pump pit 117 is located on the southeast corner of Hangar 1. Liquid wastes which were disposed through the sewer system generated from Hanger 1 and any other upstream stream generation points would have passed through this pump pit. The use of oil/water separators has not been identified in reviewed records. Although it is not known what materials may have entered the wastewater system, conducted aircraft maintenance operations included surface cleaning, degreasing, POL fluid change outs, and electroplating. These operations had the potential for generating VOCs, SVOCs, petroleum hydrocarbons, and metals bearing waste streams that had the potential of entering the sewage system.

Celestial Navigation Training Building (Bldg 172)

The celestial navigation training building is located on the southwest side of Hangar 33. No description of the provided training has been provided in reviewed documents. It is possible that training provided in this building was of a classroom nature and did not involve CERCLA hazardous substances.

Stormwater Discharge Points and Lake Washington Sediments

The 1996 EBS describes the property's stormwater system as servicing NAVSTA PS, Seattle; NOAA; and Magnuson Park. This stormwater system was installed during the 1940s and 1950s and conveys stormwater to Lake Washington. Figure 6-1 depicts what the EBS describes as the "existing discharge locations." It is suspected that additional discharge points exist located along the Magnuson Park shoreline. During the property's naval operations, oil/water separators were sometimes placed in laterals located upstream of the main drain lines. Portions of the aircraft landing and fueling aprons, near the hangar buildings, have stormwater collector trenches that discharge to the lake. A trench collection system is described in the 1996 EBS as remaining at the site of demolished Building 283 (Construction Equipment Maintenance Shop). This system connects to an oil/water separator which drained to Lake Washington; however; the current status of this system is unknown (US Navy, 1996).

A 1993 site investigation collected sediments near stormwater outfalls which yielded PAH concentrations that were reported as being comparable to sample results at other locations in Lake Washington (NAVFAC, 1996). Bioassay sampling along the lakeshore, conducted during the summer of 1995, identified three locations where Ecology sediment management standards were exceeded; however, no remediation was required due to the locations not being contiguous. Figure 6-2 depicts the bioassay sampling locations and locations where exceedances occurred. A deed restriction to limit use of sediments at the eastern boundary of the DERP-FUDS ineligible property has been required by Ecology.

Ecology, in their letter of 16 May 1996, states that the eastern portion of Pontiac Bay constitutes a freshwater sediment site, and that: "…at least some of this contamination can be attributed to Navy activities, both associated with the base just before it was closed and possibly associated with the larger historic base. This portion of the site could potentially be divided into two areas, west and east of the NOAA Pier, due to past dredging and evidence that the remaining sediments north of the pier are not as contaminated…the area west of the pier could be remediated separately, ahead of the eastern area, since the direction of sediment transport is to the east. It is also the area most directly attributable to Navy operations. The Navy may choose to either conduct a cleanup in this limited area, or transfer it with deed restrictions to a future owner, recognizing that the Federal government is will still [sic] responsible at a future date. The sediments in the eastern half of Pontiac Bay have a <u>NO FURTHER ACTION with deed restrictions</u> determination."

6.2.2 DERP-FUDS Ineligible Locations

DERP-FUDS ineligible portions of the property identified as having had DoD operations with the potential for past releases of CERCLA hazardous substances to the environment are addressed in the Naval Facilities Engineering Command (NAVFAC) report titled “Final Environmental Baseline Survey, Naval Station Puget Sound" (NAVSTA PS), Seattle, CTO 0104”. The table provided in Appendix G.9 has been excerpted from this report and summarizes the environmental findings of the EBS report.

The previously referenced table identifies a list of 24 buildings and three USTs where storage of hazardous substances or petroleum products occurred but from which no release, disposal, or migration from adjacent areas has occurred. A second list identifies buildings/areas where storage, release, disposal, and/or migration of hazardous substances or petroleum products has occurred, but at concentrations that do not require a removal or a remedial action. These buildings/areas are: Bldg 67, former Bldg 137, stormwater outfall area, and the former plating shop area of Building 2. A third list identifies buildings/areas where storage, release, disposal, and/or migration of hazardous substances or POLs have occurred, and all remedial actions necessary to protect human health and the environment have been taken (including use of deed restrictions). This grouping includes Bldg 98, the auto hobby shop (Bldg 310), pesticide residue tank (Tank 206), former equipment shed (Bldg 206), sewage treatment facilities, former avgas/mogas tank farm, 16 tanks and one UST.

One area not addressed in the EBS is a release of low level radioactivity associated with past use of radioluminescent paint. This former activity was discovered by the City of Seattle while undertaking the rehabilitation of Building No. 2. Information regarding this is provided in Appendix G.10 and below.

Radiological Contamination at Bldgs 2, 12, and 27

The Navy completed a clean-up action in 2015 which addressed radiological contamination at certain portions of Bldg 2, the south shed of Bldg 27, and soil adjacent to Bldgs 2, 12, and 27. This contamination resulted from processes in which radium-226 (Ra-226) was used to make radioluminsescent paint and the subsequent application of the radioluminescent paint on aircraft dials, gauges and compasses. NAS Seattle is reported to have received routine shipments of Ra-226 for this purpose. Confirmation of the radiological contamination occurred in 2010. Additional contaminants are strontium-90 (Sr-90) and cesium-137 (Cs-137). Further information is provided in Appendix G.10. A removal action closeout report was scheduled to be finalized in August 2015; however, this report was not available during preparation of this PA.

Hangar 2 (Bldg 2)

Operations conducted in Bldg 2 include plating operations; airplane maintenance; and, storage activities (NAVFAC, 1996). After NAS Seattle was decommissioned in 1970, the hangar housed the Marine Corps Reserve motor pool and offices. Specific information regarding the types of plating operations conducted were not discovered during development of this PA. Materials potentially used at Hangar 2 include avgas, lubrication oils, fabric doping fluids, stripping agents, paints, thinners, and organic solvents. Metals exceeding MTCA B cleanup levels in soils beneath the floor of a former plating shop were reported in 1994; groundwater was sampled and reported in 1995 to contain arsenic and manganese exceeding MTCA Method B criteria but were also comparable to background levels Additionally, no VOCs or SVOCs were detected in groundwater samples collected during the 195 sampling event (NAVFAC, 1996).

Engine/Motor Test Buildings (Bldg 17)

Engine Test Building 17 is located just south of Bldg 2, the "assembly and repair shop." Engine/motor test buildings are where repaired/overhauled engines were run-in prior to being reinstalled into aircraft. Engine test buildings were typically located near or adjacent to the engine repair and engine storage buildings (USACE, 2006d).

During the run-in period, air cooled motors needed the test building to have good ventilation while liquid cooled engines required ethylene glycol. A fueling system and fuel tank for the storage of aviation fuel would have been associated with each motor test facility. Lubricating oil would also have been available and added to the engine on an as needed basis.

Vehicle Maintenance and Storage Garage (Bldg 67)

Bldg 67, located west of Bldg 2, had been used since the late 1930s as a vehicle maintenance and storage garage. This facility had maintenance stalls, some of which had oil/water sumps and hydraulic lift stations. Materials used likely included lubrication oils, petroleum distillates, thinners, lacquers, paints, gasoline, diesel fuel, and engine oil. Two monitoring wells were installed in vicinity to Bldg 67 during a 1992-93 site investigation. No detections of VOCs or SVOCs were reported in groundwater or soils at Bldg 67 (NAFVAC, 1996).

Wastewater Treatment Plant (Bldgs 110 thru 113)

The installation's wastewater treatment plant was located at the very northwestern portion of the contiguous property. A definitive description of the NAS Seattle wastewater treatment plant (WWTP) process train was not available during development of this PA. A WWTP designed for an installation the size of NAS Seattle typically would have had a trickling filter as part of its treatment train. Trickling filters of this era utilized elemental mercury to provide a seal for its distribution column. A full charge of mercury present in "Pacific Flush Tank" reaction-type distributors is known to have ranged between 15 to 40-lbs depending upon size/capacity of the trickling filter (USACE, 2006c).

Former Laundry (Bldg 137)

The former Laundry (Bldg 137) is located west and adjacent to Bldg 5. The EBS describes Bldg 137 as having been used as a dry cleaning facility from the 1940s until its demolition in 1983. The EBS states that Stoddard solvent was the dry cleaning agent used, but also allows that other organic chemicals or solvents may have also been used prior to the 1960s. With regard to what other cleaning agents might have been used, by 1940 annual carbon tetrachloride use by the U.S. drycleaning industry was estimated to be 45 million pounds versus 12 million pounds of PCE and 5 million pounds of TCE[23].

[23] https://drycleancoalition.org/chemicals/ChemicalsUsedInDrycleaningOperations.pdf

An isolated soil sample from a depth of 12-ft bgs is reported to have contained Stoddard's Solvent exceeding MTCA A cleanup criteria at the southeast corner of the building where an UST had been formerly located. As reported in the EBS, monitoring wells installed in vicinity to Bldg 137 in 1993 were under artesian conditions and were non-detect for VOCs or SVOCs It is unclear as to the number of wells installed to detect potential releases from Bldg 137, as the EBS provides two incongruent statements: 1) "Monitoring wells were installed in 1993…to determine if chemicals were released from the former laundry facility…" and, 2) "…no diesel-range compounds were detected in the monitoring well near Building 137." Ecology requires the implementation of land use restrictions for laundry facility subsurface soils.

Boiler Plant and Coal Storage (Bldg 186)

The boiler plant is located in the southwestern portion of the installation. Adjacent to the boiler plant is an area depicted as a coal storage yard (Navy, 1944). Management of generated fly ash has not been addressed in reviewed documents and it is not known how fly ash had been managed. Coal and fly ash storage have the possibility of releasing metals into the vadose zone and groundwater through dissolution by rainwater. The boiler plant likely used mercury filled manometers as well as mercury switches. Boiler plant maintenance operations had the potential for using materials that could have generated CERCLA hazardous substances.

Contamination Associated with Transport Hangar (Bldg 193)

Petroleum contaminated soil was discovered during 2008 wetland construction activities in an area proximate to where former Transport Hangar (Bldg 193) had been located. This area is generally described as being in the southeastern portion of Manguson Park and is bordered by Lake Washington shoreline to the east, NE 65th Street to the south, former Navy Base buildings to the west, and grass playfields and the NOAA campus to the north. Characterization of the wetland construction area, conducted by the City of Seattle, indicated contamination at five locations (SA-1 through SA-5). Contaminants in excess of MTCA cleanup criteria were TPH as DRO, TPH as heavy oil, arsenic, cadmium, and lead (NAVFAC, 2009). PAHs were also detected in samples collected during excavation. During characterization of the sites, SA-3 through SA-5 were remediated.

Remediation (excavation and off-site disposal) commenced in July 2009 of SA-1 and SA-2 along with two hot-spot areas located beyond the excavation limits of SA-1 and SA-2. Groundwater entering excavation SA-1 was found to contain TPH as DRO and heavy oils that exceeded MTCA Method A groundwater cleanup levels. Additional groundwater sampling, as well as historic sampling, did not reproduce the concentration of TPH as found at SA-1. Groundwater sampled at excavations SA-1 and SA-2 were reported as not having metal concentrations exceeding the associated MTCA Method A cleanup criteria. A total of 4,059 tons of contaminated soil was excavated from delineated areas. The cleanup action is documented in the report titled "Final Site Characterization and Removal Action Report for Response Action for Contaminated Soils at Former Sand Point Naval Station Source Areas 1 and 2, Seattle Washington". Figures and remedial action confirmation sample results are provided in Appendix G.4 (ECC, 2009).

It is noted that the figures depicting sample locations and excavated areas do not depict landmarks and therefore it is difficult to state with certainty what former NAS activity generated this contamination. However, the former Transport Hangar is the most significant NAS Structure which had been in vicinity to the discovered contamination.

Pesticide Residue Tank (Bldg 206)

Pesticides were stored, mixed, and prepared in Bldg 206 which was located on the north end of Bldg 115 and west of Bldg 11. The tank itself was an UST/sump where pesticide dispensing equipment and residual products from canisters were cleaned and drained to. The tank was decommissioned during the mid-1970s. Groundwater monitoring conducted during 1992 and 1993 yielded no detections of VOCs, SVOCs, PCBs, or chlorinated herbicides greater than MTCA B criteria. Nineteen metals were detected at concentrations greater than upgradient results and the concentrations of arsenic exceeded both EPA and MTCA B criteria (NAFVAC, 1996).

Six boreholes sampled in vicinity to the tank yielded no detections of VOCs, SVOCs, PCBs, or chlorinated herbicides. Pesticides were detected at depths of 2.5 to 5.5 bgs at concentrations exceeding MTCA B criteria. The Navy has completed removal of the pesticide tank and adjacent soils (NAVFAC, 1996).

Auto Hobby Shop (Bldg 310)

The Auto Hobby Shop was located in the southern portion of the property. A sump, located in the steam cleaning area on the east side of the building reportedly received various lubrication oils, petroleum distillates, thinners, lacquers, paints, and fuel products. In February 1994, the Navy removed the sump and adjacent soil due to diesel soil concentrations present in one borehole and motor oil soil concentrations in two boreholes exceeding MTCA A cleanup criteria; however, contaminated soil remains beneath the adjacent Service Bay (Bldg 345) (NAVFAC, 1996).

Stormwater Discharge Points and Lake Washington Sediments

A portion of this site, as previously described in Section 6.2.1, is located on DERP-FUDS ineligible property.

6.2.3 Washington Department of Ecology Cleanup Approval (BRAC Property)

Ecology issued a letter dated 16 May 1996 (Appendix G.11) which conveys the determination that "…the release of contaminants into the soil, and surface and ground water at the Sand Point facility no longer poses a threat to human health or the environment. Ecology has requested a Deed Restriction or Restrictive Covenant where there is a potential for release or the contaminated soil could not be removed." This determination is specific to the 151.74 acres conveyed through BRAC. Ecology, in conjunction with this determination, also stipulated the following conditions:

- Soil samples must be taken and evaluated when Bldg 193 (Commissary) is demolished as it was formerly an airplane hangar and materials used in the building could contribute to site contamination.
- That with regard to the residential area (Parcel 2), the NFA is made only with respect to releases previously identified in referenced remedial action reports and does not apply to remedial actions determined necessary as a result of confirmation monitoring.
- A NFA with deed restriction was given to the soils beneath Buildings 2 and 30. Long term monitoring of the sites will take place to assure that metals are not affecting groundwater.
- NFA with deed restrictions was given to the soils below the concrete/asphalt pad at Bldg 137 (former drycleaning facility). Bldg 137 has been removed, and the foundation at that time was being used as a parking lot. Sampling through the concrete identified Stoddard Solvent at a depth of about 12-ft bgs.
- Long term groundwater monitoring of Parcel 4 (light industry) was required to confirm cleanup. This is inclusive of the monitoring associated with Bldg 137.
- Long term monitoring is required of Parcel 5 (North Shore/Tank Farm). A NFA is provided, contingent upon results of the long term monitoring. Avgas pipelines in Parcel 5 had been cleaned and closed. Sampling identified one location with petroleum contamination above MTCA cleanup levels that is located beneath 18 to 24 inches of concrete and rebar (former tarmac area).
- Sediments in the eastern half of Pontiac Bay have a NFA with deed restrictions. The eastern portion (about one-third) of Pontiac Bay constitutes a freshwater sediment site. Ecology attributes “at least some” of the contamination to Navy activities, both associated with the base just before it was closed and possibly associated with the larger historic base.

7.0 Evaluation of CON/HTRW and BD/DR

The former NAS Seattle property has been assessed for areas where containerized hazardous, toxic, and radioactive waste (CON/HTRW) were once managed. These areas are where USTs, above ground storage tanks (ASTs), transformers, hydraulic systems, investigative derived waste (IDW), abandoned inactive monitoring wells, etc. were present during DoD operations. The USTs/ASTs are to either have contained a CERCLA hazardous substances and/or a POL. The former installation was also assessed for unsafe buildings and structures as well as unsafe debris. Such unsafe structures and debris would be managed under the building demolition/debris removal project (BD/DR) project category.

7.1 Evaluation of CON/HTRW Presence and Areas

7.1.1 DERP-FUDS Eligible Property

AVGAS Distribution Lines

The avgas storage and piping system consisted of 15 USTs and associated pumps, valves, pipes, and airplane fueling stations. The system was constructed in the 1930s and 1940s and was deactivated in 1970 when the U.S. Navy decommissioned NAS Seattle (Navy, 1996). The tank farm was located on DERP-FUDS ineligible property. The complete length of the fuel distribution pipeline was approximately 7,275-ft, of which an estimated 1,935 linear ft is on DERP-FUDS eligible property. The remaining pipeline is located on the former BRAC property. Pipeline size varies from 1 to 8 inches in diameter and the piping is entirely underground. The EBS states that the pipeline was abandoned by the early 1960s and was cleaned by the Navy in 1995 (the record does not address if the 1995 cleaning operation included pipelines located on previously transferred property).

Avgas has been a leaded fuel since the 1920s and contains tetraethyl lead as the octane boosting agent. Avgas also contains benzene, toluene, ethylbenzene, xylene, and the lead scavenger EDB. Both EDB and 1,2-DCA[24] were used in non-avgas leaded fuel beginning in the 1940s.

NAVFAC conducted a site investigation along the NAS Puget Sound avgas pipeline in 1993-1994 in which soil samples were collected at discrete locations and analyzed for TPH and lead. The EBS reports that field screened samples "…indicated that TPH is present along most of the avgas lines west of Bldg 27" (NAVFAC, 1996). Although not on DERP-FUDS eligible property, the results provide an indication of the likelihood of leakage from avgas pipelines located on DERP-FUDS eligible property. Reviewed records did not address what occurred to the avgas distribution pipelines present on the DERP-FUDS eligible portion of the property both during and after the transition of the property from naval air station to public park. No reviewed

[24] http://info.ngwa.org/gwol/pdf/041980217.pdf

document indicated that environmental sampling had been conducted along the pipeline located on DERP-FUDS eligible property.

Storage Tanks

The 1944 site plan sheet (Appendix R) depicts three gasoline tanks (tanks numbered 103, 104 and 105) and one fuel oil tank (tank no. 107) which were associated with the motor test facility (Bldg 102) located near the shoreline in the north-northeast portion of NAS Seattle. The property on which these former tanks were located is now NOAA property. Based on discussions with a NOAA employee, five non-Navy USTs were removed and replaced with ASTs, the employee was not aware of any remaining USTs in this area that could date from Navy use (Hurtado, 2008).

The former transmitter site, located on noncontiguous property adjacent to Sand Point Way, southwest of the main installation, had an underground fuel oil storage tank and a paint and oil storage area (Navy, 1944). During the Herrera site visit, no evidence was observed of the fuel oil storage tank. The site has since been converted into a city park and low income housing (Herrera, 2009) and is depicted in Figure 3-10.

A review of the Ecology database for "Regulated Underground Storage Tanks, Inactive Facilities[25]" yields a listing of six USTs, five of which have been removed and one that is exempt. This same database also lists sixteen USTs for NAS Seattle, of which seven are identified as having been closed in place and nine "removed". Although the location of these USTs is not described, the USTs listed for NAS Seattle are interpreted to be located on the approximate 154 acres transferred under BRAC. No USTs are identified on the Ecology "Regulated Underground Storage Tanks, Active Facilities[26]" data base as belonging to either the Navy or NOAA. Ecology database excerpts, specific to the former NAS Seattle property, are provided in Appendix G.7.

7.1.2 DERP-FUDS Ineligible Property

Avgas Tank Farm and Distribution System

The avgas tank farm and piping system consisted of 15 USTs and associated pumps, valves, pipes, and fueling stations. The tank farm had been located in the northwestern portion of the installation (west of Bldg 11 and north of Bldg 98). This storage and distribution system was constructed during the 1930s and 1940s and deactivated in 1970 when the U.S. Navy decommissioned NAS Seattle. The EBS states that due to elevated TPH concentrations present at the former tank farm, 3,800 cy of contaminated soil had been excavated and disposed.

[25] Inactive Facilities have no tanks with status of "Operational", "Deferred", "Temporarily Close", or "Red Tag".
[26] Active Facilities have at least one tank with status of "Operational", "Deferred", "Temporarily Close", or "Red Tag".

The EBS describes 5,340 linear ft of avgas pipeline as being on naval property that had been conveyed under BRAC. As previously described, collected samples indicate that TPH is present along most of the avgas lines located west of Bldg 27. The EBS reports that "…due to the apparent low permeability of the soils surrounding the avgas line, the soils have acted to retard migration of fuel off site. However, the horizontal extent of petroleum hydrocarbon-impacted soils has not been determined."

The reviewed EBS and environmental records and reports do not provide information regarding groundwater monitoring related to either the avgas tank farm or fuel distribution lines. The Ecology letter of 16 May 1996 states that long term groundwater monitoring was to be implemented for the tank farm area and that Ecology's determination of No Further Action is contingent upon the results of the long term monitoring. The EBS states that the tank farm cleanup was based upon soil TPH concentrations. The possibility exists that lead and/or EDB are present in soil, groundwater, or the volatile portion of these contaminants as a vapor in soil pore space.

Boiler Plant (Bldg 12)

Boiler Plant (Bldg 12) historically had oil-fired steam boilers until converted to natural gas. Fuel oil had been supplied via railroad tanker and by barge/ship at Pier No. 1 and stored in Tank 12C, a 100,000 gallon UST. As part of a site investigation conducted during 1992-93, soil samples taken in vicinity to Tank 12C indicated that soils were not impacted by petroleum hydrocarbons (NAVFAC, 1996). In proximity to Bldg 12, the 1944 plan sheet also identifies two fuel oil tanks of unknown type and capacity and one 2,000 gallon gasoline UST. Reviewed documents have not indicated that sampling was conducted in vicinity of these tanks.

Non-Tank Farm USTS

The EBS for the BRAC property identifies seventeen USTs, of which fourteen are listed as having been "removed" and three as having been closed in-place. The former contents of these USTs are identified as either gasoline, fuel oil, diesel, or waste oil. Information regarding these tanks, as reported by the EBS, is provided in Appendix G.12.

Mogas had been stored in two USTs located near Bldg 98, the former gasoline pump house. During a site investigation of the area around Bldg 98, one soil sample obtained from 8.5-ft bgs had 2,900 kg/kg TPH and groundwater water was reported present at 10.5-ft bgs. The EBS states that soil exceeding MTCA Method A cleanup criteria were excavated and properly disposed (NAVFAC, 1996).

7.2 Evaluation of BD/DR Presence and Areas

DOD structures remaining on eligible portions of the property include two hangars on the NOAA property and four magazines on Seattle Parks and Recreation property. All of these structures have been beneficially used by subsequent owners, and therefore are not eligible for projects under the DERP-FUDS program. In addition, based upon visual inspection conducted during the site visit, there is no indication that any of these structures present a hazard.

8.0 Pathway and Environmental Hazard Assessment

This section provides an assessment of the human and environmental exposure pathways and receptors in vicinity of the NAS Seattle FUDS. Each assessment yields a conclusion as to whether potential exists for human and environmental exposures to hazardous substances potentially released during DoD jurisdictional control of NAS Seattle. The source of these potential releases are described in Sections 5, 6 and 7. Contaminants of potential concern at the former NAS Seattle property include PAHs, VOCs (including 1,2-DCA, EDB and TCE), petroleum hydrocarbons, tetraethyl lead, metals, and products of incomplete combustion from the burning of waste oil.

8.1 Ground Water Pathway

The assessment of the groundwater exposure pathway involves the following determinations: can groundwater become contaminated by potential releases that occurred during DoD jurisdictional control of the FUDS; the number and location of groundwater wells producing potable water for either domestic or public use within a 4-mile radius of the FUDS; population serviced by groundwater wells within the 4-mile radius; is there a well-head protection program within the 4-mile radius; and, which of the identified wells have a relatively high likelihood of becoming contaminated (remaining wells by default are identified as having a low likelihood). These determinations allow a conclusion to be made as to whether a potential exists for human exposures to potentially released hazardous substances from former DoD operations of the NAS Seattle FUDS.

8.1.1 Groundwater Targets

One well is identified as having formerly existed on the NAS Seattle FUDS. This well was installed in 1960, abandoned in 1992, and was owned by the U.S. Fish and Wildlife Service (Herrera, 2009). This well's drilling log describes brown and blue clay from 5-ft to 45-ft bgs being underlain by gravel and coarse sand to a total depth of 250 ft bgs. The static water level was recorded as 25-ft bgs. Kyle Sotto, a facility manager for U.S. Fish and Wildlife Service, stated that this well was never used to supply drinking water to the facility and was not used for research purposes due to excess levels of iron. All drinking water to the facility is provided by the City of Seattle and all research water is pumped directly from Lake Washington (Herrera, 2009).

The King County Water and Land Services Groundwater Protection Program "Groundwater Well Viewer" interactive map (Herrera, 2009) identifies no groundwater wells within a 4-mile radius of the property (Figure 8-1). The nearest well is located across Lake Washington.

8.1.2 Groundwater Conclusions

Exposure to contaminants via groundwater is assessed as not being possible due to there not being any documented groundwater wells providing potable water within a 4-mile radius of the NAS Seattle property. Artesian groundwater conditions have been observed along the western periphery of the property and as such, shallow groundwater has the potential of appearing as surface seeps. If surface seeps were to occur in areas of known contamination (i.e. former laundry facility (Bldg 137), Auto Hobby Shop (Bldg 310), avgas distribution lines), dissolved contaminants could be brought to the surface.

8.2 Surface Water Pathway

The assessment of the surface water exposure pathway evaluates whether a potential release has the ability of reaching a surface water body, and includes the identification and evaluation of surface water intakes supplying potable water, fisheries, and surface water sensitive environments within a 15-mile TDL. The assessment yields a conclusion as to whether a potential release can enter a surface water body, and if so, states whether that release has the potential of causing human exposures to released hazardous substances.

8.2.1 Surface Water Targets

The 15-mile TDL encompasses both Puget Sound and Lake Washington (Figure 8-2). Surface water drainage is directed towards Lake Washington and does not have the ability to directly enter other surface waters.

Commercial and sport fishing occur within the 15-mile TDL. The total annual commercial fish and shellfish harvest within the 15-mile TDL was estimated to be 1,300,000 pounds in 2005 (WDFW 2006a). Approximately 225,000 pounds of recreational fish and shellfish harvest was reported to occur within the 15-mile TDL in 2001 (WDFW, 2001). Lake Washington and the ship canal are fresh water bodies and Puget Sound is a salt water body. No drinking water intakes are located within the 15-mile TDL and surface water is not used for irrigation of commercial or forage crops. Recreational use of surface water occurs within the 15-mile TDL (Herrera, 2009).

The site lies within the Puget Sound National Estuary Program area (EPA 2008). The southern resident orca (*Orcinus orca*) is listed as endangered and is known to utilize areas within the 15-mile TDL (50 CFR 226), but not the freshwater habitat adjacent to the property. Additionally, proposed critical habitat for the southern resident orca, which includes all marine waters of Puget Sound (50 CFR 226), is within the 15-mile TDL. Several federally-listed threatened species use surface waters within the 15-mile TDL, including Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*), Puget Sound steelhead (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*) (WDFW, 2006b). Critical habitat for the Puget Sound Chinook salmon includes Puget Sound nearshore (70 CFR 52630), which is also located within the 15-mile TDL.

It was estimated from National Wetlands Inventory (NWI) wetlands maps that approximately 24.4 miles of HRS-qualified wetland frontage is present within the 15-mile TDL (USFWS, 2000) (Figure 8-2).

8.2.2 Surface Water Pathway Conclusions

Surface soil contamination subject to being conveyed to Lake Washington via overland flow is assessed as not present, except for the possibility of lead impacted soils being potentially located in the vicinity of the former machine gun and small arms ranges. Direct discharge of contaminated groundwater to Lake Washington may have occurred and/or may be occurring as the property is located adjacent to the lake and groundwater gradients result in shallow groundwater discharging into the lake. Additionally, Lake Washington has been directly impacted from skeet/trap range use directed over the lake and the fuel transfer operations which occurred at Pier 1.

Due to substantial dilution occurring within the 15-mile TDL, quantifiable impacts to surface water and associated ecosystems are expected to be limited to the Lake Washington near shoreline ecosystems located relatively near outfalls and/or areas of known environmental releases. Although the surface water pathway presents a significant number of human health and environmental targets because the site TDL extends into Puget Sound wetlands, habitat used by threatened and endangered species, and commercial and sport fisheries, actual possible impacts are expected to be associated within habitats located a limited distance from NAS Seattle.

8.3 Soil Exposure and Air Pathways

The assessment of the soil exposure pathway evaluates whether direct exposures to hazardous substances at areas of suspected contamination may occur. The target population for soil exposures includes the property resident population and the nearby resident population that have the potential of visiting the site. The assessment yields a conclusion as to whether property residents and/or nearby residents have a potential for being directly exposed to potentially released hazardous substances.

The assessment of the air exposure pathway evaluates whether hazardous substances are likely to be migrating from the property to the air and includes a determination of the population within the property 4-mile radius and any sensitive populations within ½ mile of the property. The assessment yields a conclusion as to whether there is a potential for human exposure to airborne releases of hazardous substances.

8.3.1 Soil and Air Targets

Based upon US Census Bureau 2000 census data, an estimated 382,596 people reside within 4 miles of both the contiguous and noncontiguous former NAS Seattle property (USCB, 2000) (Figure 8-3). Google maps identify child day care centers, elementary schools, and a hospital located within 2 miles of the property. Table 3-1 and Figures 8-4 through 8-6 respectively list and identify day/child day care facilities, elementary, and high schools located nearest Magnuson Park. The nearest day care facility is “Little Anchor Child Care”, located at 7600 Sand Point NE, Seattle, WA 98115 (appears to be inside the former Bldg 5); the nearest elementary school, “Sand Point Elementary School”, is located adjacent the property at 6208 609th Ave NE, Seattle, WA 98115.

The residential exposure scenario applies to areas adjacent to the property which are predominantly residential as well as FUDS acreage converted to residential use (University of Washington facilities and the Sand Point Community Housing Associations). Recreational users include all visitors to Magnuson Park including users of commercial businesses occupying the rehabilitated former Navy structures. Workers include employees of NOAA, U.S. Department of the Interior/Western Fisheries Research Center, NARA, University of Washington, Seattle Parks Department and construction/utility workers conducting below grade work. Sensitive environments include the Magnuson Park reclaimed wetland areas and the Lake Washington near shore ecosystem.

Regarding the noncontiguous parcels: the former RACON site (Disposal Item No. 25) is occupied by Moorland Park and Moorland's Elementary School (Figure 3-8); the former Low Frequency Navigational Aid (Disposal Item No. 26) is a residential area (Figure 3-9); the former transmitter site (Disposal Item No. 27) is occupied by the Burke-Gilman Playground Park, a Ronald McDonald House (Figure 3-10), and the Children's Center at Burke Gilman Gardens; the former water tower (Disposal Item No. 28) appears to be occupied by a residence and is surrounded by residences (Figure 3-11); a former warehouse (Disposal Item No. 30) is owned by GSA and occupied by the NARA (Figure 3-12); the former Shearwater Housing tracts (Disposal Item No. 40) is occupied by the Thornton Creek School (Figure3-13); and, property formerly associated with the current NARA warehouse (Disposal Item No. 42) is occupied by residential housing (Figure 3-12).

The NWI map (Figure 8-2) depicts an estimated 371 acres of wetlands within the 4-mile TDL (USFWS 2000). The wetlands most at risk to impacts are present on Magnuson Park property. Estimated wetland acreage and population by distance ring are presented in Table 8-1.

The site lies within the Puget Sound National Estuary Program area (EPA 2008). Several federally-listed threatened species use surface waters within the 4-mile TDL, including Puget Sound Chinook salmon, Puget Sound steelhead, and bull trout (WDFW, 2006b).

8.3.2 Soil Exposure and Air Pathway Conclusions

Soil Exposure Pathway

A recreational user of Magnuson Park may be exposed to surface and/or near surface soils potentially containing elevated lead concentrations in the areas of the former machine gun and small arms ranges. Although soil sampling to confirm the presence/absence of elevated lead concentrations has not been conducted, it is known that the historic use of such ranges typically results in lead having been contributed to surface soil. Mitigation of potential exposures may have resulted from any regrading done during redevelopment of the area.

The former water tower site, Parcel 28, is located within a residential area and appears occupied by a residence (Figure 3-11). It is expected that maintenance of the water tower would have included periodic paint scraping followed by application of new paint. Such painting operations could have contributed lead bearing paint to surface soils proximate to the water tower. No characterization of surface soil lead at this location has been reported in reviewed documents. It is possible that use of this area could result in exposures to elevated soil lead concentrations. An additional location where surface metal contamination may be present is the former coal storage yard associated with boiler plant Bldg 186. This former coal storage yard is now a residential area.

Other contamination either known or suspected to exist is described as below grade and inaccessible. However, a construction worker performing subsurface work could potentially encounter subsurface contamination along the avgas distribution pipeline and near locations where former NAS operations may have released CERCLA hazardous substances.

Air Exposure Pathway

Inhalation exposures to VOCs may occur via vapor intrusion (VI) into occupied buildings. Subsurface VOC contamination is potentially present due to past releases of avgas and dry cleaning agents. Although solvents were likely used for degreasing and parts cleaning, the EBS reports non-detect VOC concentrations in groundwater. With regard to potential VI exposures resulting from avgas releases, published literature suggests that VI exposures associated with fuel releases is a relatively rare occurrence (Groundwater Monitoring & Remediation 33, no. 2/Spring 2013/pages 53-57).

Avgas is documented to have been released at the avgas tank farm and along the avgas fueling distribution system. Although the avgas tank farm release was remediated, reviewed data is insufficient to eliminate the VI exposure pathway for VOCs associated with the former avgas tank farm release. Tank farm contaminated soils were remediated based upon TPH concentrations; reviewed documents indicate that no characterization of groundwater or soil was conducted for the avgas volatile constituents BTEX, EDB, and tetraethyl lead. Reviewed documents do not address if contaminated soil exceeding cleanup objectives was left behind due to the proximity of Sand Point Way NE. The nearest residential exposure points appear to occur at the Fairway Estates, located approximately 525-ft west of the former tank farm (Google Maps). The potential for VI to occur at Fairway Estates is mitigated by several factors: distance from source; wet climate; age of release, and, groundwater gradient directed towards Lake Washington (although vapor migration is not controlled by groundwater gradients, potentially impacted groundwater would flow towards Lake Washington).

Tank farm releases also result in a potentially complete VI exposure pathway for the recreational and non-residential occupants of Bldg 11, located south-southeast of the former avgas tank farm. Google Maps indicate that tenants of Bldg 11 include the Cascade Bicycle Club and Seattle Waldorf School. Additional residential and non-residential potential exposure points are located at greater distances and are therefore less likely to experience VI.

The VI exposure pathway cannot be eliminated at this time for releases attributable to the avgas fueling system due to insufficient data. The avgas volatile constituents BTEX, tetraethyl lead, and EDB were not characterized in either soil or groundwater during the investigation of the avgas fuel line as only TPH and lead were sampled and analyzed. This sampling yielded elevated TPH concentrations “along most of the avgas lines west of Building 27” (TPH results east of

Building 27 were not described) and MTCA TPH cleanup standards were exceeded at one location (Navy, 1996). No environmental sampling is indicated to have occurred along the avgas lines located on DERP-FUDS eligible property. Additionally, the layout of the avgas line in the DERP-FUDS eligible property is not known as it was not addressed in reviewed documents.

The VI exposure pathway is assessed as being potentially complete for known and potential releases from the former dry cleaning facility (Bldg 137) due to adjacent buildings being occupied. Soil contaminated with Stoddard solvent is present at a depth of 12-ft bgs (Ecology, 1996); however, solvents other than Stoddard may have also been used as dry cleaning agents since the facility had been a dry cleaner from the 1940s to 1983. The EBS reports that groundwater samples collected in 1993, "in vicinity to Bldg 137", were non-detect for VOCs and SVOCs. Reviewed documents did not disclose the location of the sampled monitoring wells and it is not known if the most appropriate locations were sampled with respect to detecting releases from Bldg 137. Bldg 5, located directly downgradient and adjacent to the former dry cleaner facility, inhibits the placement of downgradient monitoring wells near Bldg 137. Bldg 5 is indicated by Google Maps to be occupied by Sand Point Gallery School of Art, and the Conservation Corps. Little Anchor Child Care is located at 7600 Sand Point Way NE, which also appears to be Bldg 5.

The VI exposure pathway for potential releases associated with degreasing and parts cleaning operations conducted at Bldg 2 (Hangar 2) appears to be incomplete due to the EBS reporting that VOCs and SVOCs were non-detect in groundwater samples collected in vicinity of Bldg 2. Although adjacent buildings are occupied, the reported non-presence of VOCs in groundwater indicates a source is not present. However, it is noted that reviewed documents did not identify the locations of the sampled monitoring wells, therefore it is not known how representative the data is of groundwater conditions beneath the occupied former Hangars 1, 32 and 33.

9.0 Summary and Conclusions

The NAS Seattle FUDS property, located along the western shoreline of Lake Washington, had been a military installation from the 1920s until the last portion of the operating installation was closed in 1995. Total acreage constituting NAS Seattle was approximately 537 acres of which approximately 340 acres were conveyed to non-DoD parties circa 1975 and approximately 197 acres similarly conveyed circa 1998-99. Approximately 340 acres are eligible for DERP-FUDS program funding.

Significant Navy operations conducted on the property include aircraft repair/overhauls, aircraft engine overhauls, torpedo maintenance/repair, bomb sight maintenance/repair, munitions storage; additionally, the installation had the associated ancillary shops required to support the overhauling of aircraft and engines. In addition to the overhaul operations, other significant operations included armed aircraft training missions which were conducted up to 1941, the outfitting of escort carriers produced at the Kaiser Shipyards (Grant et. al., 1996) and Alaska resupply operations. Significant property improvements included: UST and AST fuel storage of at least 175,000 gallons; 7,275-ft of underground avgas distribution pipeline; multiple hangar facilities; electrical transformers, two boiler plants; machine gun and small arms ranges; torpedo shop, seven magazines; 8 runways of up to 3,700-ft in length; wastewater treatment plant; trap and skeet ranges; barracks; and, more than 65 structures to support operations. At the peak of air station operations which occurred during WWII, nearly 8,000 combined military and civilian personnel were either stationed or worked at NAS Seattle.

Current property use of the former NAS Seattle site includes use as public parkland, a NOAA campus occupying approximately 100 acres, University of Washington storage and student studios, and Department of Interior Headquarters for the Western Fisheries Research Center. Adjacent property is predominantly residential with the eastern property border occupied by Lake Washington.

No environmental studies have been conducted of the 340 acres transferred prior to 1975. Environmental studies and cleanups were conducted of the remaining acreage prior to its transfer under BRAC. These studies determined that releases had occurred at the fuel tank farm, along the avgas distribution pipelines, former dry cleaning/laundry facility (Stoddard Solvent), Bldg/Hangar 2 (metals), pesticide/herbicide formulation tank (pesticides), sump in the Auto Hobby Shop (diesel and oil), former Gasoline Pump House, and tanks associated with the former transportation building. Cleanup actions were conducted at the fuel tank farm, pesticide tank, sump at the Auto Hobby Shop, and mogas impacted soils at the former Gasoline Pump House. Ecology has additionally required land use restrictions be enforced at Bldgs 2 and 30 (soils), former dry cleaner/laundry facility (soil), and sediments along shoreline in Pontiac Bay.

The City of Seattle has discovered on two separate occasions petroleum impacted soils during construction related activities. The first of which occurred in 2004 along the Washington Lake shoreline. Sampling confirmed the presence of benzene, gasoline, diesel, JP-4 jet fuel, and lube oil concentrations exceeding Washington environmental standards (HWA, 2005). The City of

Seattle next discovered petroleum related contamination proximate to the former Transport Hangar (Bldg 193) during 2008 wetland construction activities. Contamination included TPH, PAHs, arsenic, cadmium, and lead. Characterization and remediation (dig and haul) was implemented by Naval Facilities Engineering Command Northwest Division during 2008 and 2009. Reviewed documents identified a partial tally of remediated soil to be 4,059 tons removed from two of five delineated areas.

Low level radiological contamination was confirmed present at Bldgs 2, 12, and 27 in 2010 and the Navy completed remediation in 2015. The removal action closeout report was not available during development of this PA.

Aerial photographs depict oil burning pits, garbage disposal pits, and an incinerator along the Lake Washington shoreline during Navy ownership. These locations are now part of Magnuson Park and correlate to the locations of where the city of Seattle discovered POL related contamination in 2004. Further investigation of these areas has not occurred to date.

9.1 Areas That May Warrant No Further Action by DoD

DERP-FUDS Eligible Property

The following areas are assessed as either not having had a release or as having a minimal likelihood of having had a former release of a CERCLA hazardous substance:

- Magazine Areas. Four former magazines are reported to remain intact (hi-explosive magazines 54 and 55, pyrotechnics magazine 43/312, and magazine 19). All other storage magazine buildings have been removed. No MEC has been encountered during development of the property into Magnuson Park. Although no sampling for MC has been conducted, it is assessed that the likelihood for having had a MC release to be very low.

- Bomb Sight Repair Shop (Bldg 66). The Bomb Sight Repair Shop had been located on the south side of Hangar/Bldg No. 1. The nature of work performed is not expected to have generated appreciable quantities of hazardous substances. The use of elemental mercury (Appendix G.8) in recalibrating a bomb sight is assessed as being specific to a problem encountered in a field setting and one which is not likely to have been duplicated in a depot setting.

- Engine/Motor Test Building 102. This facility had been located along the northern shoreline, situated behind the skeet ranges, on what is now NOAA property. The fuel storage tanks associated with this motor test building are reported to have been previously closed.

- Celestial Navigation Training Building (Bldg 172). This facility is located on the south side of Hangar No. 33. It appears that this training would have been a classroom setting and would not have likely caused a release of hazardous substances.

- Sewage Pump Pit (Bldg 117). This sewage pump pit is located on the southeast corner of Hangar 1. Any upstream waste deposited into the sewer line is likely to have passed through this pump pit. Although as-built construction details of the sewage pump were not reviewed, this pump pit is believed to have been a self-contained unit, consisting of a concrete box in which the pump would be located. It is assessed that there is a low likelihood that releases from this pump pit occurred. COPCs include VOCs, SVOCs, petroleum hydrocarbons, and metals.

DERP-FUDS Ineligible Property

The following areas are assessed as either having had a release which was remediated, not having had a release, or as having a minimal likelihood of having released a CERCLA hazardous substance:

- Torpedo Shop (Bldg 20). The torpedo shop had been located on the east side of Bldg 11. Maintenance and modifications were made to torpedoes in this shop. Releases of CERCLA hazardous substances are not expected to have occurred based upon the nature of work performed. The building is not listed as an existing facility in the EBS and therefore is presumed to have been demolished sometime prior to having been transferred to the City of Seattle.

- Engine Test Building (Bldg 17). Engine Test Building 17 is located just south of Bldg 2, the "assembly and repair shop." The building is not listed as an existing facility in the EBS and therefore is presumed to have been demolished sometime prior to having been transferred to the City of Seattle.

- Vehicle Maintenance and Storage Garage (Bldg 67). Located west of Bldg 2, this facility had been used since the late 1930s as a vehicle maintenance and storage garage. Two monitoring wells were installed in vicinity to Bldg 67 during a 1992-93 Navy conducted site investigation. No VOCs or SVOCs were detected in groundwater or soil at Bldg 67.

- Transport Hangar (Bldg 193). This facility is located in the southern portion of the installation. Petroleum contaminated soil was discovered during 2008 wetland construction activities in an area proximate to where former Transport Hangar (Bldg 193) had been located. Characterization and remediation was conducted in 2008-2009. Bldg 193 is described in the EBS as having been converted into a commissary/exchange. This building is no longer standing.

- Pesticide Residue Tank (Bldg 206). Pesticides were stored, mixed, and prepared in Bldg 206 which was located on the north end of Bldg 115 and west of Bldg 11. Groundwater monitoring conducted during 1992 and 1993 yielded no detections of VOCs, SVOCs, PCBs, or chlorinated herbicides greater than MTCA B criteria. Nineteen metals were detected at concentrations greater than upgradient results and the concentrations of arsenic exceeded both EPA and MTCA B criteria. Pesticides were detected at depths of

2.5 to 5.5-ft bgs at concentrations exceeding MTCA B values. The Navy completed removal of the pesticide tank and adjacent soils. (NAVFAC, 1996).

- Auto Hobby Shop (Bldg 310). The auto hobby shop was located in the southern portion of the property, and housed a sump in the steam cleaning area. In February 1994, the Navy removed the sump and adjacent soil due to diesel soil concentrations in one borehole and motor oil soil concentrations in two boreholes that exceeded MTCA A cleanup levels. (NAVFAC, 1996). Bldg 310 is identified in the EBS as being intact.

9.2 Areas That May Warrant FUDS Projects

9.2.1 HTRW

<u>DERP-FUDS Eligible Property</u>

The following areas are assessed as either having had a release or had operations assessed as having had the potential for releasing CERCLA hazardous substances:

- Waste Oil Burn Pits. Historic aerial photographs depict oil burn pits located along the Lake Washington shoreline (Anchor, 2005). Sampling has verified the presence of POL constituents at concentrations exceeding Washington unrestricted land use criteria.

- Garbage Pits. Historic aerial photographs depict an area described as garbage disposal pits located along the Lake Washington shoreline (Anchor, 2005). No reviewed document addressed what materials were placed in these pits.

- Incinerator. Historic aerial photographs depict a former incinerator located along the Lake Washington shoreline (Anchor, 2005). No reviewed document addressed what materials were burned or what ash management practices were employed.

- Machine Gun and Small Arms Ranges. Located on the southernmost portion of the installation, these two ranges were adjacent one another. It is not known how expended bullets were managed during the active period of the installation and it is also not known how soils associated with these ranges were managed during the redevelopment of the property. No characterization of lead soil concentrations has been performed. This area is now part of Magnuson Park and borders a residential area.

- Hangars Nos. 1, 32, and 33. Activities consistent with depot level maintenance which may have been conducted in these hangars include: engine removals, exterior engine degreasing, aircraft surface cleaning, structural repairs, parts degreasing, engine oil draining, and hydraulic system flushing. Navy has previously conducted a removal action for contamination associated with Hangar No. 193, identified as a "transport hangar" (ECC, 2009). The remediated petroleum and metals contaminated soils associated with Hangar No. 193 is assessed as being indicative of the types of contaminants that could have been released at Hangars 1, 32, and 33.

- Transformer House (Bldg 226). The transformer house is located at the southwest corner of Hangar No. 1. Navy first began the phase out of PCB transformers in 1984 which is after the date when the property on which the Transformer House is located had been transferred to the city of Seattle. No reviewed document addressed the management of potential PCB transformers from Bldg 226 and/or described sampling for PCBs at the former Bldg 226 location. Former NAS Seattle Public Works personnel have recounted that there may have been spills or fires at some of the transformer locations on the property transferred under BRAC (Navy 1996). This is assessed to indicate that releases may also have potentially occurred on the DERP-FUDS eligible property.

- Stormwater Discharge Points and Lake Washington Sediments. Bioassay sampling conducted in 1995 identified three locations where Ecology sediment management standards were exceeded. One of these sample locations is on DERP-FUDS eligible property. Ecology identifies the eastern portion of Pontiac Bay as constituting a freshwater sediment site (this area appears to encompass both DERP-FUDS eligible and ineligible property) (Ecology, 1996; Appendix G.11).

- Water Tower (Disposal Parcel No. 28). Painting operations conducted on the water tower is expected to have contributed lead bearing paint to surface soils proximate to the water tower.

DERP-FUDS Ineligible Property

The following areas are assessed as either having had a release or had operations assessed as having had the potential for releasing CERCLA hazardous substances:

- Buildings 2 and 30. Ecology has required long term groundwater monitoring for metals.

- Wastewater Treatment Plant (Bldgs 110 thru 113). The buildings associated with the installation's WWTP appear to have been demolished prior to the property being transferred to the City of Seattle (they do not appear on the EBS "Facility Information" table). Although a trickling filter (TF) is not identified on the previously cited 1944 plan sheet, TFs were commonly part of a WWTP's process train. TFs of that period utilized elemental mercury as a seal for its distribution column. Certain sized TFs are known to have contained up to 40-lbs of elemental mercury (USACE, 2006c). Reviewed documents did not address the demolition of the WWTP and it is not known if the potential presence of mercury had been accounted for during its demolishment.

- Laundry Facility (Bldg 137). The former Laundry (Bldg 137) was located west and adjacent to Bldg 5. Sampling conducted in 1993 identified Stoddard Solvent present at a depth of 12-ft bgs. In addition to Stoddard Solvent, there is the potential that other dry cleaning agents which were typically used between 1943 and 1983 (carbon tetrachloride, PCE and TCE) were also used at this facility. Ecology has required implementation of land use controls for subsurface soil beneath the remaining slab foundation of the former laundry facility.

- Service Bay (Bldg 345). The service bay is located adjacent to the Auto Hobby Shop (Bldg 310) and is reported to have petroleum contaminated soil beneath the building. Ecology requires that upon the building being removed, sampling is to be conducted and removal of contaminated soil if indicated to be a threat to the environment or to human health.

- Boiler Plant and Coal Storage (Bldg 186). This boiler plant (one of two) was located in the southwestern portion of the installation. A coal storage area was located in an adjacent area. Elevated metal soil concentrations may exist due to the potential leaching of metals from the coal stock pile. It is also not known how fly ash generated from the boiler plant was managed.

- Stormwater Discharge Points and Lake Washington Sediments. Bioassay sampling conducted in 1995 identified three locations where Ecology sediment management standards were exceeded. Two of these sample locations are on DERP-FUDS ineligible property. Ecology has required deed restrictions for the eastern half of Pontiac Bay as this portion constitutes a freshwater sediment site (this area appears to encompass both DERP-FUDS eligible and ineligible property).

9.2.2 Military Munitions Response Program (MMRP)

A MRSPP score of "No Known or Suspected Explosive Hazard" was assigned to the munitions response site constituting the machine gun and small arms ranges. Only small arms ammunition had been used at these ranges and as such, does not posed an explosive hazard. The MRSPP tables are provided in Appendix N. Additionally, no MEC has been reported at the site.

A former skeet range, target gun house associated with the skeet range, trap range, magazine (arch type), ordnance material storage building, and pyrotechnic ready locker building were located on current NOAA property. An igloo magazine for dynamite storage, a magazine (arch type), two high-explosive magazines, a small arms pyrotechnic magazine, both a machine gun range and small arms range, firing shed, and a target shelter were located on what is now City of Seattle property (Magnuson Park). Throughout redevelopment of the NAS Seattle property, no discovery of a munition's related explosive threat is known to have occurred.

9.2.3 Potentially Responsible Party (PRP)/HTRW Considerations

None.

9.2.4 PRP/MMRP Considerations

None.

9.2.5 CON/HTRW

The following constitute CON/HTRW data gaps:

- A former fuel tank at the NARA building was closed in place. Documentation of this closure was not available during this PA.

- Documentation addressing the disposition of the UST associated with the former transmitter site (Parcel 1) was not available during this PA. This site is now public parkland located in a residential area.

- Documentation of the characterization (if conducted) of potential releases to soil and/or groundwater from the avgas distribution pipelines located on DERP-FUDS eligible property was not available during development of this PA.

9.2.6 BD/DR

None.

9.3 Environmental Pathway Exposure Assessment

Assessments were conducted of the groundwater, surface water, soil and air exposure pathways to determine whether there is potential for human exposures resulting from potential releases from former Navy operations conducted on the property. The assessment summaries are as follows:

- Groundwater Pathway. Exposure to groundwater via domestic wells is assessed as not being a possible route of exposure due to there being no documented domestic and/or private groundwater wells within a 4-mile radius of the NAS Seattle property providing potable water. Additionally, groundwater flow is towards Lake Washington, away from the adjacent residential population.
- Surface Water Pathway. Due to substantial dilution occurring within the 15-mile TDL, quantifiable impacts to surface water and associated ecosystems are expected to be limited to the Lake Washington near shoreline ecosystems located relatively near outfalls and/or areas of known environmental releases. Surface soil contamination subject to being conveyed to Lake Washington via overland flow is assessed as not present, except for the possibility of lead impacted soil potentially located in the vicinity of the former machine gun and small arms ranges. Direct discharge of contaminated groundwater to Lake Washington may have occurred and/or may be occurring as the property is located adjacent to the lake and groundwater gradients result in shallow groundwater discharging into the lake.
- Soil Pathway. A recreational user of Magnuson Park can be exposed to surface and/or near surface soils potentially containing elevated lead concentrations in the areas of the former machine gun and small arms ranges, and the former water reservoir tower. The former coal storage yard presents the possibility of elevated surface soil metal concentrations resulting from metals leaching from either stockpiled coal and/or fly ash. Other soil contamination either known or suspected to exist is described as below grade and inaccessible; however, a construction worker performing subsurface work could

potentially encounter subsurface contamination along the avgas distribution pipeline and near locations where former NAS operations may have released CERCLA hazardous substances.

- Air Exposure Pathway. Inhalation exposures to VOCs may occur via VI into occupied buildings. Subsurface VOC contamination is potentially present due to past releases of avgas and dry cleaning agents. Although solvents were likely used for degreasing and parts cleaning, the EBS does not report the presence of such solvents in monitored groundwater. Regarding potential VI exposures resulting from avgas releases, published literature suggests that such VI exposures is a relatively rare occurrence.

Appendix A

Reference Sources and Records Reviewed

Reference Sources and Records Reviewed

Herrera Environmental conducted a historical records review at the National Archives and Records Administration (NARA) Pacific Alaska Region facility in Seattle, Washington (contact: Kathleen Crosman, Public Records, 206-336-5121); records reviewed at NARA are summarized in Table 1. Summaries of relevant documents are provided in the following the tables.

A file review also was conducted at the USACE Seattle District Office and summaries of relevant documents are provided below.

Table 1. Records reviewed at NARA-Seattle

Record Group	Accession	Box	Project Number	Name	City	State	Date
103	52A-013	14	N-Wash-21,FCA-12-2	Naval Auxiliary Air Station		WA	
121	74A1679	3/5	N-Wash-553E	Sand Point Reservoir Site	Seattle	WA	
121		263-264	N-Wash-553F	Sand Point Naval Support Activity Old Air Station)	Seattle	WA	
121		176	N-Wash-553	Naval Air Station land, building 266, etc.	Seattle	WA	
121	85-0004	9/10	10-U-WA-822B	Sandpoint Naval Air Station Transmitter Site	Seattle	WA	
121		122	N-Wash-558	Buildings, U.S. Naval and Marine Reserve Training Center	Seattle	WA	
121		201	N-Wash-553F	Sand Point Naval Air Station, Spur Trackage	Seattle	WA	
181		3		Ships and Aircraft Movement	Seattle	WA	1940
181		24		District Planning Dept.	Seattle	WA	1944
181		33		District Operations Office	Seattle	WA	1949
181		17		District Operations Office	Seattle	WA	1952
269		10	GS10-59-31	Naval Air Station	Seattle	WA	1959
269		30	46-8001/2	Naval Air Station, Bldgs. 5D & 266	Seattle	WA	
269		10		Naval Air Station	Seattle	WA	1959
269		11		Naval Air Station	Seattle	WA	
270	93-001	3		Naval Air Station	Seattle	WA	
291	269800001	3	C-Wash-553H	NOAA Regional Center 2 Bldgs.	Seattle	WA	
291	269800001	3	C-Wash-553I	NOAA Regional Center Hangar 1	Seattle	WA	
291	269800001	4	G-Wash-581B	Seattle Army Terminal 3 Bldgs.	Seattle	WA	
291	64A-774	99	N-Wash-553	Sand Point Naval Air Station, Building	Seattle	WA	

Summaries of Relevant Documents

U.S. Navy. November 15, 1940. Letter from Captain Ralph Wood, U.S. Navy, Senior Member of the Board to Study Night Flying Facilities for VPB Airplanes, to the Commandant of the 13th Naval District, via Commander Patrol Wing FOUR (Serial 1619). Subject: Night Flying Facilities for VPB Airplanes. *(RG-181, 13ND, Commandant's Office, Subject Files 1939-1940; Box 3, [Location: 8/29/10], File: A4-3 Ships & Aircraft Movements; NARA-Seattle, WA).* References a seadrome in Lake Washington adjacent to the Naval Air Station.

U.S. Navy. March 31, 1944. Memorandum from Commandant S.A. Taffinder, 13th Naval District to the Commandant of the U.S. Coast Guard (Serial 154009). Subject: Restricted areas in navigable waters; establishment of under Anchorage Regulations. *(RG-181, 13ND, District Planning Department, Central Subject Files 1919-1947; Box 24, [Location: 11/39/11], File: A16-1 (73) 1942-1944; NARA-Seattle, WA).* Sand Point used by seaplanes for landing.

USACE. April 15, 1949. Title 33 – Navigation and Navigable Waters, Part 207 – Navigation Regulations, Seattle District, Corps of Engineers, from Kenneth C. Royall, Secretary of the Army. *(RG-181, 13ND, District Operations Office, Central Subject Files 1946-1950 (Entry 33); Box 9, [Location: 13/2/10], File: H2-14 Target and Torpedo Ranges; NARA-Seattle, WA).* Seaplane restricted area in Lake Washington, U.S. Naval Air Station, Sand Point, Seattle.

U.S. Navy. October 20, 1952. Letter from the Commander of the Naval Air Bases, 13th Naval District, to the Commandant of the 13th Naval District (Serial 566). Subject: Survey of Naval Gunnery, Bombing and Training Areas, Thirteenth Naval District. *(RG-181, 13ND, Entry 37, District Operations Office, Administrative Records 1951-1952; Box 17, [Location: 13/2/12], File: A5-1 1952 Operating Areas, Gun Exercises; NARA-Seattle, WA); (RG-71, 13ND, Real Property Records 1962-1970 (181-65A0664); Box 60, [Location: 7/48/9-0], File: 344 – Aerial Gunnery Targets; NARA-Seattle, WA).* Lake Washington Seaplane Restricted Area.

U.S. Navy. August 25, 1959. Letter from A.W. Walker, Jr., Chief, Buildings Management Division to Asst. Commander for A&DD. *(RG-121; Box 176, [Location: 8/46/5], NARA-Seattle, WA).* Building 266 and 9.31 acres transferred by U.S. Navy to GSA. Present location of NARA Pacific Alaska Region facility.

U.S. Navy. January 18, 1975. Letter from Director Real Estate Division to NOAA. Transfer 100 acres of land (portion of Naval Support Activity, Sand Point) and improvements from GSA to NOAA.

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U.S. HUD. November 22, 1982. Quit Claim Deed between U.S. Secretary of Housing and Urban Development and the City of Seattle. *(RG-121; Boxes 9 & 10, [Location: 9/4/12], NARA-Seattle, WA)*. Former NAS Transmitter Site and Coast Guard facility transferred to City of Seattle. Present location of Burke-Gilman Playground.

NOAA. January 25, 1988. Letter from Kelly Sandy, Director of U.S. Dept of Commerce, Western Administrative Support Center, NOAA to Kevin Stoops, Seattle Parks Department. Letter identifies two potentially hazardous sites from Navy use of the property, including an old burn pit and landfill on the park property and potential underground storage tanks on the NOAA property.

USACE. February 28, 1990. Findings and Determination of Eligibility for Magnuson Park (Sand Point Naval Air Station), FUDS NO. F10WA0031. Three subterranean munitions storage bunkers and an aboveground pyrotechnic magazine remain on park property. These structures were formerly used by the Navy, but were deemed to be in good condition and do not constitute a hazard. The FDE stated: "There is no evidence of unsafe structures or debris, hazardous or toxic waste, or unexploded ordnance resulting from DOD use of the site."

City of Seattle. November 4, 2005. Letter from Kevin Stoops, Seattle Department of Parks and Recreation to Matthew Allen, FUDS Project Manager, USACE. Soil and sediment investigations conducted by HWA GeoSciences in 2003 and 2004, and Anchor Environmental in 2005 identified petroleum hydrocarbons, PAHs, and metals in excess of MTCA cleanup levels along the shoreline of Magnuson Park. The contamination was attributed to Navy use of the area to burn waste oil and garbage; the site should be eligible for cleanup under the FUDS program.

Appendix B

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Appendix C

Abbreviations, Acronyms, and Brevity Codes

Abbreviations, Acronyms, and Brevity Codes

avgas	aviation gas
AR	Army Regulation
AST	above ground storage tank
BD/DR	Building Demolition/Debris Removal
bgs	below ground surface
Bldg	Building
BRAC	Base Realignment and Closure Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CN	phenacyl chloride
COPCs	contaminants of potential concern
CS	o-chlorobenzylmalononitrile
CL	chlorine
CON/HTRW	containerized hazardous, toxic, and radioactive waste
CSCS	Confirmed or Suspected Contaminated Sites (list)
Cs-137	cesium-137
cy	cubic yard
1,2-DCA	1,2-dichloroethane
DERP	Defense Environmental Restoration Program
DoD	United States Department of Defense
DMM	discarded military munitions
DNT	dinitrotoluene
DRO	diesel range organics
EBS	Environmental Baseline Survey
Ecology	Washington State Department of Ecology
EDB	ethylene dibromide
EPA	United States Environmental Protection Agency
FDE	Findings and Determination of Eligibility
FEMA	Federal Emergency Management Agency
ft	feet

FUDS	formerly used defense site
GSA	General Services Administration
HRS	hazard ranking system
Herrera	Herrera Environmental Consultants, Inc.
HTRW	hazardous, toxic, and radioactive waste
ID	identification
INPR	Inventory Project Report
lbs	pounds
LUST	leaking underground storage tank
MC	munitions constituents
MEC	munitions and explosives of concern
MMRP	Military Munitions Response Program
mogas	motor gas
MRS	Munitions Response Site
MRSPP	Munitions Response Site Prioritization Protocol
MSL	mean sea level
MTBE	methyl tertiary butyl ether
MTCA	Washington Model Toxics Control Act
NARA	National Archives and Records Administration
NAS	Naval Air Station
NAVFAC	Naval Facilities Engineering Command
NAVSTA PS	Naval Station Puget Sound
NDAI	No DOD Action Indicated
NFA	no further action
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
NSS	Naval Station Seattle
NWI	National Wetlands Inventory
PA	Preliminary Assessment
PAH	polycyclic aromatic hydrocarbon
PCBs	polychlorinated biphenyls
PCE	perchloroethylene

PETN	pentaerythrite tetranitrate
POL	petroleum, oil, lubricant
PRP	potentially responsible party
PSSS	Property Survey Summary Sheet
PSS	Project Summary Sheet
Ra-226	radium-226
RCRA	Resource Conservation and Recovery Act
RCWM	recovered chemical warfare materiel
RDX	Royal Demolition Explosive (cyclotrimethylenetrinitramine)
RG	Record Group
SHA	Site Hazard Assessment
sq. ft.	square feet
sq. mi.	square mile
Sr-90	strontium-90
TCE	trichloroethylene
TCRA	Time-Critical Removal Action
TDL	target distance limit
TF	trickling filter
TNT	trinitrotoluene
TPH	total petroleum hydrocarbons
USACE	United States Army Corps of Engineers
USCB	United States Census Bureau
USGS	United States Geological Survey
USFWS	United States Fish and Wildlife Service
UST	underground storage tank
UXO	unexploded ordnance
VI	vapor intrusion
VOCs	volatile organic compounds
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WWTP	waste water treatment plant

Appendix D

Glossary
(not used)

Appendix E

Preliminary Assessment Form

Preliminary Assessment Form

Not used. The Preliminary Assessment form (EPA/540/G-91/013, Appendix D) is no longer used by EPA. Information required for HRS scoring of the property is included in Sections 4.0, 5.0, and 8.0 of the PA report.

Appendix F

Munition Constituents
and
Authorized Chemicals

F.1. Pyrotechnics Constituents

Cratering xplosive – During World War II, a cratering explosive having the following composition was developed. 86.6% ammonium nitrate, 7.6% dinitrotoluene, 5.7% ferrosilicon, and 0.1% red dye.[709,710,711]

Ammonium Nitrate and Fuel Oil Explosive (ANFO) – The addition of fuel oil to ammonium nitrate increases the explosive power of straight ammonium nitrate. This explosive mixture requires a booster for detonation. This explosive is used primarily as a blasting agent.[712]

Water Gel and Slurry Explosives – Along with ANFO explosives, the water gel and slurry explosives have virtually replaced dynamite in mining operations. Water gel and slurry explosives have a higher energy content than ANFO, small critical diameter, and can be used in wet conditions. The gel explosives consist of ammonium nitrate with or without other oxidizing agents, explosive or non-explosive sensitizers, fuels, and gelatin forming compounds in an aqueous medium. Slurry explosives contain the same ingredients with additional compounds that bond the solid particles and prevent water from defusing in and out of the slurry. The explosive sensitizers are such compounds as pentolite, TNT, methylamine nitrate, smokeless powder, and nitrostarch. Non-explosive sensitizers can be finely granulated aluminum, gas bubbles in suspension, gas contained in small glass spheres, and porous solids. The fuels include coal dust, urea, sulfur, and various types of hydrocarbons. The gelatin forming compounds include guar guns, carboxymethyl cellulose, resins, and synthetic thickeners. The viscosity of the mass can be altered by the addition of cross-linking agents like sodium tetraborate and potassium dichromate. Glycerol, methanol, and diethylene glycol may be added as antifreezes.[713]

Flares

Illuminating Projectile Compositions - Compositions used in illuminating projectiles consistsof sodium nitrate, magnesium, and laminac A (a binder). The percentages of each component varies with the size of the projectile.[714,715]

Trip Flare Compositions - Two compositions are used in trip flares. The first consists of 21.5% aluminum, 69.5% barium nitrate, 5% sodium oxalate, and 4% sulfur. The second consists of 30.4% magnesium, 26.6% sodium nitrate, 11% strontium nitrate, 16.5% sodium oxalate, 8.3% calcium carbonate, 5% gilsonite, 1.1% castor oil, and 1.1% linseed oil.[716] By 1967, the composition consisted of sodium nitrate, magnesium, and laminac.[717]

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709 TM 9-1910, Military Explosives, 14 Apr 55, p. 207.
710 TM 9-1300-214, Military Explosives, 28 Nov 67, p. 7-85.
711 TM 9-1300-214, Military Explosives, 20 Sep 84, pp. 8-131 to 8-135.
712 Ibid., p. 8-135.
713 Ibid.
714 TM 9-1910, Military Explosives, 14 Apr 55, p. 284.
715 TM 9-1300-214, Military Explosives, 28 Nov 67, p. 13-10.
716 TM 9-1910, Military Explosives, 14 Apr 55, p. 285.
717 TM 9-1300-214, Military Explosives, 28 Nov 67, p. 13-10.

Airport Flare Composition - Airport flares, used to light runways in for or rain or at emergency landing fields, are composed of aluminum, barium nitrate, strontium nitrate, sulfur, and linseed oil.[718,719]

Aircraft Parachute Flare Composition - Aircraft parachute flares had composition of magnesium, sodium nitrate, and laminac. In one formulation, 2% polyvinyl chloride is added.[720,721]

Reconnaissance and Landing Flare Composition – The illuminate in these flares consists of the following components: aluminum, magnesium, barium nitrate, sodium oxilate, sulfur, linseed oil, and castor oil.[722]

Bombardment Flare Composition – The illuminate in this type of flare consists of aluminum, magnesium, barium nitrate, sodium oxalate, linseed oil, and castor oil.[723]

Tow Target Flare Composition - Tow target flares are the flare used to illuminate tow targets for anti-aircraft crews and has the same two formulations as trip flares. The first consists of 21.5% aluminum, 69.5% barium nitrate, 5% sodium oxalate, and 4% sulfur. The second consists of 30.4% magnesium, 26.6% sodium nitrate, 11% strontium nitrate, 16.5% sodium oxalate, 8.3% calcium carbonate, 5% gilsonite, 1.1% castor oil, and 1.1% linseed oil.[724,725]

Photoflash Composition – Used in photoflash cartridges and bombs for nighttime aerial photography, the composition consists of 30% barium nitrate, 40% aluminum, and 30% potassium perchlorate. Ignition is effected by a small charge of lead azide.[726,727]

Pyrotechnic Signals Composition – The composition of the colored illumination compounds used in signals according to a 1955 TM is presented in Table 17 below. The same type of information as presented in a 1967 TM is presented in Table 18 below.

[718] TM 9-1910, Military Explosives, 14 Apr 55, p. 285.
[719] TM 9-1300-214, Military Explosives, 28 Nov 67, p. 13-11.
[720] TM 9-1910, Military Explosives, 14 Apr 55, p. 285.
[721] TM 9-1300-214, Military Explosives, 28 Nov 67, p. 13-11.
[722] TM 9-1910, Military Explosives, 14 Apr 55, p. 286.
[723] Ibid., p. 287.
[724] Ibid.
[725] TM 9-1300-214, Military Explosives, 28 Nov 67, p. 13-11.
[726] TM 9-1910, Military Explosives, 14 Apr 55, p. 287.
[727] TM 9-1300-214, Military Explosives, 28 Nov 67, p. 13-11.

Table 17: Compositions Used in Pyrotechnic Signals, Circa 1955[728]

	White	Green	Amber	Yellow	Red
Magnesium	17%	16%	25%	9%	40%
Aluminum	15	--	--	--	--
Barium Nitrate	55	59	--	--	--
Strontium Nitrate	5	--	--	--	30
Potassium Perchlorate	--	--	50	50	20
Sodium Oxalate	--	--	13	17	--
Hexachlorobenzene	--	21	2	9	5
Copper Dust	--	2	--	--	--
Sodium Resinate	--	--	10	--	--
Asphaltum	5	--	--	12	5
Linseed Oil	3	--	--	3	--
Castor Oil	--	2	--	--	--

Table 18: Compositions Used in Pyrotechnic Signals, Circa 1967[729]

	Ground							Aircraft		
	White 1	White 2	Green 1	Green 2	Red 1	Red 2	Red 3	Red	Yellow	Green
Magnesium	57%	29.5%	33%	16%	33%	30%	19%	18%	18%	17%
Laminac	5	5	5	--	4	7	--	--	--	--
Barium Nitrate	--	49	46	59	--	--	--	--	25	53
Strontium Nitrate	--	16.5	--	--	48	42	4.3	44.5	8	--
Potassium Perchlorate	--	--	--	--	--	9	21.4	24	16	13
Polyvinyl Chloride	--	--	15	--	16	12	--	--	--	--
Hexachlorobenzene	--	--	--	21	--	--	6.4	6	12	13
Copper	--	--	--	2	--	--	--	--	--	--
Sodium Nitrate	38	--	--	--	--	--	--	--	--	--
Asphaltum	--	--	--	--	--	--	7.4	7	--	--
Linseed Oil	--	--	--	2	--	--	--	0.5	4	4
Graphite	--	--	--	--	--	--	2.8	--	--	--
Sodium Oxalate	--	--	--	--	--	--	--	--	17	--

[728] TM 9-1910, Military Explosives, 14 Apr 55, p. 288.
[729] TM 9-1300-214, Military Explosives, 28 Nov 67, pp. 13-11 to 13-12.

F.2. Small Arms Munitions Constituents

APPENDIX D – MUNITIONS CONSTITUENTS TABLE

Small Arms Munitions Constituents

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
Shotgun Cartridges (Note 1)	Cartridge, 20 gage, Shotgun, (Commercial)	Projectile	Guard and Combat - No. 0 or 00 lead shot Trap Shooting – No. 7 ½, 8, or 9 lead shot Hawk Loading – No. 6 Shot	Lead
		Cartridge Case	Propellant – Commercial Smokeless Powder	Note, General
			Primer – Commercial Percussion	Note, General
	Cartridge, 16 gage, Shotgun, (Commercial)	Projectile	Guard and Combat - No. 0 or 00 lead shot Trap Shooting – No. 7 ½, 8, or 9 lead shot Hawk Loading – No. 6 Shot	Lead
		Cartridge Case	Propellant – Commercial Smokeless Powder	Note, General
			Primer – Commercial Percussion	Note, General
	Cartridge, 12 gage, Shotgun, (Commercial)	Projectile	Guard and Combat - No. 0 or 00 lead shot Trap Shooting – No. 7 ½, 8, or 9 lead shot Hawk Loading – No. 6 Shot	Lead
		Cartridge Case	Propellant – SR 7325	Nitrocellulose, Diphenylamine, Graphite, Dinitrotoluene
			Primer – Percussion #209	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum, PETN, Tetracene
	Cartridge, .410, Shotgun, No. 6 shot, M35	Projectile	Filler – No. 6 copper coated lead-antimony-arsenic shot	Copper, Lead, Antimony, Arsenic

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
		Cartridge Case	Propellant – Smokeless Powder (Hercules)	Nitrocellulose, Nitroglycerin, Ethyl Centralite, Potassium Nitrate, Barium Nitrate
			Primer – Percussion #209	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
	Cartridge, 12 gage, Shotgun, No. 00 shot, M19	Projectile	Filler – No. 00 lead-antimony-arsenic shot	Lead, Antimony, Arsenic
		Cartridge Case	Propellant – Smokeless Powder	Note, General
			Primer - Percussion	Potassium Chlorate, Mercury Fulminate, Antimony Sulfide
	Cartridge, 12 gage, Shotgun, No. 00 shot, M162	Projectile	Filler – No. 00 steel shot	Iron
		Cartridge Case	Propellant – WAA 80	NYD
			Primer - #209 with primer mix #955	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
	Cartridge, 12 gage, Shotgun, No. 4 shot, M257	Projectile	Filler – No. 4 lead-antimony shot	Lead, Antimony
		Cartridge Case	Propellant – Smokeless Powder	NYD
			Primer - Percussion	NYD
	Cartridge, 12 gage, Shotgun, No. 4 shot, M274	Projectile	Filler – No. 4 hard lead shot	NA
		Cartridge Case	Propellant – Smokeless Powder	NYD
			Primer - Percussion	NYD
Caliber .22 Cartridges	Cartridge, Caliber .22, Ball, Long Rifle (Commercial)	Projectile	Lead or Lead antimony alloy	Lead, or Lead and antimony

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
		Cartridge Case	Primer integral with cartridge case	Lead Styphanate, Barium Nitrate, Ground Glass, Tetracene, Gum
			Propellant – Lesmok A or	Nitrocellulose, Black Powder (Sodium Nitrate or Potassium Nitrate plus Charcoal and Sulfur)
			Propellant – WRF 360	Nitrocellulose, Nitroglycerin, Diphenylamine, Polyester Adipate, Graphite, Water
	Cartridge, Caliber .22, Ball, Long Rifle, M24	Projectile	Lead antimony with copper alloy jacket	Lead, Antimony, Copper
		Cartridge Case	Primer integral with cartridge case	Lead Styphnate, Barium Nitrate, Ground Glass, Tetracene, Gum
			Propellant – Western Ball or	Double Base
			Propellant – HI SKOR 700X	Nitrocellulose, Nitroglycerin, Ethyl Centralite, Potassium Nitrate, Graphite, Ethyl Alcohol
	Cartridge, Caliber .22, Ball, Hornet, M65	Projectile	Lead antimony with copper alloy jacket	Lead, Antimony, Copper
		Cartridge Case	Primer - No. 200 with primer mix K75 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Nitrocellulose, Tetracene, Prussian Blue Dye, Gum Tragacanth, Gum Arabic
			Primer – 116M with primer composition #282C or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, PETN, Tetracene

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Primer - #44 with primer mix #5061W	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Calcium Silicide, Tetracene
			Propellant – WC 665	Nitrocellulose, Nitroglycerin, Dibutylphthalate, Diphenylamine, Graphite
	Cartridge, Caliber .22, Tracer, Long Rifle, M861	Projectile	Lead or Lead antimony alloy	Lead, or Lead and antimony
			Tracer - red	NYD
		Cartridge Case	Primer integral with cartridge case	Lead Styphnate, Barium Nitrate, Ground Glass, Tetracene, Gum
			Propellant – WRF 360	Nitrocellulose, Nitroglycerin, Diphenylamine, Polyester Adipate, Graphite, Water
Caliber .30 Carbine Cartridges	Cartridge, Caliber .30, Carbine, Ball, M1	Projectile	Lead antimony with copper alloy jacket or brass jacket	Lead, Antimony, Copper or Brass (copper with zinc or tin)
		Cartridge Case	Propellant – WC 820 or	Nitrocellulose, Nitroglycerin, Dibutylphthalate, Diphenylamine, Calcium Carbonate, Sodium Sulfate, Graphite
			Propellant – HPC 5	Nitrocellulose, Nitroglycerin, Ethyl Centralite, Diphenylamine, Graphite
			Primer – No. 30 (FA 675) or	Barium Nitrate, Red Phosphorus
			Primer - #45 with primer compound FA-956 or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Primer – 116M with primer compound #282C or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, PETN, Tetracene
			Primer – 44M with primer compound #5067 or	Barium Nitrate, Lead Styphnate, Tetracene
			Primer – 81M with primer compound #5067W or	Barium Nitrate, Lead Styphnate, Tetracene, Gum
			Primer – 200 with primer mix K75 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Nitrocellulose, Tetracene, Prussian Blue Dye, Gum Tragacanth, Gum Arabic
			Primer – 100 with primer mix K75	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Nitrocellulose, Tetracene, Prussian Blue Dye, Gum Tragacanth, Gum Arabic
	Cartridge, Caliber .30 Carbine, Tracer, M16 (T24)	Projectile	Copper alloy clad steel with lead-antimony slug	Copper , Lead, Antimony, Iron
			Tracer (Tracer compound and igniter composition), R-256 and I-276	R-256 (Strontium Peroxide, Calcium Resinate, Strontium Oxalate, Strontium Nitrate, Magnesium Powder) and I-276 (Barium Peroxide, Magnesium Powder, Calcium Resinate Zinc Stearate, Toluidine dry red)
		Cartridge Case	Propellant – Hercules 3950 or	NYD
			Propellant – HPC 5 or	Nitrocellulose, Nitroglycerin, Ethyl Centralite, Diphenylamine, Graphite

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Propellant – WC 820	Nitrocellulose, Nitroglycerin, Dibutylphthalate, Diphenylamine, Calcium Carbonate, Sodium Sulfate, Graphite
			Primer – No. 30 (FA 675) or	Barium Nitrate, Read Phosphorus
			Primer – 116M with primer compound #282C or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, PETN, Tetracene
			Primer – 44M with primer compound #5067 or	Barium Nitrate, Lead Styphnate, Tetracene
			Primer – 81M with primer compound #5067W or	Barium Nitrate, Lead Styphnate, Tetracene, Gum
			Primer – 200 with primer mix K75 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Nitrocellulose, Tetracene, Prussian Blue Dye, Gum Tragacanth, Gum Arabic
			Primer – 100 with primer mix K75	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Nitrocellulose, Tetracene, Prussian Blue Dye, Gum Tragacanth, Gum Arabic
	Cartridge, Caliber .30, Carbine, Tracer, M27 (T43)	Projectile	Lead antimony with copper alloy clad steel jacket	Lead, Antimony, Copper, Iron

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Tracer R-256, I-276, and I-310 or	R-256 (Strontium Peroxide, Calcium Resinate, Strontium Oxalate, Strontium Nitrate, Magnesium), I-276 (Barium Peroxide, Magnesium, Zinc Stearate, Toluidine dry red), and I-310 (Black Powder - Sodium Nitrate or Potassium Nitrate plus Charcoal and Sulfur)
			Tracer – R256*2, I-194, I-276 or	R-256*2 (Strontium Nitrate, Magnesium Powder, Strontium Peroxide, Calcium Resinate, Polyvinyl Chloride, Strontium Oxalate, Hydro Fumed Silica), I-194 (Strontium Peroxide, Calcium Resinate, Magnesium Powder), I-276 (Barium Peroxide, Magnesium Powder, Calcium Resinate, Zinc Stearate, Toluidine Red Toner)
			Tracer – R256*2, I-194, I-280	R-256*2 (Strontium Nitrate, Magnesium Powder, Strontium Peroxide, Calcium Resinate, Polyvinyl Chloride, Strontium Oxalate, Hydro Fumed Silica), I-194 (Strontium Peroxide, Calcium Resinate, Magnesium Powder), I-280 (Strontium Peroxide, Magnesium Powder, Calcium Resinate)

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
		Cartridge Case	Propellant – WC 820 or	Nitrocellulose, Nitroglycerin, Dibuthyphthalate, Diphenylamine, Calcium Carbonate, Sodium Sulfate, Graphite
			Propellant – HPC 5	Nitrocellulose, Nitroglycerin, Ethyl Centralite, Diphenylamine, Graphite
			Primer – No. 30 (FA 675) or	Barium Nitrate Read Phosphorus
			Primer – 116M with primer compound #282C or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, PETN, Tetracene
			Primer – 44M with primer compound #5067 or	Barium Nitrate, Lead Styphnate, Tetracene
			Primer – 81M with primer compound #5067W or	Barium Nitrate, Lead Styphnate, Tetracene, Gum
			Primer – 200 with primer mix K75 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Nitrocellulose, Tetracene, Prussian Blue Dye, Gum Tragacanth, Gum Arabic
			Primer – 100 with primer mix K75	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Nitrocellulose, Tetracene, Prussian Blue Dye, Gum Tragacanth, Gum Arabic
Caliber .30 Rifle and Machine Gun Cartridges	Cartridge, Ball, Caliber .30, M1	Projectile	Lead antimony with gilding metal jacket	Lead, Antimony
		Cartridge Case	Propellant – IMR 6971	NYD

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Primer – No. 26 (FA 70 or FA675)	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT) or FA 675 (Barium Nitrate, Red Phosphorus)
	Cartridge, Caliber .30, Incendiary, M1	Projectile	Steel body with gilding metal jacket and lead body filler	Iron, Lead
			Incendiary Mix – IM-11	Barium Nitrate, Magnesium-Aluminum Alloy
		Cartridge Case	Propellant – IMR 6971	NYD
			Primer – No. 26 (FA 70 or FA675)	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT) or FA 675 (Barium Nitrate, Red Phosphorus)
	Cartridge, Caliber .30, Tracer, M1	Projectile	Lead antimony slug with gilding metal clad steel jacket	Lead, Antimony, Iron
			Tracer (Igniter composition and tracer composition), R256 and I-276	R-256 (Strontium Peroxide, Calcium Resinate, Strontium Oxalate, Strontium Nitrate, Magnesium) and I-276 (Barium Peroxide, Magnesium, Zinc Stearate, Toluidine dry red)
		Cartridge Case	Propellant – IMR 4895 or	Nitrocellulose, 2,4-Dinitrotoluene
			Propellant – IMR 17 1/2	Nitrocellulose, 2,4-Dinitrotoluene
			Primer – No. 26	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT) or FA 675 (Barium Nitrate, Red Phosphorus)

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
	Cartridge, Caliber .30, AP, M2	Projectile	Hardened steel core with gilding metal jacket and lead-antimony point filler	Iron, Lead, Antimony
		Cartridge Case	Propellant – WC 852 or	Nitrocellulose, Nitroglycerin, Dibutylphthalate, Diphenylamine, Calcium Carbonate, Potassium Nitrate, Sodium Sulfate, Graphite
			Propellant – IMR 4895	Nitrocellulose, Dinitrotoluene, Diphenylamine, Potassium Sulfate, Graphite
			Primer – No. 26 (FA 70 or FA675) or	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT) or FA 675 (Barium Nitrate, Red Phosphorus)
			Primer - #34 with primer compound FA-956	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
	Cartridge, Caliber .30, Ball, M2	Projectile	Gilding metal clad steel with lead antimony core	Steel, Lead antimony
		Cartridge Case	Propellant – IMR 4895 or	Nitrocellulose, 2,4-Dinitrotoluene
			Propellant – WC852 or	Nitrocellulose, Nitroglycerin, Dibutylphthalate, Diphenylamine, Calcium Carbonate, Potassium Nitrate, Sodium Sulfate, Graphite
			Propellant – IMR 4895	Nitrocellulose, Dinitrotoluene, Diphenylamine, Potassium Sulfate, Graphite

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Propellant – CMR 100	Nitrocellulose, Dinitrotoluene, Diphenylamine, Graphite, Potassium Sulfate
			Primer – No. 26 or	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT) or FA 675 (Barium Nitrate, Red Phosphorus)
			Primer - #34 with primer compound FA-956	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
	Cartridge, Caliber .30, API, M14 (T15)	Projectile	Brass with steel core and lead antimony base filler	Brass (copper with zinc or tin), Iron, Lead, Antimony
			Incendiary Composition – IM-11	Barium Nitrate, Magnesium-Aluminum Alloy
		Cartridge Case	Propellant – WC 852 or	Nitrocellulose, Nitroglycerin, Dibutylphthalate, Diphenylamine, Calcium Carbonate, Potassium Nitrate, Sodium Sulfate, Graphite
			Propellant – IMR 4895	Nitrocellulose, Dinitrotoluene, Diphenylamine, Potassium Sulfate, Graphite
			Primer – No. 26 or	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT) or FA 675 (Barium Nitrate, Red Phosphorus)

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Primer - #34 with primer compound FA-956 or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
			Primer - #36 with primer compound FA-961 or	Lead Styphnate, Barium Nitrate, Zirconium, Lead Dioxide, Antimony Sulfide, PETN, Tetracene
			Primer - #205 with primer mix K75 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Nitrocellulose, Tetracene, Prussian Blue Dye, Gum Tragacanth, Gum Arabic
			Primer - #210 with primer mix K75 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Nitrocellulose, Tetracene, Prussian Blue Dye, Gum Tragacanth, Gum Arabic
			Primer - #80 with primer mix #5061W or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Calcium Silicide, Tetracene
			Primer – 84M with primer mix #5074 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Aluminum Powder, Tetracene
			Primer - #120M or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
			Primer – Large Rifle with primer mix #304 or	Lead Styphnate, Barium Nitrate, Calcium Silicide, Antimony Sulfide, Tetracene, Aluminum Powder

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Primer – 72M with primer mix #5061	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Calcium Silicide, Tetracene
	Cartridge, Caliber .30, Ball, Frangible, M22 (T44)	Projectile	50% Bakelite, 50% Powdered lead	Lead, Bakelite (constituents NYD)
		Cartridge Case	Propellant – SR 4759	Nitrocellulose, Potassium Nitrate, Diphenylamine, Potassium Sulfate, Graphite
			Primer – No. 26 or	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT) or FA 675 (Barium Nitrate, Red Phosphorus)
			Primer - #34 with primer compound FA-956	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
	Cartridge, Caliber .30, Tracer, M25 (T10)	Projectile	Lead antimony with gilding metal clad steel jacket	Lead, Antimony, Iron
			Tracer – R256 and I-194 or	R-256 (Strontium Peroxide, Calcium Resinate, Strontium Oxalate, Strontium Nitrate, Magnesium) and I-194 (Magnesium, Strontium Peroxide, Calcium Resinate)

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Tracer – R-321 or R-284, I-136 or R-10-F, I-280*1 or R-20-C	R-321 (Strontium Nitrate, Magnesium Powder, Polyvinyl Chloride, Chlorinated Rubber), R-284 (Strontium Nitrate, Magnesium Powder, Polyvinyl Chloride), I-136 (Strontium Peroxide, Calcium Resinate), R-10-F (Strontium Peroxide, Calcium Resinate, Calcium Silicide, Lead Dioxide, Barium Peroxide), I-280*1(Strontium Peroxide, Magnesium Powder, Calcium Resinate), R-20-C (Strontium Peroxide, Magnesium Powder, Calcium Resinate, Lead Dioxide, Barium Peroxide)
		Cartridge Case	Propellant – WC 852 or	Nitrocellulose, Nitroglycerin, Dibutylphthalate, Diphenylamine, Calcium Carbonate, Potassium Nitrate, Sodium Sulfate, Graphite
			Propellant – IMR 4895	Nitrocellulose, Dinitrotoluene, Diphenylamine, Potassium Sulfate, Graphite
			Primer – No. 26 or	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT) or FA 675 (Barium Nitrate, Red Phosphorus)

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Primer - #34 with primer compound FA-956 or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
			Primer - #36 with primer compound FA-961 or	Lead Styphnate, Barium Nitrate, Zirconium, Lead Dioxide, Antimony Sulfide, PETN, Tetracene
	Cartridge, Caliber .30, Ball, Match, M72	Projectile	Lead antimony slug with gilding metal jacket	Lead, Antimony
		Cartridge Case	Propellant – IMR 4895	Nitrocellulose, Dinitrotoluene, Diphenylamine, Potassium Sulfate, Graphite
			Primer – No. 26 or	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT) or FA 675 (Barium Nitrate, Red Phosphorus)
			Primer - #34 with primer compound FA-956 or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
	Cartridge, Ball, Caliber .30, M1906	Projectile	Lead antimony with cupro-nickel jacket	Lead, Antimony, Copper, Nickel
		Cartridge Case	Propellant – Pyro DG	Nitrocellulose, Diphenylamine, Graphite
			Primer – No. 26	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT)
	Cartridge, Guard, Caliber .30, M1906	Projectile	Lead antimony with cupro-nickel jacket	Lead, Antimony, Copper, Nickel

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
		Cartridge Case	Propellant - Bullseye	Nitroglycerin, Dibutyl Phthalate, Polyester Adipate, Ethyl Centralite, Rosin, Ethyl Acetate, Diphenylamine, N-nitrosodiphenyl-amine, Potassium Nitrate, Potassium Sulfate, Nitrocellulose
			Primer – No. 26	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT) or FA 675 (Barium Nitrate, Red Phosphorus)
	Cartridge, Caliber .30, Tracer, M1917	Projectile	Lead antimony slug with cupro-nickel metal clad steel jacket or cupro-nickel metal jacket	Lead, Antimony, Copper, Nickel, Iron
			Tracer	Barium Peroxide, Magnesium
		Cartridge Case	Propellant – IMR 16 or IMR 17 or IMR 23 or	Nitrocellulose, 2,4-Dinitrotoluene
			Propellant Pyro DG	Nitrocellulose, Diphenylamine, Graphite
			Primer – No. 26	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT) or FA 675 (Barium Nitrate, Red Phosphorus)
	Cartridge, AP, Caliber .30, M1918	Projectile	Steel core, lead-antimony point and base filler and cupro-nickel metal jacket	Iron, Lead, Antimony, Copper, Nickel
		Cartridge Case	Propellant – IMR 1185 or	Nitrocellulose, 2,4-Dinitrotoluene
			Propellant – Pyro DG	Nitrocellulose, Diphenylamine, Graphite

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Primer – No. 26	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT)
	Cartridge, Incendiary, Caliber .30, Model 1918	Projectile	Lead antimony with cupro-nickel jacket and fusible plugs (lead, tin, bismuth)	Lead, Antimony, Copper, Nickel, Tin, Bismuth
			Incendiary mix	Yellow Phosphorus
		Cartridge Case	Propellant	NYD
			Primer – No. 26	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT)
	Cartridge, Gallery Practice, Caliber .30, M1919 also called Cartridge, Guard, Caliber .30, M1 (Note 2)	Projectile	Lead antimony alloy	Lead, Antimony
		Cartridge Case	Propellant – Bullseye or	Nitroglycerin, Dibutyl Phthalate, Polyester Adipate, Ethyl Centralite, Rosin, Ethyl Acetate, Diphenylamine, N-nitrosodiphenyl-amine, Potassium Nitrate, Potassium Sulfate, Nitrocellulose
			Propellant – Dupont No. 80	NYD
			Primer – No. 26	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT) or FA 675 (Barium Nitrate, Red Phosphorus)
	Cartridge, AP, Caliber .30, M1922	Projectile	Tungsten-steel core, lead-antimony point and base filler and gilding metal jacket	Tungsten, Iron, Lead, Antimony

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
		Cartridge Case	Propellant – IMR 1185 or	Nitrocellulose, 2,4-Dinitrotoluene
			Propellant – IMR 17 or IMR 23	Nitrocellulose, 2,4-Dinitrotoluene
			Primer – No. 26	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT)
	Cartridge, Caliber .30, Tracer, M1923	Projectile	Lead antimony slug with cupro-nickel metal clad steel jacket	NA
			Tracer, White W64E (Igniter composition and tracer composition)	NYD
		Cartridge Case	Propellant – IMR 16 or IMR 17 or IMR 23	Nitrocellulose, 2,4-Dinitrotoluene
			Primer – No. 26	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT) or FA 675 (Barium Nitrate, Red Phosphorus)
	Cartridge, Caliber .30, Tracer, M1924	Projectile	Lead antimony slug with gilding metal clad steel jacket	Lead antimony, Clad steel
			Tracer, red (R-131-3 and I-3) or green (G3 and I-3) (Igniter composition and tracer composition)	NYD
		Cartridge Case	Propellant – IMR 16 or IMR 17 or IMR 23	Nitrocellulose, 2,4-Dinitrotoluene
			Primer – No. 26	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT) or FA 675 (Barium Nitrate, Red Phosphorus)
Caliber .32 Cartridges	Cartridge, Caliber .32, Ball (71, 74, or 88 grain bullet)	Projectile	Lead antimony with gilding metal clad steel jacket	Lead, Antimony, Iron

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
		Cartridge Case	Propellant - Bullseye	Nitroglycerin, Dibutyl Phthalate, Polyester Adipate, Ethyl Centralite, Rosin, Ethyl Acetate, Diphenylamine, N-nitrosodiphenyl-amine, Potassium Nitrate, Potassium Sulfate, Nitrocellulose
			Primer - Percussion	NYD
Caliber .38 Cartridges	Cartridge, Caliber .38, Ball (130, 145, or 146 grain bullet)	Projectile	Lead antimony with gilding metal jacket	Lead, Antimony
		Cartridge Case	Propellant - Bullseye	Nitroglycerin, Dibutyl Phthalate, Polyester Adipate, Ethyl Centralite, Rosin, Ethyl Acetate, Diphenylamine, N-nitrosodiphenyl-amine, Potassium Nitrate, Potassium Sulfate, Nitrocellulose
			Primer - Percussion	NYD
	Cartridge, Caliber .38, Ball, Special, M41	Projectile	Lead antimony with gilding metal jacket	Lead, Antimony
		Cartridge Case	Propellant – SR 7325 or	Nitrocellulose, Diphenylamine, Graphite, Dinitrotoluene
			Propellant – HPC 1	Nitrocellulose, Nitroglycerin, Ethyl Centralite, Potassium Sulfate, Graphite
			Primer – Percussion #108M with primer mix #864 or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Tetracene, Aluminum, PETN
			Primer - #49 with primer mix #5061 or	Barium Nitrate, Lead Styphnate, Antimony sulfide, Calcium Silicide, Tetracene

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Primer – 100 with primer mix K75 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Nitrocellulose, Tetracene, Prussian Blue Dye, Gum Tragacanth, Gum Arabic
			Primer - #500 with primer mix #9	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Lead Oxide, Tetracene, PETN
	Cartridge, Caliber .38, Wad Cutter	Projectile	Lead or lead alloy	Lead or Lead alloy
		Cartridge Case	Propellant - Bullseye	Nitroglycerin, Dibutyl Phthalate, Polyester Adipate, Ethyl Centralite, Rosin, Ethyl Acetate, Diphenylamine, N-nitrosodiphenyl-amine, Potassium Nitrate, Potassium Sulfate, Nitrocellulose
			Primer - Percussion	NYD
	Cartridge, Caliber .380, Ball	Projectile	Lead antimony with gilding metal jacket	Lead, Antimony
		Cartridge Case	Propellant - Bullseye	Nitroglycerin, Dibutyl Phthalate, Polyester Adipate, Ethyl Centralite, Rosin, Ethyl Acetate, Diphenylamine, N-nitrosodiphenyl-amine, Potassium Nitrate, Potassium Sulfate, Nitrocellulose
			Primer	NYD
Caliber .45 Cartridges	Cartridge, Caliber .45, Wad Cutter	Projectile	Copper alloy jacket and lead or lead alloy slug	Copper, Lead
		Cartridge Case	Propellant – Smokeless Powder	NYD

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Primer – No. 27 (FA 70)	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT)
	Cartridge, Tracer, Caliber .45, M1	Projectile	Lead antimony with gilding metal jacket	Lead, Antimony
			Tracer (Tracer and igniter compositions)	NYD
		Cartridge Case	Propellant – WC 460 or	NYD
			Propellant - P4768	NYD
			Primer – No. 27 (FA 70)	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT)
	Cartridge, Caliber .45, Shot, M12	Projectile	#7 ½ Lead Shot	Lead
		Cartridge Case	Propellant	NYD
			Primer – No. 27 (FA 70)	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT)
	Cartridge, Caliber .45, Shot. M15	Projectile	#7 ½ Lead Shot	NA
		Cartridge Case	Propellant	NYD
			Primer – No. 27 (FA 70)	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT)
	Cartridge, Caliber .45, Tracer, M26 (T30)	Projectile	Lead antimony with gilding metal clad steel jacket	Lead, Antimony, Iron
			Tracer (Igniter composition and tracer composition), R256 and I-276	R-256 (Strontium Peroxide, Calcium Resinate, Strontium Oxalate, Strontium Nitrate, Magnesium) and I-276 (Barium Peroxide, Magnesium, Zinc Stearate, Toluidine dry red)

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
		Cartridge Case	Propellant – SR 7970	Nitrocellulose, Dinitrotoluene, Diphenylamine, Graphite
			Primer – No. 27 (FA 70)	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT)
	Cartridge, Caliber .45, Ball, M1911	Projectile	Lead antimony with gilding metal jacket or cupro-nickel metal jacket	Lead, Antimony, Copper, Nickel
		Cartridge Case	Propellant – SR 7970 or	Nitrocellulose, Dinitrotoluene, Diphenylamine, Graphite
			Propellant – HPC 18 or	Nitrocellulose, Nitroglycerin, Ethyl Centralite, Potassium Sulfate, Potassium Nitrate, Graphite, Carbon Black
			Propellant - Bullseye	Nitroglycerin, Dibutyl Phthalate, Polyester Adipate, Ethyl Centralite, Rosin, Ethyl Acetate, Diphenylamine, N-nitrosodiphenyl-amine, Potassium Nitrate, Potassium Sulfate, Nitrocellulose
			Primer – No. 27 (FA 70) or	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT)
			Primer - #111M with primer mix #295A or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Tetracene, PETN, Lead Thiocyanate

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Primer - #150 with primer mix K75 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Nitrocellulose, Tetracene, Prussian Blue Dye, Gum Tragacanth, Gum Arabic
			Primer - #73 with primer mix #5061 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Calcium Silicide, Tetracene
			Primer - #15-025 with primer mix #604	NYD
	Cartridge, Caliber .45, Ball, Match, M1911	Projectile	Lead antimony with gilding metal jacket or cupro-nickel metal jacket	Lead, Antimony, Copper, Nickel
		Cartridge Case	Propellant – SR 7970	Nitrocellulose, Dinitrotoluene, Diphenylamine, Graphite
			Primer – No. 27 (FA 70)	FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT)
Caliber .50 Cartridges	Cartridge, Ball, Caliber .50, M1	Projectile, Ball, Caliber .50, M1	Gilding Metal Jacket, Steel Core, Lead-antimony filler	Iron, Lead, Antimony
		Cartridge Case	Propellant - Smokeless	Nitrocellulose, Diphenylamine
			Primer (Priming mix FA No. 90)	NYD
	Cartridge, AP, Caliber .50, M1	Projectile, Armor-Piercing, Caliber .50, M1	Gilding Metal Jacket, Tungsten Chromium Steel Core, Lead-antimony filler	Tungsten, Chromium, Iron, Lead, Antimony
		Cartridge Case	Propellant - Smokeless	Nitrocellulose, Diphenylamine
			Primer (Priming mix FA No. 90)	NYD
	Cartridge, Caliber .50, Tracer, M1	Projectile, Caliber .50, Tracer, M1	Gilding Metal clad steel jacket, Lead-antimony core	Iron, Lead, Antimony

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Tracer, R-256 and I-276	R-256 (Strontium Peroxide, Calcium Resinate, Strontium Oxalate, Strontium Nitrate, Magnesium) and I-276 (Barium Peroxide, Magnesium, Zinc Stearate, Toluidine dry red
		Cartridge Case	Propellant, IMR 5010 or	Nitrocellulose, Dinitrotoluene, Diphenylamine, Potassium Sulfate, Graphite
			Propellant, IMR 4814	Nitrocellulose, 2,4-Dinitrotoluene
			Primer No. 28 w/ FA90A mix (percussion) or	Lead Thiocyanate, Antimony Sulfide, PETN, Potassium Chlorate, Gum Solution
			Primer, Percussion #50M with primer mix #5061W or	Barium Nitrate, Lead Styphnate, Antimony sulfide, Calcium Silicide, Tetracene
			Primer - #35 with primer mix FA-958 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
			Primer - #257 with primer mix #257 or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
			Primer - #315 with primer mix K75	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Nitrocellulose, Tetracene, Prussian Blue Dye, Gum Tragacanth, Gum Arabic
	Cartridge, Caliber .50, Incendiary, M1	Projectile, Caliber .50, Incendiary, M1	Gilding Metal Jacket Steel and Lead-antimony core, Lead-antimony filler	Iron, Lead, Antimony

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Incendiary Mix – IM-11	Barium Nitrate, Magnesium-Aluminum Alloy
		Cartridge Case	Propellant, WC 860 or	Nitroglycerin, Dibutyl Phthalate, Polyester Adipate, Ethyl Centralite, Rosin, Ethyl Acetate, Diphenylamine, N-nitrosodiphenyl-amine, Potassium Nitrate, Potassium Sulfate, Nitrocellulose
			Propellant, IMR 4814	Nitrocellulose, 2,4-Dinitrotoluene
			Primer No. 28 w/ FA90A mix (percussion) or	Lead Thiocyanate, Antimony Sulfide, PETN, Potassium Chlorate, Gum Solution
			Primer, Percussion #50M with primer mix #5061W or	Barium Nitrate, Lead Styphnate, Antimony sulfide, Calcium Silicide, Tetracene
	Cartridge, Caliber .50, Ball, AP, M2	Projectile, Caliber .50, Ball, Armor Piercing, M2	Gilding Metal Jacket Manganese-Molybdenum Steel Core, Lead-antimony filler	Manganese, Molybdenum, Iron, Lead, Antimony
		Cartridge Case	Propellant, WC 860 or	Nitroglycerin, Nitrocellulose, Dibutylphthalate, Diphenylamine, Calcium Carbonate, Potassium Nitrate, Sodium Sulfate, Graphite
			Propellant, IMR 5010 or	Nitrocellulose, Dinitrotoluene, Diphenylamine, Potassium Sulfate, Graphite
			Propellant, IMR 4814	Nitrocellulose, 2,4-Dinitrotoluene
			Primer No. 28 w/ FA90A mix (percussion) or	Lead Thiocyanate, Antimony Sulfide, PETN, Potassium Chlorate, Gum Solution

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Primer, Percussion #50M with primer mix #5061W or	Barium Nitrate, Lead Styphnate, Antimony sulfide, Calcium Silicide, Tetracene
	Cartridge, Caliber .50, Ball, M2	Projectile, Caliber .50, Ball, M2	Gilding Metal Jacket Steel Core Lead-antimony point filler	Iron, Lead, Antimony
		Cartridge Case	Propellant, WC 860 or	Nitroglycerin, Nitrocellulose, Dibutylphthalate, Diphenylamine, Calcium Carbonate, Potassium Nitrate, Sodium Sulfate, Graphite
			Propellant, IMR 4814 or	Nitrocellulose, 2,4-Dinitrotoluene
			Propellant – Propellant Cal .50	Nitrocellulose, Nitroglycerin, Potassium Sulfate, Diphenylamine, Starch, Barium Nitrate
			Primer No. 28 w/ FA90A mix (percussion) or	Lead Thiocyanate, Antimony Sulfide, PETN, Potassium Chlorate, Gum Solution
			Primer, Percussion #50M with primer mix #5061W or	Barium Nitrate, Lead Styphnate, Antimony sulfide, Calcium Silicide, Tetracene
			Primer - #315 with primer mix K75 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Nitrocellulose, Tetracene, Prussian Blue Dye, Gum Tragacanth, Gum Arabic
			Primer - #35 with primer mix FA-958 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Primer - #257 with primer mix #257 or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
	Cartridge, Caliber .50, Ball, API, M8	Projectile, Caliber .50, Ball, API, M8	Gilding Metal Jacket Tungsten Chrome Steel Core Lead-antimony filler	Tungsten, Chromium, Iron, Lead, Antimony
			Incendiary Mix –IM-11 or	Barium Nitrate, Magnesium-Aluminum Alloy
			Incendiary Mix IM-161 or	Barium Nitrate, Magnesium Powder, Aluminum Powder, Potassium Perchlorate, Asphaltum
			Incendiary Mix IM-28	Barium Nitrate, Magnesium Powder, Aluminum Powder, Potassium Perchlorate
		Cartridge Case	Propellant, WC 860 or	Nitroglycerin, Nitrocellulose, Dibutylphthalate, Diphenylamine, Calcium Carbonate, Potassium Nitrate, Sodium Sulfate, Graphite
			Propellant, IMR 5010 or	Nitrocellulose, Dinitrotoluene, Diphenylamine, Potassium Sulfate, Graphite
			Primer No. 28 w/ FA90A mix (percussion)	Lead Thiocyanate, Antimony Sulfide, PETN, Potassium Chlorate, Gum Solution
			Primer, Percussion #50M with primer mix #5061W or	Barium Nitrate, Lead Styphnate, Antimony sulfide, Calcium Silicide, Tetracene
			Primer - #257 with primer mix #257 or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Primer - #35 with primer mix FA-958 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
			Primer - #315 with primer mix K75 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Nitrocellulose, Tetracene, Prussian Blue Dye, Gum Tragacanth, Gum Arabic
	Cartridge, Caliber .50, Tracer, M10	Projectile, Caliber .50, Tracer, M10	Gilding Metal clad steel Jacket Lead-antimony core	Iron, Lead, Antimony
			Tracer – R-256 and I-194 and I-527	R-256 (Strontium Peroxide, Calcium Resinate, Strontium Oxalate, Strontium Nitrate, Magnesium) and I-194 (Magnesium, Strontium Peroxide, Calcium Resinate), I-527 (Barium Peroxide, Magnesium Powder, Calcium Resinate)
		Cartridge Case	Propellant, IMR 5010 or	Nitrocellulose, Tin, Diphenylamine
			Propellant – Propellant Cal .50	Nitrocellulose, Dinitrotoluene, Diphenylamine
			Primer No. 28 w/ FA90A mix (percussion)	Lead Thiocyanate, Antimony Sulfide, PETN, Potassium Chlorate, Gum Solution
	Cartridge, Caliber .50, Tracer, M17 (T9)	Projectile, Caliber .50, Tracer, M17	Gilding Metal clad steel Jacket Lead-antimony core	Iron, Lead, Antimony

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Tracer – R-257, R-256 and I-276 or	R-257 (Strontium Nitrate, Potassium Perchlorate, Calcium Resinate, Strontium Oxalate, Magnesium), R-256 (Strontium Peroxide, Calcium Resinate, Strontium Oxalate, Strontium Nitrate, Magnesium) and I-276 (Barium Peroxide, Magnesium, Zinc Stearate, Toluidine dry red)
			Tracer – R-256*5 and I-280*2 or	R-256 (Strontium Nitrate, Strontium Peroxide, Magnesium Powder, Calcium Resinate, Polyvinyl chloride, Strontium Oxalate), I-280 (Strontium Peroxide, Magnesium Powder, Calcium Resinate)

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			R-284 or R-321 or R256 and I-276 or I-508	R-284 (Strontium Nitrate, Magnesium Powder, Polyvinyl Chloride), R-321 (Strontium Nitrate, Magnesium Powder, Polyvinyl Chloride, Chlorinated Rubber), R-256 (Strontium Nitrate, Strontium Peroxide, Magnesium Powder, Calcium Resinate, Polyvinyl chloride, Strontium Oxalate), I-276 (Barium Peroxide, Magnesium, Zinc Stearate, Toluidine dry red), I-508 (Barium Peroxide, Magnesium Powder, Chlorinated Rubber, Zinc Stearate, Toluidine Red Toner)
		Cartridge Case	Propellant, IMR 5010	Nitrocellulose, Dinitrotoluene, Diphenylamine, Potassium Sulfate, Graphite
			Primer No. 28 w/ FA90A mix (percussion) or	Lead Thiocyanate, Antimony Sulfide, PETN, Potassium Chlorate, Gum Solution
			Primer, Percussion #50M with primer mix #5061W or	Barium Nitrate, Lead Styphnate, Antimony sulfide, Calcium Silicide, Tetracene
			Primer - #315 with primer mix K75 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Nitrocellulose, Tetracene, Prussian Blue Dye, Gum Tragacanth, Gum Arabic

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Primer - #257 with primer mix #257 or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
			Primer - #35 with primer mix FA-958	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
	Cartridge, Caliber .50, API Tracer, M20	Projectile, Caliber .50, API Tracer, M20	Gilding Metal Jacket Tungsten Chrome Steel Core	Tungsten, Chromium, Iron
			Incendiary Mix – IM-11 or	Barium Nitrate, Magnesium-Aluminum Alloy
			Incendiary Mix IM-161 or	Barium Nitrate, Magnesium Powder, Aluminum Powder, Potassium Perchlorate, Asphaltum
			Incendiary Mix IM-28	Barium Nitrate, Magnesium Powder, Aluminum Powder, Potassium Perchlorate
			Tracer – R-257, R-256 and I-276 or	R-257 (Strontium Nitrate, Potassium Perchlorate, Calcium Resinate, Strontium Oxalate, Magnesium), R-256 (Strontium Peroxide, Calcium Resinate, Strontium Oxalate, Strontium Nitrate, Magnesium) and I-276 (Barium Peroxide, Magnesium, Zinc Stearate, Toluidine dry red
			Tracer – R-284 and I-280	R-284 (Strontium Nitrate, Magnesium Powder, Polyvinyl Chloride), I-280 (Strontium Peroxide, Magnesium Powder, Calcium Resinate)

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
		Cartridge Case	Propellant, IMR 5010 or	Nitrocellulose, Dinitrotoluene, Diphenylamine, Potassium Sulfate, Graphite
			Propellant, WC 860	Nitroglycerin, Nitrocellulose, Dibutylphthalate, Diphenylamine, Calcium Carbonate, Potassium Nitrate, Sodium Sulfate, Graphite
			Primer No. 28 w/ FA90A mix (percussion) or	Lead Thiocyanate, Antimony Sulfide, PETN, Potassium Chlorate, Gum Solution
			Primer, Percussion #50M with primer mix #5061W or	Barium Nitrate, Lead Styphnate, Antimony sulfide, Calcium Silicide, Tetracene
			Primer - #35 with primer mix FA-958 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
			Primer - #257 with primer mix #257 or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
			Primer - #315 with primer mix K75	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Nitrocellulose, Tetracene, Prussian Blue Dye, Gum Tragacanth, Gum Arabic
	Cartridge, Caliber .50, Incendiary, M23 (T48)	Projectile	Gilding metal clad steel with lead antimony slug	Iron, Lead, Antimony
			Incendiary Mix – IM-11 or	Barium Nitrate, Magnesium-Aluminum Alloy

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Incendiary Mix – IM 28	Barium Nitrate, Potassium Perchlorate, Magnesium-Aluminum Alloy
		Cartridge Case	Propellant – IMR 4831	Nitrocellulose, Dinitrotoluene, Diphenylamine, Potassium Sulfate, Graphite
			Primer No. 28 w/ FA90A mix (percussion) or	Lead Thiocyanate, Antimony Sulfide, PETN, Potassium Chlorate, Gum Solution
			Primer, Percussion #50M with primer mix #5061W or	Barium Nitrate, Lead Styphnate, Antimony sulfide, Calcium Silicide, Tetracene
			Primer - #257 with primer mix #257 or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
			Primer - #315 with primer mix K75 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Nitrocellulose, Tetracene, Prussian Blue Dye, Gum Tragacanth, Gum Arabic
			Primer - #35 with primer mix FA-958	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
	Cartridge, Caliber .50, Ball, M33	Projectile, Caliber .50, Ball, M33	Gilding Metal Jacket Steel Core Sodium Carbonate Monohydrate and Lead-antimony base filler	Iron, Sodium, Carbonate, Lead, Antimony
		Cartridge Case	Propellant, WC 860 or	Nitroglycerin, Nitrocellulose, Dibutylphthalate, Diphenylamine, Calcium Carbonate, Potassium Nitrate, Sodium Sulfate, Graphite

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Propellant – IMR 5010	Nitrocellulose, Dinitrotoluene, Diphenylamine, Potassium Sulfate, Graphite
			Primer No. 28 w/ FA90A mix (percussion) or	Lead Thiocyanate, Antimony Sulfide, PETN, Potassium Chlorate, Gum Solution
			Primer, Percussion #50M with primer mix #5061W or	Barium Nitrate, Lead Styphnate, Antimony sulfide, Calcium Silicide, Tetracene
			Primer - #257 with primer mix #257 or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
			Primer - #35 with primer mix FA-958	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
			Primer - #315 with primer mix K75 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Nitrocellulose, Tetracene, Prussian Blue Dye, Gum Tragacanth, Gum Arabic
	Cartridge, Caliber .50, Ball, Plastic Practice, M858	Projectile – Polyethylene Plastic		NA
		Cartridge Case, Plastic	Propellant – 10B101	NYD
			Primer - Percussion	NYD
	Cartridge, Caliber .50, Tracer, Plastic Practice, M860	Projectile – Polyethylene Plastic		NA
			Tracer – DAG9591254/4	NYD
		Cartridge Case, Plastic	Propellant – 10B101	NYD
			Primer - Percussion	NYD

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
	Cartridge, Caliber .50, SLAP, M903	Projectile	Penetrator	Tungsten, Nickel, Iron
		Cartridge Case	Propellant – WC 856	Nitrocellulose, Nitroglycerin, Dibutylphthalate, Diphenylamine, Potassium Salts, Sodium Sulfate, Graphite, Calcium Carbonate
			Primer – Percussion Primer compound #979	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum, Tetracene, Iron, Zinc, Silicon
	Cartridge, Caliber .50, SLAP-Tracer, M962	Projectile	Penetrator	Tungsten, Nickel, Iron
			Tracer – R-543 and I-562	R-543 (Strontium Nitrate, Magnesium, Polyvinyl Chloride, Carbon Black), I-562 (Barium Peroxide, Magnesium Powder, Zinc Stearate, Toludine Red Toner
		Cartridge Case	Propellant – WC 856	Nitrocellulose, Nitroglycerin, Dibutylphthalate, Diphenylamine, Potassium Salts, Sodium Sulfate, Graphite, Calcium Carbonate
			Primer – #50M Primer compound #5061W	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Calcium Silicide, Tetracene
	Cartridge, Caliber .50, API, MK 211 Mod 0 or MK 211 Mod 1	Projectile	Brass jacket, steel body with tungsten core	Brass (copper with zinc or tin), Iron, Tungsten

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Incendiary Charge - #136 and Zirconium	Magnesium-Aluminum Alloy, Potassium Perchlorate, Calcium Resinate, Zirconium
			Explosive Charge – Comp A4	RDX, Wax
			Propellant – IMR 5010 or	Nitrocellulose, Dinitrotoluene, Diphenylamine, Potassium Sulfate, Graphite
		Cartridge Case	Propellant – WC 860	Nitroglycerin, Dibutyl Phthalate, Polyester Adipate, Ethyl Centralite, Rosin, Ethyl Acetate, Diphenylamine, N-nitrosodiphenyl-amine, Potassium Nitrate, Potassium Sulfate, Nitrocellulose
			Primer – #50M Primer compound #5061W or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Calcium Silicide, Tetracene
			Primer - #315 with primer mix K75 or	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Nitrocellulose, Tetracene, Prussian Blue Dye, Gum Tragacanth, Gum Arabic
			Primer - #257 with primer mix #257 or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
			Primer - #35 with primer mix FA-958	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Aluminum Powder, PETN, Tetracene
5.56-mm Cartridges	Cartridge, 5.56-mm, Ball, M193	Projectile	Lead Alloy with gilding metal jacket	Lead

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
		Cartridge Case	Propellant – WC 844 or	Nitroglycerin, Nitrocellulose, Dibutyl Phthalate, Diphenylamine, Sodium Sulfide, Graphite, Calcium Carbonate
			Propellant – CMR 170	Nitrocellulose, Nitroglycerin, Methyl Centralite, Ethyl Centralite, Potassium Sulfate, Graphite
			Primer - #41	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum, PETN, Tetracene
	Cartridge, 5.56-mm, Tracer, M196	Projectile	Lead alloy with gilding metal jacket	Lead
			Tracer – R-257, R-256 and I-276 or	R-257 (Strontium Nitrate, Potassium Perchlorate, Calcium Resinate, Strontium Oxalate, Magnesium), R-256 (Strontium Peroxide, Calcium Resinate, Strontium Oxalate, Strontium Nitrate, Magnesium) and I-276 (Barium Peroxide, Magnesium, Zinc Stearate, Toluidine dry red

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Tracer – R-284, I-560, and I-559 or I-561	R-284 (Strontium Nitrate, Magnesium Powder, Polyvinyl Chloride), I-560 (Strontium Peroxide, Strontium Nitrate, Magnesium Powder, Polyvinyl Chloride), I-559 (Strontium Peroxide, Magnesium Powder, Calcium Resinate, Lead Dioxide), I-561 (Strontium Peroxide, Magnesium Powder, Calcium Resinate)
		Cartridge Case	Propellant – WC 844 or	Nitroglycerin, Nitrocellulose, Dibutyl Phthalate, Diphenylamine, Sodium Sulfide, Graphite, Calcium Carbonate
			Propellant – IMR 8208M or	Nitrocellulose, Ethylene Dimethacryl, Diphenylamine, Potassium Sulfate, Graphite
			Propellant – CMR 170	Nitrocellulose, Nitroglycerin, Methyl Centralite, Ethyl Centralite, Potassium Sulfate, Graphite
			Primer – #41 with primer compound FA-956	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum, PETN, Tetracene
	Cartridge, 5.56-mm, Ball, M855	Projectile	Lead alloy with steel core and gilding metal Jacket	Lead, Iron
		Cartridge Case	Propellant – WC 844	Nitroglycerin, Nitrocellulose, Dibutyl Phthalate, Diphenylamine, Sodium Sulfide, Graphite, Calcium Carbonate

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Primer – #41	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum, PETN, Tetracene
	Cartridge, 5.56-mm, Tracer, M856	Projectile	Lead alloy with gilding metal jacket	Lead
			Tracer – R-257, R-256 and I-276 or	R-257 (Strontium Nitrate, Potassium Perchlorate, Calcium Resinate, Strontium Oxalate, Magnesium), R-256 (Strontium Peroxide, Calcium Resinate, Strontium Oxalate, Strontium Nitrate, Magnesium) and I-276 (Barium Peroxide, Magnesium, Zinc Stearate, Toluidine dry red
			Tracer – R-528 and I-194	R-528 (Strontium Nitrate, Magnesium, Polyvinyl Chloride) I-194 (Strontium Peroxide, Calcium Resinate, Magnesium)
		Cartridge Case	Propellant – WC 844T or	Nitrocellulose, Nitroglycerin, Dibutylphthalate, Diphenylamine, Sodium Sulfate, Graphite, Calcium Carbonate
			Propellant, WCR 845	Nitrocellulose, Nitroglycerin, Ethyl Centralite, Diphenylamine, Sodium Sulfate, Graphite, Calcium Carbonate
			Primer – #41	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum, PETN, Tetracene

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
	Cartridge, 5.56-mm, Plastic Practice, M862	Projectile	Plastic – Melamine Formaldehyde	Melamine, Formaldehyde
		Cartridge Case	Propellant – WPR 260	NYD
			Primer – 41-282A	NYD
	Cartridge, 5.56-mm, AP, M995	Projectile		NYD
		Cartridge Case	Propellant – WCR 845	NYD
			Primer – 4.5mm Berdan	NYD
7.62-mm Cartridges	Cartridge, 7.62-mm, Ball, M59	Projectile	Steel core with Lead antimony alloy filler and with gilding metal jacket	Iron, Lead, Antimony
		Cartridge Case	Propellant – WC 846 or	Nitrocellulose, Nitroglycerin, Dibutylphthalate, Diphenylamine, Sodium Sulfate, Graphite, Calcium Carbonate
			Propellant – IMR 4475	Nitrocellulose, Dinitrotoluene, Diphenylamine, Potassium Sulfate, Graphite
			Primer, Percussion #34	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum, PETN, Tetracene
	Cartridge, 7.62-mm, AP, M61	Projectile	Steel core with lead-antimony point and base filler and gilding metal jacket	Iron, Lead, Antimony
		Cartridge Case	Propellant – IMR 4475 or	Nitrocellulose, Dinitrotoluene, Diphenylamine, Potassium Sulfate, Graphite
			Propellant – WC846	Nitrocellulose, Nitroglycerin, Dibutylphthalate, Diphenylamine, Sodium Sulfate, Graphite, Calcium Carbonate

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Primer, Percussion #34	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum, PETN, Tetracene
	Cartridge, 7.62-mm, Tracer, M62	Projectile	Gilding metal clad steel with lead antimony point filler	Iron, Lead, Antimony
			Tracer – R-284 and I-280 and I-136	R-284 (Strontium Nitrate, Magnesium Powder, Polyvinyl chloride), I-280 (Strontium Peroxide, Calcium Resinate), I-136 (Strontium Peroxide, Calcium Resinate)
		Cartridge Case	Propellant – WC 846	Nitrocellulose, Nitroglycerin, Dibutylphthalate, Diphenylamine, Sodium Sulfate, Graphite, Calcium Carbonate
			Primer - #34 with primer composition FA-956	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum, PETN, Tetracene
	Cartridge, 7.62-mm, Ball, M80	Projectile	Lead-antimony alloy slug with gilding metal jacket	Lead, Antimony
		Cartridge Case	Propellant – WC 846 or	Nitrocellulose, Nitroglycerin, Dibutylphthalate, Diphenylamine, Sodium Sulfate, Graphite, Calcium Carbonate
			Propellant – IMR 4475 or	Nitrocellulose, Dinitrotoluene, Diphenylamine, Potassium Sulfate, Graphite
			Primer - #34 with primer compound FA-956	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum, PETN, Tetracene

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Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
	Cartridge, 7.62-mm, Ball, Special, M118	Projectile	Lead antimony alloy with gilding metal jacket	Lead, Antimony
		Cartridge Case	Propellant – WC 846 or	Nitrocellulose, Nitroglycerin, Dibutylphthalate, Diphenylamine, Potassium Salts, Sodium Sulfate, Graphite, Calcium Carbonate
			Propellant - IMR 4895 or	Nitrocellulose, Dinitrotoluene, Diphenylamine, Potassium Sulfate, Graphite
			Propellant - WC750	Nitrocellulose, Nitroglycerin, Dibutylphthalate, Diphenylamine, Potassium Sulfate, Potassium Nitrate, Sodium Sulfate, Graphite, Calcium Carbonate
			Primer – Percussion # 36 with primer compound FA-961 or	Lead Styphanate, Barium Nitrate, Zirconium, Lead Dioxide, Antimony Sulfide, PETN, Tetracene
			Primer, Percussion #34 with primer compound FA-956or	Lead Styphnate, Barium Nitrate, Antimony Sulfide, Aluminum, PETN, Tetracene
			Primer, Percussion #43 with primer compound FA-1023	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Aluminum, Tetracene
	Cartridge, 7.62-mm, Frangible, M160	Projectile	Bakelite	NYD
		Cartridge Case	Propellant – SR 8074 or	Nitrocellulose, Dinitrotoluene, Diphenylamine, Graphite

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Propellant – HPC 8 or	Nitrocellulose, Nitroglycerin, Ethyl Centralite, Diphenylamine, Graphite
			Propellant – WC 140	Nitrocellulose, Nitroglycerin, Diphenylamine, Dibutylphthalate, Calcium Carbonate, Sodium Sulfate, Graphite
			Primer - #34 with primer compound FA-956	Lead Styphnate, Barium Nitrate, Lead Sulfide, Aluminum, PETN, Tetracene
	Cartridge, 7.62-mm, Dim Tracer, M276	Projectile	Gilding metal clad steel with lead-antimony point filler	Iron, Lead, Antimony
			Tracer – R-440 and I-136	R-440 (Strontium Peroxide, Barium Peroxide, Magnesium Carbonate, Calcium Resinate) I-136 (Strontium Peroxide, Calcium Resinate)
		Cartridge Case	Propellant – WC 846	Nitrocellulose, Nitroglycerin, Dibutylphthalate, Diphenylamine, Potassium Salts, Sodium Sulfate, Graphite, Calcium Carbonate
			Primer - #34 with primer compound FA-956	Lead Styphnate, Barium Nitrate, Lead Sulfide, Aluminum, PETN, Tetracene
	Cartridge, 7.62-mm, Match, M852	Projectile	Lead alloy with gilding metal jacket	Lead
		Cartridge Case	Propellant – IMR 4895 or	Nitrocellulose, Dinitrotoluene, Diphenylamine, Potassium Sulfate, Graphite

Weapon	Complete Round	Component	Sub-Component	Chemical Constituents
			Propellant – WC 750	Nitrocellulose, Nitroglycerin, Dibutylphthalate, Diphenylamine, Potassium Sulfate, Potassium Nitrate, Sodium Sulfate, Graphite, Calcium Carbonate)
			Primer - #43 with primer mix FA-1023	Barium Nitrate, Lead Styphnate, Antimony Sulfide, Aluminum, Tetracene
	Cartridge, 7.62-mm, AP, M993	Projectile		NYD
		Cartridge Case	Propellant – Bofors NC1290	NYD
9-mm Cartridges	Cartridge, 9-mm Ball (Commercial)	Projectile		NYD
		Cartridge Case	Propellant - Commercial	NYD
			Primer – Percussion	NYD
	Cartridge, 9 – mm, Ball, M1	Projectile	Lead antimony with gilding metal jacket	Lead, Antimony
		Cartridge Case	Propellant	NYD
			Primer	NYD
	Cartridge, 9-mm, Ball, NATO, M882	Projectile	Lead alloy with gilding metal jacket	Lead
		Cartridge Case	Propellant – HPC 26 or	NYD
			Propellant – HPC 33 or	Nitrocellulose, Nitroglycerin, Vinsol*, Potassium Nitrate, Diphenylamine, Graphite
			Propellant – WPR 280	Nitrocellulose, Nitroglycerin, Ethyl Centralite, Dinitrotoluene, Diphenylamine, Potassium Sulfate, Graphite
			Primer - Percussion	Lead Styphnate, Barium Nitrate, Lead Sulfide, PETN, Tetracene

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* Vinsol is a pine resin and composed of monoterpenoids (e.g., limonene), sesquiterpenoids (e.g., farnesol), and diterpenoids (e.g., abietic acid) (Department of Archaeological Sciences, University of Bradford, UK, www.student.brad.ac.uk/clampert)

AP = armor piercing
API = armor piercing incendiary
NA = Not applicable
NATO =
NYD = Not yet determined
PETN = pentaerythrite tetranitrate
RDX = cyclotrimethylenetrinitramine
SLAP = saboted light armor penetrator
TNT = trinitrotoluene

Note, General – The military often purchased commercial ammunition, propellants, and primers. Although the military standards specified the requirements such as muzzle velocity, chamber pressure, etc., the commercial producers were allowed to use any materials that met these standards. Military manuals do not normally identify the chemical constituents of these items. Some information on components, sub-components, and chemical constituents is extracted from the Defense Ammunition Center MIDAS database.

Note 1 – The military standardized the 12 gage for guard and combat use and the .410 for use as a survival weapon. In the past, the military has acquired commercial weapons in 16 and 20 gage. Additionally, large quantities of commercial ammunition for the various shotguns were acquired.
Note 2 – The Cartridge, Guard, Caliber .30, M1906 is made from second class components generated in the manufacture of the Cartridge, Ball, Caliber .30, M1906.
Note 3 – Information extracted from the Material Safety Data Sheet produced by Olin-Winchester for the complete round of ammunition

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F.3. Authorized Chemicals for Aircraft Maintenance

3.0 AUTHORIZED CHEMICALS AND RELATED MATERIAL USE AND STORAGE PRACTICES

Various chemicals were used in all aspects of field and depot aircraft maintenance operations. When investigating field and depot aircraft maintenance facilities, specific aircraft, aircraft engine, and equipment manuals should be consulted to determine the types of chemicals authorized for specific field and depot aircraft maintenance operations. Site-specific analysis is required to determine the types of aircraft serviced at a given facility. Table 3.1 provides a list of chemicals authorized for use by the War Department, and later by the Department of the Army, between 1944 and 1951. The list was compiled from different versions of TM 9-850, which discusses all chemicals used in abrasion, cleaning, preserving, sealing, and adhesive operations.

Table 3.1, while not related specifically to aircraft maintenance, identifies chemicals authorized for use by the War Department and later by the Department of the Army, specifically the Ordnance Department. This list only pertains to the period from 1942 through 1951; no documents were located that discuss chemicals authorized for use by DOD after this time period. It should be noted that the uses of chemicals authorized by TM 9-850 were often modified by technical bulletins, especially during World War II. For example, TB 9-850-4, dated October 30, 1942, and entitled "Use of Solvent, Dry-Cleaning," directs ordnance personnel that "[d]uring maintenance operations SOLVENT, dry-cleaning, should be used for the general cleaning of all automotive, artillery, and other equipment parts which may be coated with oil or grease. However, Diesel fuel may be used for cleaning Diesel-powered equipment."[161] Similarly, TB 9-850-17, dated March 16, 1945, entitled "Degreasing of Small Arms," discusses the susceptibility of phosphate finishes of small arms to rapid deterioration when degreased with strong alkaline solutions. This TB states the following: "Dry-cleaning solvent is first preference for degreasing small arms, as it does harm phosphate finishes, dries rapidly, is noncorrosive, and has a degreasing action... Hot-water solutions may be used in lieu of dry-cleaning solvent, provided only the prescribed materials and proportions are used."[162] Furthermore, this table should not be construed as being a comprehensive list of chemicals used in the operations discussed. It is important to conduct site-specific research, particularly for World War II operations, to determine which chemicals were associated with certain operations. Tables 3.2, 3.3, and 3.4 provide examples of consumable lists for selected aircraft engines. Table 3.5 presents solvents, thinners, and finishes used in wood aircraft structural repair, and Table 3.6 provides a list of materials used in engine preservation.

[161] TB 9-850-4, "Use of Solvent, Dry Cleaning," War Department, 1944, p. 1 [CEHCX 31114].
[162] TB 9-850-17, "Degreasing of Small Arms," War Department, 1945, p. 1 [CEHCX 31107].

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Table 3.1
Chemicals Authorized for Use by the War Department and the Department of the Army, 1944–1951

Category	Compound	Use	1944	1947	1951
Cleaner	Acetone (Grade B)	Removal of varnish-like deposits from engine parts	x	x	x
	Acid, Boric	A flux in soldering and brazing	x	x	x
	Acid, Chromic	To apply dichromate finish to die cast carburetors and fuel pumps		x	x
	Acid, Nitric (Technical Grade)	To apply dichromate finish to die cast carburetors and fuel pumps		x	x
	Acid, Phosphoric	Rust removal, preparation of iron and steel surfaces for painting	x	x	x
	Acid, Sulfuric	A battery electrolyte		x	x
	Aluminum Oxide	Grinding and polishing metals			x
	Alcohol, Denatured (Grade 2)	Antifreeze for sponging solutions, preparation for paint and varnish removal, emergency substitute for antifreeze compound and paint thinner, solvent or brush cleaner for shellac varnish, prevent ice formations in fuel tanks, cleaning hydraulic brake parts	x	x	x
	Alcohol, Ethyl (Grade 1)	Cleaning of optics of sighting and fire control equipment	x	x	x
	Ammonia, Aqua, ACS, Grade B	Mixed with pure soap and distilled water to form a solution for cleaning optical lenses	x		x
	Benzyl, Technical (Benzene, Grade C)	Remove certain gum deposits formed by oxidation of gasoline, used in preparation of paint and varnish remover	x		x
	Carbon Tetrachloride	Clean electrical wiring and electrical mechanisms that cannot be cleaned with an inflammable solvent because of the fire hazard	x	x	x
	Cleaner, Antistatic	To remove electrostatic charges from methacrylate plastics			x
	Cleaner, Painted Surface, Powdered	Cleaning operations that require a nonabrasive cleaner, cleaning automotive equipment, removing oil, grease, and occupational soil from painted surfaces, and for general soil removal			x
	Compound, Absorbing	To clean surfaces and floors of oil, grease, water, and allied products		x	x
	Compound, Cleaning	Cleaner and neutralizer for cleaning of internal combustion engine systems	x	x	x
	Compound, Cleaning (Alkaline)	Removal of grease, tar, and paint from metal parts and radiators in shops	x	x	x
	Compound, Grease Cleaning	Dissolving grease and oil from engine blocks, chassis, and parts	x	x	x
	Compound, Paint Stripping (Alkali Type)	Removal of paint, lacquer, and enamel from metal surfaces in shops	x	x	x
	Compound, Pickling, Acid	Removal of heavy rust deposits from steel and cast-iron parts			x
	Compound, Steam Cleaning	In high-pressure, steam cleaning of ferrous and nonferrous surfaces of equipment			x

Table 3.1 (continued)
Chemicals Authorized for Use by the War Department and the Department of the Army, 1944–1951

Category	Compound	Use	1944	1947	1951
Cleaner (cont.)	Compound, Vapor Cleaning	Added to water for use in steam cleaning appliances	x	x	x
	Detergent, Lens Cleaning (Liquid)	Final washing of optics before magnesium chloride coating		x	
	Oil, Fingerprint Remover	Removal of fingerprints from finished parts, shells, and polished surfaces prior to application of preservative			x
	Remover, Paint (Alkali Type)	Stripping of alkyd resin, modified ureaformaldehyde alkyd resin, oleoresinous, and nitrocellulose from aluminum, ferrous metal, and nonferrous metals			x
	Remover, Paint and Varnish (Alkali-Organic-Solvent-Type)	Removing multiple coats of paint from motor vehicles, removing paint from silica-base materials such as glass, concrete, and brick			x
	Remover, Paint and Varnish (Type II)	Removal of paint and varnish from metal and wood surfaces	x	x	x
	Soap, Liquid (Lens Cleaning)	Cleansing agent on eye lenses and objective lens on optical equipment		x	
	Soda, Caustic (Lye)	Preparation of target paste, to quicken the action of other cleaning solutions		x	x
	Solvent, Carbon Remover	Removal of gummy deposits from carburetor parts, clean fuel pumps, clean pistons and other parts coated with carbon and varnish-like deposits	x	x	x
	Solvent, Dry Cleaning (Stoddard Solvent)	Cleaning metal surfaces and bearings, removal of oil and grease spots, clean air cleaners and breathers, removal of rust preventive compounds	x	x	
	Solvent, Grease-Cleaning, Self Emulsifying	Removal of oils, greases, asphalts, tars, and preservative type materials			x
	Thinner, Methyl Ethyl Ketene	A thinner in strippable film process for materiel storage			x
	Thinner, Paint, Volatile Mineral Spirits (TPM)	Clean metal surfaces and bearings, remove oil and grease spots, clean air cleaners and breathers, removal of rust preventive compounds, oils, and greases from guns and machine tools being reprocessed after storage			x
	Trichloroethylene	Fluid for vapor degreasing equipment	x	x	x
	Trisodium-Phosphate (Cleaner, Phosphate)	Washing glassware and painted surfaces	x	x	x
Lubricant	Fluid, Hydraulic Brake	Hydraulic brake systems, lubrication of rubber bushings and shackles to stop squeaks	x		
	Fluid, Shock Absorber (Light and Heavy)	Lubrication of brake vacuum and hydria cylinders (light grade), used in house shock absorbers (heavy grade)	x		
	Grease, Aircraft and Instruments	Grease used in ball, roller, and needle bearings, gears and on sliding and rolling surfaces or such equipment as instruments, cameras, electronic gear, and aircraft control systems			x

Table 3.1 (continued)
Chemicals Authorized for Use by the War Department and the Department of the Army, 1944–1951

Category	Compound	Use	1944	1947	1951
Lubricant (cont.)	Grease, Lubricant, Mineral, Ball and Roller Bearing	Intended for a wide range of lubricating applications, including rotating, sliding, or roller bearing surfaces at constant or intermittent high temperatures			x
	Grease, Lubricating, ORD Dept., No. 00 (OG-00)	Lubrication at temperatures below 32 degrees Fahrenheit, protect against corrosion or pitting of ferrous and nonferrous metals			x
	Grease, Lubricating, Primer Seat	Prevent galling of metal surfaces of primer seats after exposure to high firing temperatures			x
	Inhibitor, Corrosion, Volatile Types (Crystals)	Inhibit corrosion on ferrous metals			x
	Oil, Cutting, Mineral, Fatty, Sulfurized	A coolant and lubricant for cutting tools on high-speed lathes, multiple spindle, automatic screw machines, and other machines			x
	Oil, Cutting, Mineral-Lard (Grade 3)	A cutting oil and coolant for machine cutting tools			x
	Oil, Cutting, Mineral-Lard, Sculpture Treated	A cutting oil and coolant for machine cutting tools			x
	Oil, Engine Preservative, SAE-10 and SAE-30 (PE-10 and PE-30)	Protect against high humidity and moisture condensation and has the ability to neutralize acidic products of combustion within an internal combustion engine, preservative of internal combustion engines during shipment and limited storage, a lubricant for distances up to 500 miles			x
	Oil, Hydraulic, Petroleum Base	In recoil mechanisms at all temperatures, in other mechanisms as prescribed			x
	Oil, Insulating	An insulating and cooling medium in oil-immersed transformers, oil switches, and oil circuit breakers			x
	Oil, Lard, Pure	Lubricating tools used for pipe threading and cutting			x
	Oil, Lubricating, Aircraft Instruments	Lubricating aircraft instruments and electronic equipment			x
	Oil, Lubricating, Engine SAE-10 (OE-10)	Quenching and light tempering, low-temperature-drawing heat treatment			x
	Oil, Lubricating, Engine SAE-30 (OE-30)	Quenching and light tempering, low-temperature-drawing heat treatment			x
	Oil, Lubricating, Engine SAE-50 (OE-50)	Quenching and light tempering, low-temperature-drawing heat treatment			x
	Oil, Lubricating, General Purpose	Lubricating the mechanical pump of optical coating equipment			x
	Oil, Lubricating, Steam Cylinder, Mineral	Quenching and tempering where a heavier oil is needed, lubrication of non-condensing steam-engine cylinders			x
	Oil, Tempering, Light and Medium	Quenching and tempering oil for low-temperature-drawing heat treatment			x

Table 3.1 (continued)
Chemicals Authorized for Use by the War Department and the Department of the Army, 1944–1951

Category	Compound	Use	1944	1947	1951
Preservative	Compound, Antifreeze (Arctic)	In internal combustion engine cooling systems and in water-cooled machine gun jackets and water chests under arctic conditions			x
	Compound, Antifreeze (Ethylene Glycol Type)	In water-cooled internal combustion engine cooling systems below 32 degrees Fahrenheit		x	x
	Compound, Corrosion Preventive, Fingerprint-Remover	Removal of fresh fingerprint residues, suppression of corrosion that has developed as a result of fingerprint residues, a temporary corrosion preventive			x
	Compound, Gum, Preventive	For treating the fuel in all vehicles or other equipment powered by gasoline engines, or having gasoline auxiliaries, which are to remain idle for 30 days or more		x	x
	Compound, Inhibitor, Corrosion	As a corrosion inhibitor for cooling systems of water-cooled engines and to re-inhibit reclaimed antifreeze compound (ethylene glycol type)		x	x
	Compound, Insulation, Ignition	Waterproofing ignition wires, battery cables, and other electrical parts		x	x
	Compound, Leather Dressing, Preservative for Field Treatment	For moistureproofing and moldproofing leather and articles made of leather		x	
	Compound, Protective, Strippable (Hot-dipping)	The preservation of spare parts and other equipment during shipment and storage			x
	Compound, Protective, Strippable (Sprayable) (Type I, Class 1)	A protective coating for materiel in storage		x	x
	Compound, Protective, Strippable (Sprayable) (Type II)	A protective coating for materiel in storage, a top coating over compound, protective, Type I, Class 1			x
	Compound, Protective, Strippable (Sprayable) (Type III)	A protective coating for materiel in storage, a top coating over compound, protective, Type II			x
	Compound, Retreating, Water-, Weather-, and Mildew-Resistant	For protection of cotton duck and webbing from deterioration by water, weather, and mildew		x	
	Compound, Rubbing	Cleaning and polishing of lacquered and aluminum surfaces to produce the desired gloss			x
	Compound, Rust-arresting	Prevent further corrosion on rusted metal surfaces			x
	Compound, Rust Preventive, Heavy (CH)	For long-term protection of unpainted metal surfaces during storage or shipment		x	x
	Compound, Rust Preventive, Light (CL)	For protection of unpainted metal surfaces during storage or shipment, as prescribed, where the preserved surfaces are directly exposed to the elements		x	x
	Compound, Rust Preventive, Medium	To protect polished surfaces		x	x

Table 3.1 (continued)
Chemicals Authorized for Use by the War Department and the Department of the Army, 1944–1951

Category	Compound	Use	1944	1947	1951
Preservative (cont.)	Compound, Rust Preventive, Soft Film	Preservation of critical surfaces in long-term, indoor storage of machine tools, and other equipment			x
	Compound, Rust Preventive, Special	To protect antifriction bearings against corrosion in storage or shipment		x	x
	Compound, Rust Preventive, Thin Film (CT)	Restricted to only specifically prescribed uses		x	x
	Compound, Rust Preventive, Thin Film (Polar Type), Navy Specification 52-C-18, Grade II	Protection of internal surfaces of engines and/or other power trains or similar oil lubricated assemblies when placed standby or long-term storage		x	x
	Compound, Rust Preventive, Transparent	Exterior surfaces on binned materiel, on all materiel stored in shops waiting to be fabricated or materiel to be used in repair of assemblies		x	
	Cupric, Carbonate, Reagent	For cold-process of copper-base alloys			x
	Desiccant, Type V, Grade A	As a dehydrator when preparing materiel and parts for oversea shipment and long-term storage		x	x
	Desiccant, Type V, Grade B (Activated, Upgraded, Medium Absorption)	Static dehumidification of packages and closed spaces when preparing materiel and parts for oversea shipment and long-term storage to prevent corrosion, mold, and mildew			x
	Oil, Preservative, Hydraulic Equipment (Type I)	Preservative oil in aircraft hydraulic systems and shock struts, a testing and flushing oil for hydraulic components			x
	Oxidizing, Material, Black Finishing	To produce a black, nonmetallic, corrosive-resistant finish on ferrous metals		x	x
	Phosphatizing Material, Black Finishing	In Parco-Lubrite process which changes the surface of steel or cast iron to a nonmetallic phosphate coating that absorbs and retains oil		x	
	Phosphatizing Material, Black Finishing, Manganese Phosphate Type	To change the surface of iron or steel to a corrosion resistant finish		x	x
	Phosphatizing Material, Gray Finishing, Zinc Phosphate Type (Initial Make-Up Liquid)	A replenshisher for initial liquid		x	

Note: TM 9-850, "Cleaning, Preserving, Sealing, Lubricating and Related Materials Issued for Ordnance Materiel," War Department, August 24, 1944, pp. 5-63; TM 9-850, "Cleaning, Preserving, Sealing, and Related Materials Issued for Ordnance Materiel," War Department, June 1947, pp. 2-42; TM 9-850, "Abrasive, Cleaning, Preserving, Sealing, Adhesive, and Related Materials Issued for Ordnance Materiel," Department of the Army, October 1951, pp. 4-115.

Table 3.2
Consumable List for R-985 Series Reciprocating Engines

Specification No.	Title	Application
AN-F-26	Aircraft Fuel (Grade 91/96)	None Specified
AN-F-22	Aircraft Fuel (Grade 62)	Clear Gas Run; Cleaning
AN-VV-O-446a	Aircraft Oil (Grade 1065)	Slushing
AN-VV-O-446a	Aircraft Oil (Grade 1100)	Lubricating
AN-VV-O-446a	Aircraft Oil (Grade 1120)	Lubricating
AN-C-52	Exterior Corrosion Preventive Compound	External Preservative
AN-VV-C-576	Corrosion Preventive Compound	Engine Interior
AN-VV-566	Mica Base Compound	Threaded Fittings
Federal O-A-51a	Acetone	Cleaning
AN-D-6	Dehydrating Agent	Engine Preservative
Army 4-503-110B	Carbon Tetrachloride	Cleaning
Navy 51C34	Carbon Tetrachloride	Cleaning
Dow Corning No. 4	Compound	Insulating
AN-VV-N-96	Naphtha	Cleaning
AN-T-12	Adhesive Moistureproof Tape	None Specified
AN-P-12	Grease-Proof Crepe or Acid-Free Wax Paper	Covering
Federal VV-K-211	Kerosene	Cleaning
Federal P-S-661	Solvent	Cleaning

Note: AN 02-10AB-2, "Service Instructions for R-985-AN1, AN-2, AN-3, AN-4, AN-6, AN-6B, AN-8, AN-10, AN-12, AN-12B, AN-14B Aircraft Engines," Commanding General, Army Air Forces; the Chief of the Bureau of Aeronautics; and the Air Council of the United Kingdom, February 1945, p. 47 [CEHCX011058].

Table 3.3
Consumable Material Specifications for Air Force Model TF33-P-7 Jet Engines

Title	Specification No. or Manufacturer	Application
Acid, Nitric	O-A-88	Cleaning
Acid, Sulfuric, Technical Grade	O-A-115	Cleaning Fuel Control Strainers
Adhesive	No. 140	Oil Tank Cushion Replacement
Adhesive Primer	No. 4094	Oil Tank Cushion Replacement
Alkali Cleaner	Ahcoloid No. 200	Fan Disks
Alkaline Rust Remover	No. 4181/J-84a	Fuel Manifold Cleaning
Babbitrite, Sealer	Babbitrite Products, Inc.	Low Compressor Vane Replacement
Barrier Material–Grease proofed, Flexible	MIL-B-121	Covering-Wrapping
Carboblast, Jet Engine Type	Turco Products, Inc.	Air Path Cleaning
Cerrobend	Cerro-De Pasco Corporation	Low Compressor Vane Replacement
Coating, Process for Application of Permanent Resin	MIL-C-6800	Engine Internal Parts
Compound, Antiseize	BG Mica Lube	Igniter Threads
Compound, Antiseize, Anti-galling	Ease-Off 990	Combustion Chambers, Threaded Fittings
Compound, Carbon Remover (Cold Type)	Turco Super Carb	Cleaning, Separable Bearings
Compound, Corrosion Preventive	MIL-C-6529 (Type III)	Engine Interior
Compound Grease Cleaning, Solvent Emulsion Type	P-C-576	Cleaning
Compound, Iridite	Iridite 14-2 Compound	Touch-up for Aluminum Parts Repair
Compound, Lapping	Carborundum Company	Carbon Seals
Compound, Lapping	Norton Company	Mating Surfaces
Compound, Polishing	No. 45	Bearing Seal Plates and Spacers; Turbine Rear Bearing Housing
Compound, Polishing	Lea Company	Blade and Vane Repair
Compound, Sealing	MIL-S-45180 (Type III)	Bearing House Flange; Bolt Assembly; Breather Pressurizing Valve
Coolant, Water Soluble	PMC-9313	No. 1 Hub (Titanium)
Coolant White	Vantrol 523	Compressor Rotor Disks
Devcon F (Aluminum Putty)	Devcon Corporation	Aluminum Stator Vanes Repair
Dischlorodisluoromethane F-22 (Freon Gas)	FSC 6830-264-9071	Pressure test of Fuel Manifold and Pressurizing and Dump Valve
Dry Developer	Magnaflux Corporation	Fluorescent Penetrant Inspection

Table 3.3 (continued)
Consumable Material Specifications for Air Force Model TF33-P-7 Jet Engines

Title	Specification No. or Manufacturer	Application
Emulsifier	Magnaflux Corporation	Fluorescent Penetrant Inspection
Enamel, Gloss	MIL-E-7729	Exterior Finish, Gray
Enamel-Heat Resisting Glyceryl-Phthalate, Black	MIL-E-5557	Exterior Finish
Enamel, High Baking Heat Resistant Aluminum	Pratt and Lambert No. 7897	Protective Surface Treatments
Evans Clear No. 1	Evans-Thomson Manufacturing Company	Low Compressor Vane Replacement
Firelite, Asbestos Cement	Johns Mansville	Fuel Manifold Heatshields Repair
Fluid, Calibrating, For Fuel System Components	MIL-F-7024 (Type II)	Calibration
Fuel, Jet	MIL-J-5624	Engine Operation
Graphite	Gredag Lubricant	Gasket
Graphite, Colloidal Alcoholic Dispersion	Acheson Dag No. 154	Preparing Graphite Varnish
Grease	Grade No. 55	Lubricant
Grease, Extreme Temperature	MIL-G-3278	Lubrication for Cross Shaft Bearings
Grease, High Temperature (Bentonite Type)	Plastilube No. 3	Antigalling
Grease, Silicone	Dow Corning Hi Vac	Differential Fluid Pressure Switch
Grit, Lapping	John Crane 1800 Grit	Lapping Surface Plates
Ink, White	The Dykem Company	Marking
Kerosene	VV-K-211	Cleaning
Lubricant, Dry Film	Everlube No. 610	Anti-Icing Air Valve
Lubricant, Dry Film (Synthetic Graphite)	The AP Parts Corp.	Antigalling Lubricant
Lubricant, Finishing Oil	MIL-L-644	Bear Flushing Oil
Lubricant, Molybdenum Disulfide Powder	MIL-M-7866	Antiseize, Antigalling Protection
Lubricating Grease, High Temperature	MIL-L-3545	Antigalling
Lubricating Oil, Gas Turbine, Aircraft	MIL-L-7808	Engine Operation
Magnaflux Paste No. 7, Black	R51P217	Magnetic Particle Inspection
Magnaflux Paste No. 9, Red	R51P230	Magnetic Particle Inspection
Magnaglo Powder No. 41	Magnaflux Corporation	Fluorescent Magnetic Particle Inspection
Oil, Compound, Corrosion Preventive (Thin Film)	AMS 3065	Interim Preservation and Antiseize Mixture
Oil, Compound Hydraulic	Socony Mobil	Compressor Rotor Balancing
Oil, Corrosion Preventive	MIL-C-8188	Engine Preservation and Bearings Heating
Oil, Lubricating, Jet Engine	MIL-O-6081	Slushing, Components
Oil Penetrant, Non-Water Washable	Magnaflux Corporation	Fluorescent Penetrant Inspection
Oil Penetrant, Water Washable	Magnaflux Corporation	Fluorescent Penetrant Inspection

Table 3.3 (continued)
Consumable Material Specifications for Air Force Model TF33-P-7 Jet Engines

Title	Specification No. or Manufacturer	Application
Petrolatum	Esso "Snow White"	Bearings Installation
Potassium Permanganate	No. 1113, 4338; J-88	Fuel Manifold Cleaning
Primer	PWA-579	Paint Undercoat
Primer, Zinc Chromate	MIL-P-8595	Fuel Control Key Locks, Studs, and Inserts
Reducer 78A	Miller Protective Coating, Inc.	Corrosion Preventive Coating
Resin, Clear	E-2477	Corrosion Preventive Coating
Resin, Coating Engine Magnesium Parts	MIL-M-3171 (Type I)	Corrosion Preventive Coating
Resin-Coating, Permanent (for Integral Engine Parts)	MIL-R-3043	Corrosion Preventive Coating
Rigidax	M. Argueso and Company	Pit Depth Measure
Rod, Hard Facing	Coast Metal Inc.	Combustion Chamber Lugs
Rod, Welding, Aluminum	AMS 4190 (QQ-R-566), Type 43S	Welding Aluminum Parts
Rod, Welding, Corrosion and Heat Resistant Alloys	MIL-R-5031 Class 5	Welding Steel Parts
Rod, Welding, Magnesium	AMS 4395 (AZ 92A)	Magnesium Threaded Bosses; Magnesium Cases
Silver Nitrate	MIL-S-12071	Paint Remover
Sodium Dichromate, Technical Grade	O-S-595	Cleaning Fuel Control Strainers
Sodium Nitrate Salts	MIL-S-322B (PMC1560)	Flameplated Turbine Blades
Solvent, Dry-Cleaning	P-S-661	Parts Cleaning
Solvent, Petroleum	AMS 3160	Magnetic Inspection
Thinner, Alcohol	AMS 3170	Preparing Graphited Varnish
Thinner, High Baking Heat Resistant Aluminum Enamel	Pratt and Lambert	Protective Surface Treatments
Trichloroethylene, Stabilizing Degreasing	MIL-T-7003	Parts Degreasing
Varnish, Insulating	G.E. No. 1201	Differential Fluid Pressure Switch
Vehicle, Lapping	John Crane No. 3M	Seal Plates and Spacers
Wax, Refined Paraffin	ESSO 125-127 AMP	Seals and Gaskets
Wire, Molly	PMC 5151	No. 1 Bearing Support (Titanium)
Zinc Chromate Polyurethane	E-2534	Corrosion Preventive Coating

Note: TO 2J-TF33-13, "Technical Manual-Overhaul Instructions for USAF TF33-P-7 Aircraft Engines," Secretary of the Air Force, December 1963, pp. A-1–A-7 [CEHCX029551-029559].

Table 3.4
Consumable Cleaning Materials for Air Force Model TF33-P-7 Jet Engines

Type	Specification No.	Description
Acid	None Specified	Hydrofluoric (Technical Grade) 60 Percent
Acid	SPMC-1010	Hydrofluoric (Technical Grade) 70 Percent
Acid	SPMC-1011	Inhibited Hydrochloric
Acid	SPMC-1000	Nitric (Technical Grade) 42 Degrees Baume
Acid	SPMC-1270	Scale Conditioner
Acid	SPMC-9	Scale Conditioner
Acid	SPMC-10	Scale Conditioner
Acid	None Specified	Sulfuric (Technical Grade) 66 Degrees Baume
Agent	SPMC-1689	Rust Remover Wetting
Alkali	SPMC-9058	Carbon and Paint Remover
Alkali	SPMC-1266	Descaler
Alkali	None Specified	Descaler
Alkali	SPMC-1268	Descaler (Low Temperature)
Alkali	SPMC-1269	Rust Remover
Alkali	SPMC-5	Rust Remover
Alkaline	SPMC-2	Rust Remover
Alkali	SPMC-6	Rust Remover
Alkali	SPMC-7	Rust Remover
Barrier Material	SPMC-4101	Flexible, Greaseproof, Neutral, Acid Free, Grade “A”
Bead	SPMC-3084	Glass Bead, 0.15- to 0.0029-Inch Diameter
Cleaner	SPMC-4	Solvent Emulsion
Cleaner	None Specified	Field Cleaning Engine
Compound	SPMC-1612	Antisolidifying
Compound	SPMC-9047	Carbon Remover (Cold Type)
Compound	SPMC-1304	Potassium Permanganate
Compound	SPMC-1601	Sodium Hydroxide
Compound	SPMC-3010	Soft Grit Blast Dry Cleaner
Compound	SPMC-3067	Wet Abrasive
Compound	SPMC-3085	Wet Abrasive
Compound	None Specified	Cleaning
Compound	None Specified	Cleaning
Compound	None Specified	Polishing
Fluid	SPMC-1648	Acid Solution
Grit	SPMC-3052-8	Aluminum Oxide
Inhibitor	SPMC-9311	Nitrate and Amine Corrosion
Neutralizer	None Specified	Fingerprints
Oil	None Specified	Compounded, Corrosion Preventive (Thin Film)
Oil	SPMC-9101	Thin Film Corrosion Preventive Oil
Pumice	SPMC-3001	Powdered
Sodium Dichromate	None Specified	Technical Grade
Solvent	SPMC-9010	Petroleum, 145-degree Flash Point, Minimum
Solvent	AMS-3160	Petroleum, 100-degree Flash Point, Minimum
Solvent	SPMC-9004	Trichloroethylene Stabilizing Degreasing
Tape	None Specified	Insulating
Trichloroethylene	None Specified	Stabilized Degreasing

Note: TO 2J-TF33-13, “Technical Manual-Overhaul Instructions for USAF TF33-P-7 Aircraft Engines,” Secretary of the Air Force, December 1963, pp. A-8–A-12 [CEHCX029560-029563].

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Table 3.5
Solvents, Thinners, and Finishes Used in Wood Aircraft Structural Repair

Category	Substance	Use
Solvent	Acetate	Used to remove grease from fabrics before doping
	Benzene	Used for cleaning aircraft equipment that used enamel, paint, or varnish
	Butyl Alcohol	Mixed with dope to slow drying when humidity was high in order to prevent blushing
	Denatured Alcohol	Used for thinning shellac to spray-gun consistency
Thinner	Linseed Oil	Used to reduce semipaste colors, such as insignia colors, and drop-back stenciling paint to brushing consistency
	Nitrate Dope and Lacquer Thinner	Used to reduce the consistency of dopes
	Toluene	Used to thin zinc chromate primer
	Turpentine	Used to thin paint and varnish
Finish	Bronze Aluminum Finish	Prepared by mixing either a bronze-aluminum paste or powder with a definite type and quantity of thinner and of the finishing material
	Cellulose Nitrate Lacquer	Used in its clear form as a substitute for spar varnish; used in its pigmented form on exterior surfaces
	Enamels	Used to produce hard, scratch-resistant surface that could resist the action high temperatures, oil, and water
	Light-Green Finish	Used to protect fabric covered metal structures against the solvent action of dope; used as a corrosion resistant on the interior metallic structural members of an airplane
	Paint	Used to protect other finishing materials from the solvent action of dope
	Paint Drier	Added to paint in order to increase its drying rate
	Paint Removers	Used to remove oil paint, varnish, lacquer, and other finishes
	Spar Varnish	Used for finishing wood surfaces where a flexible, transparent coating was required
	Varnish	Used as a transparent and aluminized exterior protective coat
	Zinc Chromate Primer	Applied to metallic surfaces before enamel or lacquer as a corrosion-resisting base for the topcoats

Note: Charles Edward Chapel, Ralph Bent, and James L. McKinley, *Aircraft Maintenance and Repair* (New York: McGraw-Hill Book Company, Inc., 1955), pp. 356-361.

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Table 3.6
Preservatives

Type	Description	Specification No.
P-1	Thin film preservative (hard drying, cold application)	MIL-C-16173 (Gr. 1)
P-2	Thin film preservative (soft film, cold application)	MIL-C-16173 (Gr. 2)
P-3	Thin film preservative, water displacing (soft film, cold application)	MIL-C-16173 (Gr. 3)
P-4	Heavy preservative compound (hot dip, hard film)	MIL-C-11796 (Class 1)
P-5	Medium preservative compound (hot dip, soft film)	MIL-C-11796 (Class 2)
P-6	Light preservative compound (soft film)	MIL-C-11796 (Class 3)
P-7	Medium preservative oil (cold application)	MIL-L-3150
P-8	Light preservative oil (cold application)	MIL-L-3503
P-9	Very light preservative oil (cold application)	MIL-L-644
P-10	Engine preservative oil	MIL-L-21260 (Gr. 1, 2, or 3)
P-11	Preservative grease (application as required)	MIL-G-3278
P-13	Wax emulsion	MIL-W-3688
P-14	Corrosion preventive (food handling machinery and equipment, nontoxic)	MIL-C-10382
P-15	Hydraulic preservative oil	Varies by system requirements
P-16	Thixotropic preservative oil	MIL-C-5545
P-17	Instrument bearing preservative oil	MIL-L-6085
P-18	Volatile corrosion inhibitor	MIL-P-3420

Note: MIL-P-116C, "Military Specification: Methods of Preservation," Department of Defense, February 1957, p. 5 [CEHCX002239].

F.4. Authorized Chemicals for Vehicle Maintenance

(1) Remove dirt and other foreign matter from all metal surfaces. This can be done by the dip-tank method or vapor-degreaser method, or by cleaning with cloth soaked in **dry-cleaning solvent** or **mineral spirits paint thinner**. In the dip-tank method, agitation for approximately one minute in each tank is sufficient: in the vapor-degreaser method, treatment for about two or three minutes is sufficient.
(2) Remove foreign matter from recessed areas with a stiff bristled brush or a pointed wooden stick.

c. Electrical Insulation, Wiring and Components. Refer to TM 9-208-1.

d. Bearings. Remove dirt and oil or grease from bearings that can be cleaned, using either dip-tank or vapor-degreaser method. Dip and agitate bearings in clean **dry-cleaning solvent** or **mineral spirits paint thinner**. Dry thoroughly and coat with thin film of lubricant. Wrap tightly in oiled or waxed paper until ready for inspection or assembly.

e. After Shop Inspection. After shop inspections, dip part in a tank containing fingerprint removing oil (type A), remove (use rubber gloves), and dry thoroughly with dry compressed air (provided with moisture filter traps) or by wiping with clean, lint-free, dry cloth. Apply preservative as soon as possible after cleaning."[104]

Fifth Echelon of Maintenance

TM 9-850, 1951
"**Compound, Cleaning, Alkali Type**. Characteristics: a granular, alkaline compound soluble in water… Use: in depot shops only, to remove grease, paint, tar, road dirt, etc., from metal components (TM 9-1861)."[105]

FM 9-4, 1959
" These tanks will contain in order: a grease and paint removing solvent such as **compound, alkali type** (P-R-191, class 1); a hot water wash; a solvent such as **conditioner and rust remover, phosphoric acid base** (MIL-M-10578); a hot water wash; and a preserving bath such as lubricating oil, preservative, special (MIL-L-644)."[106]

Table 9: Representative Cleaning Materials Used in Vehicle Maintenance

Year documented	Material	Echelons of Maintenance			
		2nd	3rd	4th	5th
1941	Carbon tetrachloride*	X	X	X	X
	Pyrene	X	X	X	X
	Dry-cleaning solvent	X	X	X	X
1943	Dry-cleaning solvent	X	X	X	X
	Kerosene**	X	X	X	X

[104] TM 9-2300-378-35/1, Direct Support And General Support Maintenance Manual Tank, Combat, Full-Tracked: 152-Mm Gun/Launcher, M60a2 W/E (2350-930-3590) (Hull, Suspension And Final Drive, Only) And Direct Support, General Support, And Depot Maintenance Manual Tank, Combat, Full-Tracked: 105-Mm Gun, M60a1 W/E (2350-756-8497) Tank, Combat, Full-Tracked: 105-Mm Gun, M60) W/E (2350-678-5773) And Vehicle, Combat Engineer, Full-Tracked: M728 W/E (2350-795-1797) Hull, Suspension, Final Drive, Slipring Assembly, Turret And Miscellaneous Components, 1968, Chapter 1, p. 1-3
[105] TM 9-850, Abrasive, Cleaning, Preserving, Sealing, Adhesive, and Related Materials Issued for Ordnance Materiel, 1951, Chapter 3, p. 29
[106] FM 9-4, Ordnance General and Depot Support Service, 1959, Appendix VII, p. 96

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Year documented	Material	Echelons of Maintenance			
		2nd	3rd	4th	5th
	Fuel Oil	X	X	X	X
	Gasoline	X	X	X	X
	Cleaning compound***	X			
	Tetrachloroethylene (PCE)				X
	Ethylene dichloride (=1,2-dichloroethane)				X
1944	Tetrachloroethylene				X
	Ethylene dichloride				X
	Dry-cleaning solvent	X			
	Fuel oil	X			
	Diesel	X			
	Carbon tetrachloride		X		
1947[107]	Compound, cleaning with inhibitor (for engine cooling systems). Consists of two components (aluminum chloride and oxalic acid). The inhibitor is borax.				
	Thinner, paint, volatile mineral spirits (used to remove oil and grease spots from motor vehicle bodies and upholstery.				
1951	Dry-cleaning solvent	X			
	Cleaning compound, alkali type				X
	Grease-cleaning compound	X			
	Volatile mineral spirits paint thinner	X			
1955	Dry-cleaning solvent	X			
	Volatile mineral spirits	X			
1959	Dry-cleaning solvent	X	X		
	Compound, alkali type (P-R-191, class 1)				X
	Conditioner and rust remover, phosphoric acid base (MIL-M-10578)				X
1960[108]	Carbon tetrachloride, technical (O-C-141)				
	Benzene, technical, liquid (VV-B-231)				
	Cleaning compound, solvent				
	Cleaning compound, alkali-type (P-C-436a)				
	Cleaning compound, engine cooling system: w/inhibitor (MIL-C-10597B)				
	Cleaning compound, high pressure cleaner; powder, steam-cleaning type (P-5-751)				
	Polish, automobile, liquid (P-P-546a) – combination polish and cleaner containing a wax				
	Thinner, paint, mineral spirits (TT-T-291a, Grade 1)				
	Tetrachloroethylene, technical (0-P-191)				
1961[109]	Substitutes for highly toxic solvents, for				

[107] TM 9-850, Cleaning, Preserving, Sealing, and Related Materials Issued for Ordnance Materiel, 1947. *The cleaning materials identified in TM 9-850 are superseded by those listed in vehicle-specific TMs.*
[108] TM 9-247, Materials Used for Cleaning, Preserving, Abrading, and Cementing Ordnance Materiel and Related Materials Including Chemicals, 1960, Chapter 2. *The cleaning materials identified in TM 9-247 are superseded by those listed in vehicle-specific TMs.*
[109] TB MED 35, Department of the Army Technical Bulletin, Health Hazards from Industrial Solvents, 1961. *The cleaning materials identified in TB MED are superseded by those listed in vehicle-specific TMs.*

Year documented	Material	Echelons of Maintenance			
		2nd	3rd	4th	5th
	cleaning and degreasing automotive equipment and parts, and metallic parts in general:				
	a. Stoddard solvent				
	b. Mixture of: 50% Stoddard solvent 50% Perchloroethylene (=1,1,2,2-tetrachloroethylene)				
	c. Mixture of: 60% Stoddard solvent 20% Methylene chloride 20% Perchloroethylene				
	d. Mixture of: 70% Stoddard solvent 25% Methylene chloride 5% Perchloroethylene				
	e. Perchloroethylene				
	f. Methyl chloroform (1,1,1-trichloroethane), inhibited				
1968	Dry-cleaning solvent		X	X	X
	Mineral spirits paint thinner		X	X	X
	Trichloroethylene		X	X	X
	Perchloroethylene (PCE)		X	X	X
1970	Dry-cleaning solvent	X	X	X	X
	Mineral spirit paint thinner	X	X	X	X
	Grease-cleaning compound	X	X	X	X
1980	Dry-cleaning solvent	X			
	Mineral spirits paint thinner	X			
	Cleaning compound***		X	X	
1985	Dry-cleaning solvent	X	X	X	

* Usage prohibited in 1956 at some installations[110], and restricted elsewhere ("its use should be limited to cleaning electrical mechanisms, components, and wiring which must not be cleaned with other solvents because of fire hazards or their effects on rubber, fiber, etc."[111]). Although this entry is site-specific and may not be representative, it does illustrate the point that there are significant differences between chemical usage policies at different installations.

** "Kerosene oil is a nonvolatile, mineral oil… Due to its low volatility, kerosene added to gasoline makes a good cleaning mixture, because it minimizes the explosive nature of vaporized gasoline. Gasoline used alone as a cleaning agent is extremely dangerous, and existing regulations prohibit its use for cleaning purposes in shops and garages."[112]

*** Cleaning compound: There were several types of cleaning compounds, used in various cleaning operations. For example:

- Cleaning compound, solvent (MIL-C-18718) consisted of 70% Stoddard solvent, 25% dichloromethane, and 5% PCE[113]

[110] Table 2, Qualitative Solvent Usage – US Naval Air Facility, Litchfield Park (1946-1967), CEHCX002745

[111] TM 9-247, Materials Used for Cleaning, Preserving, Abrading, and Cementing Ordnance Materiel and Related Materials Including Chemicals, 1960, Chapter 1, p. 5

[112] TM 10-540, Automotive Lubrication, 1940, Section III, p.3

[113] Table 2, Qualitative Solvent Usage – US Naval Air Facility, Litchfield Park (1946-1967), p. CEHCX002745

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- Cleaning compound, oxygen systems (MIL-C-8638) consisted of 65% trichlorotrifluoroethane (Freon 113), 10% tetrachlorodifluoroethane (Freon 112), and 24% isopropyl alcohol[114]

3.2 Lubrication

"Lubrication of a motor vehicle is perhaps the chief single factor in ensuring longer vehicle life, greater freedom from operating trouble, and minimum maintenance and repair work."[115] Lubricants are classified into the following types:

- Compounded or blended lubricants. These are mixtures of petroleum oils to which fixed oils, soaps, chemicals and/or solid substances have been added to obtain desired qualities.
- Oils. These are fluid lubricants used extensively in all types of engine and machinery. They include:
  - Motor oil, used in lubricating the internal moving parts of engines
  - Light machine oil, which is usually processed to eliminate gumming, and is used for small, high speed bearing surfaces where shocks are mild and pressures are even
  - Penetrating oil, used for lubricating between leaves of flat springs and for loosening nuts, bolts, and other rusty and corroded parts
  - Other fluid lubricants commercially available include break-in, valve, cylinder head, and top cylinder oils. As a rule, these fluid lubricants are used only where special conditions warrant
- Gear lubricants. These are heavy bodied oils that cushion and sustain the sudden, high pressure, loads transmitted to the gear teeth surfaces and cling to the teeth to protect them against metal-to-metal contact. Gear lubricants are used in transmissions, transfer cases, driving axle housings, steering gears, and similar enclosed units.
- Greases. Greases are semifluid or semisolid lubricants, usually blended from mineral oils and a metallic soap. Metallic soaps (grease soaps) are chemical compounds produced from soda, lime, aluminum, potassium, antimony, barium, and other substances. Greases are used primarily on slow moving parts and on surfaces that are concealed, such as dead axles, spring shackles, wheel bearings, universal joints, and other parts generally included in "chassis lubrication."[116]

Vehicle lubrication is one of the key second echelon preventive maintenance tasks. "The second echelon performs monthly (1000-mile) and semiannual (6000-mile) maintenance services on wheeled and half-track vehicles, monthly (1000-mile) maintenance services on motorcycles, and 50- and 100-hour maintenance services on tanks and tank-like wheeled vehicles. The monthly (1000-mile) maintenance service on wheeled and half-track vehicles and the 50-hour service on tanks is performed by company and detachment second echelon, the semi-annual (6000-mile) or 100-hour service by battalion, squadron, regimental, and separate company and detachment

[114] Ibid, p. CEHCX002746
[115] TM 10-540, Automotive Lubrication, 1940, Section I, p.2
[116] Ibid., p. 10

second echelon."[117] No other echelon has lubrication responsibilities as extensive as those of the second echelon.

Vehicle lubrication requirements and procedures are published in Lubrication Orders (LO) and Technical Manuals for each type of vehicle. Appendix D includes copies of two lubrication diagrams, one from a 1941 half-track mortar carrier LO and the other from a 1983 truck tractor LO. The LO specifications are part of the preventive maintenance requirements.

The standard Army nomenclature for lubricants in 1941 is shown in Table 10 below (no other standard lubricant tables were located during this study):

Table 10: U.S. Army Standard Nomenclature for Automotive Lubricants and Specialties (1941)[118]

LUBRICANT	SEASON
Engine Oil S.A.E. 10	Winter (Automotive)
Engine Oil S.A.E. 30	Summer (Automotive)
Engine Oil S.A.E. 50	Summer and Winter (Radial, Tank)
Diesel Engine Oil S.A.E. 10	Winter
Diesel Engine Oil S.A.E. 30	Summer
Gear Oil S.A.E. 80	Winter
Gear Oil S.A.E. 90	Summer
Gear Oil S.A.E. 140	Summer
E.P. Gear Oil S.A.E. 80 EP	Winter
E.P. Gear Oil S.A.E. 90 EP	Summer
Chassis Grease No. 0	Winter
Chassis Grease No. 1	Summer
Wheel Bearing Grease No. 2	Summer and Winter
Waterproof Grease, No. 4	Summer and Winter
Hydraulic Brake Fluid	Summer and Winter
Shock Absorber Fluid, Light	
Shock Absorber Fluid, Heavy	
Vacuum Cylinder Oil	

The usage of various types of lubricants, by echelon of maintenance, is illustrated in Table 11.

[117] TM 9-2810, Motor Vehicle Inspections and Preventive Maintenance Services, 1943, Chapter 1, p. 5
[118] Lubrication, The Essence of Ordnance Operation and Maintenance, Army Ordnance, Vol. XXII, No. 129, November-December 1941, p. 394, CEHCX055722

Table 11: Representative Lubricants Used in Vehicle Maintenance

Year documented	Material	Echelons of Maintenance			
		2nd	3rd	4th	5th
1939[119]	Mineral oils (for engine bearings; starting motors; generators; slow moving surfaces such as brake pedal pivots and brake linkage, door hinges, and locks; some fan bearings; some water pumps; and some transmissions).	X			
	Gear lubricants: fluid gear oils, compound gear lubricants, extreme pressure lubricants and hypoid lubricants	X			
	Greases: chassis lubricant, cup grease, water pump grease, and sodium soap grease	X			
	Miscellaneous: spring lubricant, penetrating oil, petrolatum or vaseline.	X			
1941	See Table 10				
1945[120]	SAE 80 universal gear lubricant	X			
	SAE 75 universal gear lubricant	X			
	No. 0 general purpose grease	X			
	No. 1 general purpose grease	X			
	No. 2 general purpose grease	X			
	Grease, O.D . No. 00 Ordnance Department Specification AXS-1169	X			
	Shock absorber fluid, light	X			
	Medium lubricating preservative oil	X			
	Special lubricating preservative oil	X			
	Crankcase oil	X			
1955[121]	OES oil, lubricating, engine, transmission	X			
	OE 10 oil, lubricating, engine, transmission	X			
	OE 30 oil, lubricating, engine, transmission	X			
	GOS lubricant, gear, universal	X			
	GO 75 lubricant, gear, universal	X			
	GO 90 lubricant, gear, universal	X			
	HBA fluid, hydraulic brake	X			
	HB fluid, hydraulic brake	X			
	OHA oil, hydraulic, petroleum base	X			
	GAA grease, lubricating, automotive and artillery	X			
	PL oil, lubricating, preservative	X			
1959[122]	Lubricating oil, preservative, special (MIL-L-644)				X
1966[123]	Grease 9150-261-8297		X	X	X
	Teflon-Filled Lubricant MIL-L-46150		X	X	X

[119] FM 25-10, Motor Transport, 1939, p. 159
[120] TM 9-802, 2 ½-Ton, 6 x 6 Amphibian Truck (GMC DUKW-353), 1945, Part Two, p. 88, and Part Three, p. 99 and 116
[121] TM 9-8024/ TO 36A12-1B-321, 2 ½ Ton 6 x 6 Cargo Trucks M135 and M211, Dump Truck M215, Gasoline Tank Truck M217, Shop Van Truck M220, Truck Tractor M221, and Water Tank Truck M222, 1955
[122] FM 9-4, Ordnance General and Depot Support Service, 1959, Appendix VII, p. 97
[123] TM 9-2350-230-25P/2, Organizational, DS, GS, And Depot Maintenance Manual Turret, Elevating And Traversing Systems, Cupola, Gun-Launcher, And Mount For Armored Reconnaissance/Airborne Assault Vehicle, Full-Tracked, 152mm, M551, M551A1, 1966

Year documented	Material	Echelons of Maintenance			
		2nd	3rd	4th	5th
	Grease. Aircraft and instrument MIL-G-23827		X	X	X
	Molybdenum disulfide lubricant MIL-M-7866		X	X	X
	Oil MIL-L-6084		X	X	X
	Hydraulic oil MIL-H-6083C		X	X	X
	Gear box oil (Grade 10, MIL-L-2104)		X	X	X
	Oil (PL-S)		X	X	X
	Grease MIL-G-81322.		X	X	X
	Grease MIL-G-21164		X	X	X
	Grease (GL)		X	X	X
1969[124]	Lubricant, teflon oil R1APD-688	X	X	X	
1980[125]	Automotive and artillery grease (GAA)	X	X	X	
	SAE 10 Engine lubricating oil	X	X	X	
	SAE 90 Hypoid oil	X	X	X	
	No. 30 Engine oil	X	X	X	
	OE 10 Grease	X	X	X	
	Chassis grease	X	X	X	
	Hydraulic oil	X	X	X	
	Transmission oil	X	X	X	
	Linseed oil	X	X	X	
	Light oil	X	X	X	

3.3 Painting

"The basic function of paint on a motor vehicle body is to preserve the metal or wood to which it is applied."[126] Painting consists of surface preparation and paint application. Very limited information was located that documents the type or volume of painting by echelon of maintenance. Based on the building layout and tool information included in Subsections 2.4 and 2.5 of this report, the third and fourth echelons appear to perform the most extensive vehicle painting activities, whereas the second echelon appears to be limited to paint touch-up.

3.3.1 Surface Preparation Materials

TM 10-455, 1942[127]
"Grease, spots should be tolerated as far as possible. The relatively porous paint soaks up oil as a blotter absorbs ink. Whatever grease cannot be removed by washing with **degreasing solvent** should be allowed to remain."[128] **"Primers** are used to form a bond between the bare metal, or the old paint, and the new coats. Most primers require **thinners**."[129] "Cleaning surface. (1) Use **light duty cleaner** for the under frame. Dissolve 1 or 2 ounces of cleaner in a gallon of water

[124] TM 9-2350-230-25P/2, Armored Reconnaissance/Airborne Assault Vehicle: Full-Tracked, 152-mm, M551 (Turret and Armament), 1968
[125] TM 10-3930-638-24&P, Organizational, Direct Support and General Support Maintenance Manual, Truck, Forklift, DED, Pneumatic Tire, Articulated Frame Steer, 4,000 Lb. Capacity, Rough Terrain, Army Model MHE 237, 1980
[126] TM 10-455, The Body Finisher, Woodworker, Upholsterer, Painter, and Glassworker, 1942, Section IV, p. 74.
[127] TM 10-455, The Body Finisher, Woodworker, Upholsterer, Painter, and Glassworker, 1942
[128] Ibid., Section IV, p. 74
[129] Ibid., p. 83

and spray it on hot with a steam gun. If a steam gun is not available, mix 1 quart of **degreasing solvent** with 5 quarts of **kerosene** and spray the mixture with an ordinary paint spray gun or brush it on. Let it stand for half an hour and flush it off with water. (2) (a) On body paint, do not use either light duty cleaner or degreasing solvent; instead, sponge the surface with soap and water. **Army issue soap** is suitable."[130] "Apply **metal conditioner** (2 parts water to 1 part conditioner) to the bare metal spots; leave it oil for 2 minutes and then flush it with water. This solution removes rust and produces a surface to which paint will cling tightly."[131] "Stripping. If old paint is in bad condition, the only way to do a good job of refinishing is to remove the old paint completely, down to the bare metal. Probably the easiest way of removing old paint is to use **alkali paint stripper**, 6 to 10 ounces to a gallon of water, applied hot."[132] "Before enameling an engine, clean it thoroughly with **degreasing solvent** or steam and hot water, and dry it completely."[133]

TB ORD 244, 1945[134]

"When it is necessary to remove all old paint due to its poor condition, use a solution of **alkali-type paint stripping compound** and water, mixed in the ration of 3 pounds of compound to 1 gallon of water… Apply solution while hot, by flowing or brushing."[135] To obtain satisfactory adhesion of paint, remove all traces of grease, oil, or dirt from the surfaces to be painted, with **dry-cleaning solvent**. If dry-cleaning solvent is not satisfactory, use a solution of **grease-cleaning compound** and **dry-cleaning solvent**, mixed in the ratio of one part of compound to four parts of solvent."[136]

TM 9-2851, 1947[137]

"Unless the preparation of the surfaces prior to painting is very thorough, the labor and material expended in subsequent painting are wasted.

(1) Thoroughly clean the metal surface of all rust, grease, or dirt… using abrasives and cleaning materials as required.

(2) After cleaning, prepare the surface by the use of concentrated **phosphoric acid metal conditioner** (wash-off or wipe-off type)."[138]

TM 9-2851, 1955[139]

"Preparation of Surface.

(1) Thoroughly clean the metal surface of all rust, grease, and dirt… using abrasives and cleaning materials as required.

(2) After cleaning, prepare the surface by the use of concentrated **phosphoric acid metal conditioner** (wash-off or wipe-off type)."[140]

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[130] Ibid., p. 89
[131] Ibid.
[132] Ibid., p. 90
[133] Ibid., 92
[134] TB ORD 244, Painting In-Line and Radial Engines, 1945
[135] Ibid., p. 1
[136] Ibid., p. 2
[137] TM 9-2851, Painting Instructions for Field Use, 1947
[138] Ibid., p. 66
[139] TM 9-2851, Painting Instructions for Field Use, 1955

TM 9-247, 1960[141]
"**Remover, Paint: Alkali-Organic Solvent Type** (MIL-R-12294A)
a. Characteristics. This is a nonflammable, non-hardening, water-rinsable mixture composed of alkaline compounds, wetting agents, organic solvents, and thickening agents… It is used primarily for the removing of multiple coats of paint from motor vehicles."[142]

Table 12: Representative Surface Preparation Materials Used in Vehicle Maintenance

Year documented	Material
1942	Degreasing solvent
	Primers
	Thinners
	Light duty cleaner
	Degreasing solvent
	Kerosene
	Army issue soap
	Metal conditioner
	Alkali paint stripper
1945	Alkali-type paint stripping compound
	Dry-cleaning solvent
	Grease-cleaning compound
1947	Phosphoric acid metal conditioner (wash-off or wipe-off type)
1955	Phosphoric acid metal conditioner (wash-off or wipe-off type)
1960	Remover, Paint: Alkali-Organic Solvent Type (MIL-R-12294A)

3.3.2 Paints

TM 10-455, 1942[143]
"Synthetic olive-drab lusterless enamel… This finish was developed to blend with the average landscape without reflecting light, which might reveal the presence of the vehicle even at a considerable distance."[144] **Blue-drab stencil enamel**. It was found that **white stencil enamel**, formerly used for marking vehicles, could be photographed from the air. Therefore, this has been superseded by the newly developed blue-drab stencil enamel, which cannot be photographed from, the air.[145] "**Lacquer** is occasionally needed, and **black rubber paint** is used for tires and rubber matting."[146] "For finishing coats, thin **lusterless olive-drab enamel** with one-fourth part of **synthetic thinner**."[147] "In very hot weather the **thinner** may be too volatile (that is, it will evaporate before the paint hits the surface) and cause the paint to hit the surface in nearly dry particles. This is called 'dusting.' Adding of 2 ounces of clean **kerosene** to

[140] Ibid., p. 30
[141] TM 9-247, Materials Used for Cleaning, Preserving, Abrading, and Cementing Ordnance Materiel and Related Materials Including Chemicals, 1960
[142] Ibid., Chapter 1, p. 13
[143] TM 10-455, The Body Finisher, Woodworker, Upholsterer, Painter, and Glassworker, 1942
[144] Ibid., Section IV, p. 74
[145] Ibid.
[146] Ibid., p. 83
[147] Ibid., p. 89

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a gallon of **thinner** before it is used to dilute the enamel will relieve this condition."[148]
"Priming. After washing, spray the bare metal surface with a coat of **metal primer**, which dries in 20 to 30 minutes. This material requires no thinning."[149] "If time permits, a more durable job may be obtained by using **rust-inhibiting primer**, a material especially developed for use under the lusterless synthetic enamel. Thin it with one-seventh part **synthetic thinner** and apply it somewhat more heavily than ordinary primers."[150]

TB ORD 244, 1945[151]
"After metal surfaces of in-line or radial engines have been properly prepared, apply, by spraying, one coat of **rust inhibitive synthetic primer** thinned with **synthetic enamel thinner** in the ratio of six parts primer to one part thinner."[152] "Paint in-line engines with one coat of gray **heat-resisting enamel** or gray **gloss synthetic enamel**, mixed with approximately 5% **synthetic thinner**."[153]

TM 9-2851, 1947[154]
"**Enamel, rust inhibiting, olive drab**… It is prescribed as a primer for automotive material and artillery and small arms materiel. This enamel, as well as being a primer, may be used as the topcoat. It possesses excellent corrosion inhibiting properties. This enamel contains **toxic pigments** (such as red lead) and adequate precautions should be taken when spraying."[155]
"**Enamel, synthetic, gloss**. A very durable synthetic (alkyd) enamel, designed as a finishing coat for wood or metal. It may be applied by brush, spray, or dip, and produces a smooth, hard glossy finish for all types of material requiring a durable glossy finish. This enamel is the prescribed finish coat for automotive vehicles which are to receive a gloss finish."[156]
"Finishing Coats for Automotive Materiel
a. AR 850-15, AR 850-7, and AR 850-16 contain regulations regarding finish coats for automotive material. At the present time all vehicles are painted an approved **semigloss olive drab** in accordance with current standard specifications except as follows:
(1) Vehicles required to be painted with special finish for camouflage protection.
(2) Passenger vehicles for use by military attaches and military intelligence may be painted black.
(3) Recruiting service vehicles may be painted aluminum with dark blue trim.
(4) Except as provided in (5) below, all general purpose, special purpose, and special equipment vehicles principally operated on landing strips, taxiways, perimeter roads, aircraft parking and flight areas, etc., of flying fields within the continental limits of the United States will be painted yellow in accordance with current standard specifications. Bumper plates will be painted with 4-inch diagonal stripes 45 degrees from horizontal alternating yellow and black.

[148] Ibid., p. 90
[149] Ibid., p. 91
[150] Ibid.
[151] TB ORD 244, Painting In-Line and Radial Engines, 1945
[152] Ibid., p. 2
[153] Ibid.
[154] TM 9-2851, Painting Instructions for Field Use, 1947
[155] Ibid., Chapter 3, p. 60
[156] Ibid., Chapter 3, p. 62

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(5) Fire trucks and trailers, including airplane crash and auxiliary vehicles designated exclusively for fire fighting will be painted red in accordance with current standard specifications.
(6) Materials handling equipment will be painted a distinctive color when required in the interests of safety.
(7) Buses, ambulances, special 3/4-ton 4 x 4 and passenger sedans may be painted **full gloss olive drab**.
b. The following priming and finishing coats and thinners are authorized for automotive materiel:
(1) The priming coat for all lustreless, semigloss and gloss finishes is **olive drab, rust inhibiting enamel**. The priming coat for amphibious materiel is **zinc chromate primer**.
(2) The finishing coat for camouflage purposes only is **lustreless synthetic**.
(3) The finishing coat for a semigloss finish is **olive drab, rust inhibiting enamel**. It will be noted that this finish is also used as a primer.
(4) The finishing coat for a gloss finish is **gloss synthetic enamel**.
(5) The thinner for the above enamels and primers is **synthetic enamel thinner**."[157]

TM 9-2851, 1955[158]
"(3) The undercoat to be applied to all vehicles, except amphibious materiel, is **olive drab rust-inhibiting enamel** (par. 78.08). The undercoat for amphibious materiel is yellow **zinc-chromate primer** (par. 78.14).
(4) All vehicles will be painted an approved **semigloss olive drab** color except as indicated in (5) through (7) below. The finish coat for the semigloss finish will be **olive drab rust-inhibiting enamel** (par. 78-08) except as in (5) and (6) below. This enamel is also used for the priming coat.
(5) Vehicles, scheduled for a theater of operations outside the United States, will be painted with a dull lustreless paint when practicable, considering the availability of time and the necessary supplies.
(6) Camouflage may be applied directly on the semigloss finish coat or, at the time of manufacture, on the primer coat. The finish coat for camouflage purposes only will be **lustreless synthetic enamel** (par. 78.22).
(7) The finish coat for a full gloss finish will be **synthetic gloss enamel** (par. 78.20)."[159]

TB 43-0147, 1975[160]
"a. **Enamel, Alkyd, Camouflage**, Specification MIL-E-52798. This is the standard paint for use in the pattern painting. It is a new synthetic camouflage alkyd enamel for use as a finishing coat on military equipment. Except for white, it comes in the standard camouflage colors…5 gallons and 1 gallon cans.
b. **White Water Paste**, Specification MILP13340. This is used where white is one of the four colors specified in the camouflage pattern. NSN 8010-00-597-5253 for 5-gallon can.
c. **Butyl Cellosolve**, Specification TT-E776B. **Ethylene glycol monobutyl ether**, NSN 6810-00-281-2001 for 1-gallon can. This is used as a secondary thinner for the enamel.

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[157] Ibid., p. 65
[158] TM 9-2851, Painting Instructions for Field Use, 1955
[159] Ibid. p. 30
[160] TB 43-0147, Color, Marking and Camouflage Patterns Used on the Military Equipment, 1975

d. **Xylem** Specification TT-X-916. NSN 681000-584-4070 for 5-gallon drum; NSN 6810-00290-4166 for 55-gallon drum. This is used for thinning the enamel.
e. **Mineral Spirits**, Specification TT-T291. NSN 8010-00-558-7026 for 5-gallon drum; NSN 8010-00-246-6115 for 55-gallon drum. This is also used for thinning the enamel.
f. **Thinner, Cellulose-Nitrate Dope, Blush Retardant**, Specification MIL-T-6095B. NSN 8010-00-162-5289 (1 gal.). This is used in preparing paint for neoprene-coated tarpaulins used with the gamma goat vehicle
g. **Preservative Coating**, Canvas, Specification TTP-595A. No NSN. This is used in prepreparing paint for cotton duck canvas…
Paint Mixing. a. Vehicles.
(1) The enamel has to be thinned for various temperatures and humidity conditions. The thinners to be used and mixed are as follows: 30 °F. - 60 °F. - **Xylene** 60 °F.- 80 °F.- **Mineral spirits** Above 80 °F., moderate relative humidity (up to 55 percent), it may be necessary to add **butyl cellosolve** to allow flow-out of the paint. For these conditions, the maximum use of **butyl cellosolve** shall be 8: 1 of **mineral spirits** and **butyl cellosolve**, respectively.
(2) If raining or if temperature is above 80 °F. with high humidity (above 55 per cent), the maximum use of **butyl cellosolve**, if necessary, shall be 5: 1 of **mineral spirits** and **butyl cellosolve**, respectively."[161]

Table 13: Representative Paints Used in Vehicle Maintenance

Year documented	Material
1942	Synthetic olive-drab lusterless enamel
	Blue-drab stencil enamel
	White stencil enamel
	Lacquer
	Black rubber paint
	Synthetic thinner
	Kerosene
	Metal primer
	Rust-inhibiting primer
1945	Rust inhibitive synthetic primer
	Synthetic enamel thinner
	Heat-resisting enamel
	Gloss synthetic enamel
1947	Enamel, rust inhibiting, olive drab
	Enamel, synthetic, gloss
	Semigloss olive drab
	Full gloss olive drab
	Olive drab, rust inhibiting enamel
	Zinc chromate primer
	Gloss synthetic enamel
	Synthetic enamel thinner
1955	Olive drab rust-inhibiting enamel
	Semigloss olive drab
	Zinc-chromate primer
	Lustreless synthetic enamel

[161] Ibid., Chapter 3, p. 3-6

Year documented	Material
	Synthetic gloss enamel
1975	Enamel, alkyd, camouflage, MIL-E-52798
	Butyl cellosolve (ethylene glycol monobutyl ether) TT-E776B
	White water paste, MILP13340
	Xylem TT-X-916
	Mineral spirits TT-T291
	Thinner, cellulose-nitrate dope, blush retardant MIL-T-6095B
	Preservative coating, canvas TTP-595A
	Xylene
	Mineral spirits

3.4 Electrical

The only electrical discussed in this section is the automotive lead-acid battery. The typical battery "consists of three or more cells, depending upon the voltage desired. A battery of three cells (2 volts each) connected in series is known as a 6-volt battery and one of six cells connected in series in known as a 12-volt battery […] Each cell consists of a hard rubber jar or compartment into which are placed two kinds of lead plates, known as positive and negative […] The backbone of both the positive and negative plates is a grid made of a stiff lead alloy casting […] The active material of the plates is applied to the grid in paste form"[162] "An electrolyte is a liquid which readily conducts electricity and is decomposed when an electric current passes through it. The electrolyte in the lead-acid storage battery, having a specific gravity of 1.280, is composed of one part of chemically pure sulphuric acid (H_2SO_4) and approximately two and three-fourths parts by volume of distilled pure water."[163]

Battery inspection, maintenance, and testing are included in the preventive maintenance services performed by the second echelon for all types of vehicles: "monthly (1000-mile) and semiannual (6000-mile) maintenance services on wheeled and half-track vehicles, monthly (1000-mile) maintenance services on motorcycles, and 50- and 100-hour maintenance services on tanks and tank-like wheeled vehicles."[164] The second echelon performed all battery maintenance operations described below, except for the 1951 reference, which describes battery reconditioning performed by fifth echelon shops.

TM 25-10, 1939[165]
Clean and tighten storage battery, terminals, and carrier bolts. Test battery and refill to proper level.[166]

TM 9-2810, 1943[167]

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[162] TM 10-580, Automotive Electricity, 1941, Section III, p. 30
[163] Ibid., p. 33
[164] TM 9-2810, Motor Vehicle Inspections and Preventive Maintenance Services, 1943, Chapter 1, p. 5
[165] TM 25-10, Motor Transport, 1939
[166] Ibid., p. 161

"If the terminals are corroded, disconnect the cable terminals from the battery, clean, and lubricate the battery posts and terminals, and reinstall them securely. Make a high-rate discharge test of the battery to see that the cells are in a satisfactory condition, taking care to make the test according to the instructions for a condition test which accompany the test instrument. A true test cannot be made if the gravity of the battery is below 1.225. If the difference in the readings obtained from the cells is more than 30 per cent, replace the battery.
CLEAN. Clean the top of the battery with water or a soda wash if available, and dry with a clean rag or compressed air. Clean the battery carrier in the same way, and paint if corroded.
SERVE. Bring the electrolyte up to the correct level with distilled water, if it is available. If not available, use any clean water in preference to letting battery run dry."[168]

TB ORD 73, 1951[169]
"BATTERY RECONDITIONING… Operations.

(1) Remove caps and drain battery of electrolyte.
(2) Drill 5/8-inch hole in straps at posts and remove connector straps.
(3) Remove sealing compound around all covers and pull cells up.
(4) Place cells on edge of cells and allow plates to dry.
(5) When plates have been drained, remove and discard wooden separators.
(6) Inspect rubber separators and send to reclamation those found damaged.
(7) Examine plates for damage and for looseness. Where plates are found damaged, the elements are salvaged.
(8) Thoroughly brush sulphated plates.
(9) Thoroughly wash battery case.
(10) Insert reclaimed or new separators between plates, with ribbed side against positive plates.
(11) Install elements in case and join connector straps.
(12) Seal up battery.
(13) Fill battery with a 1.240 specific gravity electrolyte solution.
(14) Charge battery and test electrolyte. Balance electrolyte.
(15) Where plates are sulphated, battery should be cycled and electrolyte changed."[170]

TM 9-8024/ TO 36A12-1B-321, 1955[171]
"After battery test, bring electrolyte to proper level in each cell. Clean entire battery and retainers. Repair or replace retainers if corroded or damaged. Clean battery cable terminals and battery posts. Tighten terminals and retainers. After tightening terminal clamp bolts, coat terminals with grease to retard corrosion."[172] "Two 12-volt batteries are connected in series to provide 24-volt electrical current for operation of vehicle electrical system. Batteries are submersible-type with special cell vent plugs which prevent entrance of water into battery

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[167] TM 9-2810, Motor Vehicle Inspections and Preventive Maintenance Services, 1943
[168] Ibid., Chapter 3, p. 105
[169] TB ORD 73, Department of the Army Technical Bulletin, Engine Rebuild Data for Depot Maintenance (5th Echelon) Shops, 1951
[170] Ibid., Chapter 5, p. 42
[171] TM 9-8024/ TO 36A12-1B-321, 2 ½ Ton 6 x 6 Cargo Trucks M135 and M211, Dump Truck M215, Gasoline Tank Truck M217, Shop Van Truck M220, Truck Tractor M221, and Water Tank Truck M222, 1955
[172] Ibid, Chapter 3, p. 146

cells… Charge these batteries at a rate of 3 to 5 amperes and continue charging until the batteries are fully charged. This may sometimes require as much as 96 hours. If any cell does not accept a satisfactory charge under these conditions, proceed as in (a) or (b) below. (a) Increase the charge rate to approximately 50 amperes for not more than 3 minutes. (b) Add approximately 10 milliliter of concentrated sulfuric acid to the cell and continue charging at a low rate. This procedure should be tried only in those cases where nothing else will work."[173]

TM 10-3930-205-20/ TO 31M2-2-72-52, 1959[174]
"Take hydrometer reading of battery and add approved water to bring electrolyte to capacity mark on battery. The specific gravity must be above 1.225."[175] In troubleshooting chart, for "weak or discharged battery" the remedy is "charge or replace battery."[176] "b. Cleaning. Clean battery with solution of baking soda and water. c. Capacity Test. (1) Take hydrometer gravity of electrolyte solution. Minimum specific gravity is 1.175. Battery is fully charged when specific gravity is 1.275 to 1.285."[177]

T.O. 36-1-5, 1962[178]
Lead-acid type. Lead-acid type wet charged batteries shall not be placed in long term storage. They shall be removed and reported to the appropriate property class as excess, requesting disposition instructions. Batteries removed shall be maintained in a charged condition while awaiting disposition instructions.[179]

TM 10-3930-638-24&P, 1980[180]
"a. Test battery to determine cell condition (Ref TM 9-6140-200-14)
b. Clean battery top and terminals. Insure all connections are tight."[181]
Cleaning. Straps, clamp, and hardware: "Use cleaning solvent P-D-680[182]. Dry thoroughly with compressed air… Cables grommet: Wipe with a clean, dry cloth… Batteries: Use clean water on exterior only… Battery posts and cable clamps: Use a wire brush or crocus cloth to remove deposits… Cable terminals: Use cleaning solvent P-D-680 on terminals only."[183]

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[173] Ibid, Chapter 3, p. 286
[174] TM 10-3930-205-20; TO 31M2-2-72-52, Truck, Lift, Fork, Gasoline, Pneumatic-Tired, 1959
[175] Ibid, Chapter 2, p. 4
[176] Ibid., Chapter 3, p. 20
[177] Ibid., p. 40
[178] T.O. 36-1-5, Processing of Motor Vehicles for Storage and Shipment, 1962
[179] Ibid, Section V, p. 5-5
[180] TM 10-3930-638-24&P, Organizational, Direct Support and General Support Maintenance Manual, Truck, Forklift, DED, Pneumatic Tire, Articulated Frame Steer, 4,000 Lb. Capacity, Rough Terrain, Army Model MHE 237, 1980
[181] Ibid., p. 2-5
[182] P-D-680 is a dry cleaning and degreasing solvent consisting of two types of petroleum distillates. The different types are referred to as "Stoddard solvent" and as "140 °F solvent" (Federal Specifications, Dry Cleaning And Degreasing Solvent, September 9, 1988).
[183] Ibid., p. 2-185

3.5 Metal Spraying (Metallizing)

"Metallizing is a rapid and effective method of atomizing metal wire, and applying it in spray formation to any base material. This method of spraying metal is used to restore worn mechanical equipment to service, to salvage mismachined and other defective parts, to protect corrosive metals against atmosphere or chemical attack by applying a light film of non-corrosive metal, and to impart the desirable qualities of metal to nonmetallic surfaces."[184] "The production of protective metal coatings by spraying has attained considerable importance. It is the only method of applying metal coatings that lends itself to field application and it is the only feasible process for applying heavy **aluminum** coatings to steel. Sprayed coatings of **aluminum** or **zinc** followed by a durable paint system provide one of the best means of protecting steel in severely corrosive environments. Any metal available in the form of wire and fusible in the oxyacetylene flame can be sprayed on almost any surface. Actually, for protective coatings, the only metals used to any extent are **aluminum** and **zinc**. When these are used in heavy coats, steel may be sprayed as a bonding coat."[185]

Only the fifth echelon was equipped with metal spraying equipment (see Subsection 2.5).

TM 37-250, 1944[186]
"Example Of Reclamation. A large splined shaft, involving many machine operations in its original manufacture, is bent or scored, or its keyway is worn beyond standard key size. When received at a forward supply depot in exchange for a new one, the unserviceable shaft is passed back to the nearest maintenance unit having facilities available for its reclamation. The bent shaft is straightened, the scored shaft is rebuilt by metallizing, and the worn keyway is plugged by welding and a new keyway is milled. The shaft has thus been reclaimed and is again ready for service."[187]

TM 9-1834E, 1950[188]
"In most cases of reclamation by the metallizing process, the machine and equipment used regularly in fifth echelon shops are adaptable for material preparation and finishing operations."[189] There were various types of wire used in metal spraying, including: **aluminum**, **Babbitt** (1% **zinc**, 10% **tin**, lead-free), **iron**, **steel** (soft, stainless, and **chrome**), and **bronze**.[190]

Ordnance Production Methods, 1955[191]

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[184] TM 9-1834E, Vehicular Maintenance Equipment: Cleaning Equipment, Hydraulic Jacks, Boring Bars, Band Saws, Metallizing and Fuse Bonding Equipment, 1950, Chapter 2, p. 3
[185] Protective Coatings for Metals, by R.M. Burns and W.W. Bradley, Reinhold Publishing Corporation, 1955, p. 66
[186] TM 37-250, Basic Maintenance Manual, 1944
[187] Ibid., p. 23
[188] TM 9-1834E, Vehicular Maintenance Equipment: Cleaning Equipment, Hydraulic Jacks, Boring Bars, Band Saws, Metallizing and Fuse Bonding Equipment, 1950
[189] Ibid., Chapter 1, p. 4
[190] Ibid.
[191] Ordnance Production Methods, A Collection of Articles Published in Machinery Describing Manufacturing Operations on Rifles and Small Arms, Machine Guns, Bullets, Shells, Cartridge Cases, Guns, Bombs, Tanks and Other Weapons of War, Edited by Charles O. Herb, The Industrial Press, 1955

"A **molybdenum** alloy bonding under coat is then sprayed to a thickness of about 0.003 inch on the wearing surfaces of the cylinder support assembly. In this operation, Sprabond 1/8-inch diameter wire (made by Metallizing Engineering Co.) is fed continuously through the nozzle of a Metco spray gun into the gas-oxygen flame that is introduced at high pressure through ports drilled in the nozzle. As the wire melts, blasts of compressed air carry the molten metal on the surfaces to be coated. The molybdenum alloy adheres to the molecularly to the sand-blasted surfaces of the work and presents a good bonding surface for subsequent spraying on the bronze coating."[192]

Table 14: Representative Metals Used in Metal Spraying

Year Documented	Material	Echelon of Maintenance
		5th
1950	Aluminum	X
	Babbitt (1% zinc, 10% tin, lead-free)	X
	Iron	X
	Steel	X
	Bronze (copper alloy that may contain Sn, Ni, Al, and Pb)	X
1955	Molybdenum	X

[192] Ibid., Article titled Patton Tanks Roll From the Detroit Arsenal, p. 436

Appendix G

Textual References of Source Documents

G.1. FDE Memorandum
G.2. Environmental Sampling Report, April 2005
G.3. Environmental Assessment Technical Memorandum, September 2005
G.4. Final Site Characterization and Removal Action Report, October 2009
G.5. Census Tract Information
G.6. History Summaries
G.7. Department of Ecology UST Data Base Querie Results
G.8. Norden Bombsight Information
G.9. BRAC Environmental Baseline Survey Environmental Risk Classifications
G.10 Navy Low Level Radiation Cleanup
G.11 Department of Ecology No Further Action Letter, May 1996
G.12 Environmental Baseline Survey Table 4-2: Summary of USTs

Textual References of Source Documents

This appendix contains a summary of information obtained from the Seattle Department of Parks and Recreation, U.S. Navy, Ecology NW Region Public Records, online environmental databases maintained by EPA and Ecology, and documents obtained from other internet sources.

Seattle Department of Parks and Recreation, Planning and Development Division (Kevin Stoops, Director, 206-684-7053)

Environmental Sampling Report, Magnuson Park, Seattle, Washington, April 2005, prepared for City of Seattle Department of Parks and Recreation by HWA Geosciences, Inc. HWA was contracted by the City of Seattle after soil containing odors was encountered by Parks Department staff during the removal of two concrete slabs on the eastern side of the park, near the shoreline. HWA collected a total of six samples from both areas in September 2004. All samples contained gasoline at levels exceeding MTCA Method A soil cleanup levels for unrestricted land use, as well as significant concentrations of other petroleum hydrocarbons. Polychlorinated biphenyls (PCBs) were analyzed, but were not detected. Additional samples were collected in March 2005 to further define the limits of contamination. Based on results, HWA recommended areas of contamination to be excavated at each of the two locations. These areas total roughly 20,000 square feet (depth is not specified); however, the limits of contamination were not defined at the north end of the northern slab, or the south end of the southern slab. Sample location maps and a summary of analytical results from the September 2004 and March 2005 sampling begins on page G-5 of this appendix.

Environmental Assessment Technical Memorandum, September 2005, by Anchor Environmental, LLC. This assessment included a historical document review, aerial photograph review, and a preliminary soil assessment. Analysis of aerial photographs indicated changes in the eastern shoreline of the peninsula occurring between 1936 and 1969, attributed to extensive filling operations. The photographs also show waste piles and waste disposal pits.

Based on historical aerial photographs and an undated "Structure List Map," the report identifies areas formerly used by the Navy as garbage disposal pits, incinerator, and oil burn pits (the two slabs removed in 2004). Anchor collected 10 soil samples from 10 test pit locations associated with these features; samples were analyzed for petroleum hydrocarbons, polynuclear aromatic hydrocarbons, metals, volatile organic compounds, chlorinated pesticides, and PCBs. Concentrations exceeding MTCA Method A soil cleanup levels for diesel-range organics, residual-range organics, benzo(a)pyrene, cadmium, lead or mercury were found at six locations. A sample location map and a summary of analytical results from the September 2005 report begins on page G-11 of this appendix.

Regulatory Database Search

Herrera conducted a regulatory agency database search for land areas within the site boundaries. The following databases were included in the search:

- Federal National Priority List (NPL) (<http://www.epa.gov/enviro/html/cerclis/cerclis_query.html>)
- Federal Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) list (<http://www.epa.gov/enviro/html/cerclis/cerclis_query.html>)
- Federal Resource Conservation and Recovery Act Information (RCRAInfo) hazardous waste handlers list (<http://www.epa.gov/enviro/html/rcris/rcris_query_java.html>)
- National Response Center list for reporting oil or chemical spills (<http://www.nrc.uscg.mil/wdbcgi/wdbcgi.exe/WWWUSER/WEBDB.foia_query.show_parms>)
- Washington State Confirmed or Suspected Contaminated Sites (CSCS) list (<http://www.ecy.wa.gov/programs/tcp/cscs/CSCSpage.HTM>)
- Washington State Toxic Cleanup Program Site Register/Hazardous Sites list (<http://www.ecy.wa.gov/programs/tcp/mtca_gen/hazsites.html>)
- Washington State Landfill or Solid Waste Site lists (<http://www.ecy.wa.gov/programs/swfa/solidwastedata/>)
- Washington State leaking underground storage tank (LUST) list (<http://www.ecy.wa.gov/PROGRAMS/tcp/ust-lust/ust-lst2.html>)
- Washington State underground storage tank (UST) list (<http://www.ecy.wa.gov/PROGRAMS/tcp/ust-lust/ust-lst2.html>)

The following six entities were listed as RCRA generators:

- Big Onion Productions
- NOAA
- USDOT Coast Guard Reserve Center (in Building 2)
- US Navy Seattle Naval Station
- University of Washington Sandpoint
- Western Fisheries Research Center

All but NOAA are located on the non-eligible portions of the property. None is expected to impact the property.

Two cleanup sites were listed under the Ecology's Toxics Cleanup Program. Both sites are also listed on Ecology's No Further Action Site List.

- An Interim Action and Cleanup Operation and Maintenance were completed at the US Navy Station Puget Sound on March 1, 1994; a No Further Action determination was made by Ecology on April 26, 1996. It did not occur on an eligible portion of the property.

- A Site Hazard Assessment (SHA) was completed at the Pacific Marine Environmental Lab (part of the NOAA facility) on August 9, 1999; a No Further Action determination was made by Ecology on February 29, 2000. No additional information regarding the SHA was available in the Ecology file.

No sites within the project boundaries were listed on Ecology's Brownfields Inventory, the CSCS list, or the Uniform Environmental Covenants Act list.

The UST list provided the following:

- Seven tanks on the eligible portion of the site, including six on the NOAA property and one on the NARA property. Five tanks on the NOAA property were removed in 1997; the sixth tank was used to supply an emergency generator and NOAA continued to use the tank after 1997. The tank on the NARA property was closed in place.

- Sixteen USTs were listed under U.S. Naval Station Seattle on the ineligible portion of the site.

Two release sites are shown on Ecology's LUST list.

- One site refers to the NOAA tank removal and closure conducted in 1997. According to information reviewed in Ecology site files, a release of petroleum hydrocarbons to soil and groundwater reportedly was attributed to a leak in a fuel dispenser located at NOAA Building 8. The site was cleaned up and Ecology designated that the tank removal was a clean closure.

- One site pertains to the 16 USTs at U.S. Naval Station Seattle. According to Ecology file information, three of the tanks were removed and no release was reported. No other releases were identified or discussed in the Ecology file pertaining to the other 13 USTs. These 16 USTs were located on the non-eligible portions of the property.

Other Internet Sources:

- http://www.seattle.gov/parks/magnuson/history.htm. This City of Seattle website provides a history of the park property, including development and Navy use. Also included are some historical aerial photographs and historical site layout plans.
- http://www.navfac.navy.mil/navfac_worldwide/atlantic/fecs/northwest/about_us/northwest_documents.html. This Navy website is a repository for the weekly progress/status reports generated during the low level radiation cleanup project conducted in vicinity to Bldg 2.
- http://courses.washington.edu/fm328/FieldtripMaterial/Peninsulahistory_PublicComps.pdf This University of Washington website provides
- http//courses.washington.edu/fm328/Fieldtrip Material/Peninsulahistory_PublicComps.pdf. This University of Washington website provides a tabulated history of the Sand Point Peninsula (including its military history).
- http://www.historylink.org/index.cfm?DisplayPage=output.cfm&file_id=2249. This website provides the history of the Sand Point Peninsula.
- http://www.sandptnavsta.org/_NASHeritageAward/Historical-Support.php. This website is sponsored by the not-for-profit group "Friends of Sand Point Manguson Park Historic District" and provides historical information and provides photographs of remaining NAS Seattle structures.
- http://www.fws.gov/midwest/eagle/. This U.S. Fish and Wildlife website provides information regarding the North American Bald Eagle.
- http://ecos.fws.gov/tess_public/profile/speciesProfile;jsessionid=158089844648DC8C5F4362E06FB038F2?spcode=A0IL. This U.S. Fish and Wildlife website provides information regarding the federally listed endangered species Orcinus orca.
- http://www.history.navy.mil/oru-collections/photography/... This U.S. Naval History and Heritage Command website provided historic photographs of NAS Seattle.
- http://www.ww2pacific.com/torpedo.html. This website provides information relevant to torpedoes used during WWII.
- https://drycleancoalition.org/chemicals/ChemicalsUsedInDrycleaningOperations.pdf. This website sponsored by a coalition of U.S. dry cleaners provides information on the various types of substances used historically by the dry cleaning industry.
- http://info.ngwa.org/gwol/pdf/041980217.pdf. This National Groundwater Association webpage provided information relevant to mogas and avgas constituents and their likelihood for causing vapor intrusion.

G.1. FDE Memorandum

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NORTHWESTERN DIVISION
1616 CAPITOL AVE, SUITE #365
OMAHA, NE 68102

REPLY TO
ATTENTION OF

CENWD-PDM

24 June 2015

MEMORANDUM FOR Commander, Kansas City District (CENWK-PM-ES/Nelson)

SUBJECT: Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS) Findings and Determination of Eligibility Statement Property Number F10WA0031, Sand Point Naval Air Station – Magnuson Park, Seattle, King County, Washington

1. Reference CENWK-PM-ES memorandum, 18 June 2015, subject Sand Point Naval Air Station (NAS) – Magnuson Park (F10WA0031) – Change in Eligible Acreage (Encl).

2. The referenced memorandum requests a minor change in the eligible property acreage from 366.52 acres to 339.889 acres. The justification for the decrease is 26.631 acres are currently under Department of Defense control or property lacking sufficient documentation to support disposal prior to 17 October 1986.

3. This decrease of eligible property acreage is approved.

4. Please ensure this approval is filed in accordance with FUDS records management procedures, and the FUDS Management Information System is updated to reflect the current status the property.

5. Any questions may be referred to Judy Meier at (402)996-3816.

FOR THE COMMANDER:

Daniel Saniuk

DANIEL SANIUK, P.E.
Chief, Military Integration Division

Encl

CF: CENWD-PDM (Nusz)

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, KANSAS CITY DISTRICT
635 FEDERAL BUILDING
601 E 12TH STREET
KANSAS CITY MO 64106-2824

CENWK-PM-ES (200-1f)

JUN 18 2015

MEMORANDUM FOR Northwestern Division Formerly Used Defense Sites (FUDS) Program Manager (CENWD-PDM) 1616 Capitol Avenue, Suite 365, Omaha, Nebraska 68102-4909

SUBJECT: Sand Point Naval Air Station (NAS) – Magnuson Park, (F10WA0031) – Change in Eligible Acreage

1. References:

a. Memorandum for Record, CENWK, 2 April 2015, Subject: Sand Point Naval Air Station (NAS) – Magnuson Park, aka NAS, Seattle, (Formerly Used Defense Site [FUDS] Property Number F10WA0031), Justification for Change in FUDS Eligible Acreage.

b. ER 200-3-1, Formerly Used Defense Sites (FUDS) policy, 10 May 2004 section 3-1.5.1.1

2. This memorandum seeks authorization to reduce the size of the subject FUDS property. The currently approved eligible acreage is 366.52 acres. Upon further review of real estate records, the eligible acreage should be reduced to 339.8890 acres. This request is to decrease the size of the property and to justify the reasons for designating eligible and ineligible portions of the property. The original NAS was acquired with a total acreage of 536.7872, and 196.8982 acres is determined to be ineligible. Of that acreage, 165.4082 acres were transferred after 17 October 1986, and 31.49 acres were either retained property or property lacking sufficient records for a determination. 339.8890 acres have sufficient documentation to support Department of Defense ownership, jurisdiction, and disposal prior to 17 October 1986.

3. Therefore, please authorize a FUDS Management Information System revision to increase to total size of the property to 536.7872 acres, 339.8890 eligible and 196.8982 ineligible. The point of contact for this action is Mr. David Nelson. He can be reached at (816) 389-3572 or by e-mail at David.C.Nelson@usace.army.mil.

Encl

for Mary Bmle
SCOTT E. YOUNG
Chief, Environmental Programs Branch

CENWK-PM-ES (200-1f) 2 June 2015

MEMORANDUM FOR RECORD

SUBJECT: Sand Point Naval Air Station (NAS) – Magnuson Park, aka NAS, Seattle, (Formerly Used Defense Site [FUDS] Property Number F10WA0031), Justification for Change in FUDS Eligible Acreage.

1. Enclosures:

a. Map of Naval Air Station, Seattle, Washington, Showing Conditions on June 30, 1944.

b. *Findings and Determination of Eligibility (FDE), Magnuson Park (Sand Point Naval Air Station)*, Seattle, Washington, Project No. F10WA003100, USACE, 28 February 1990.

c. Plate number 100, Sheet 1 of 3, Sand Point N.A.S., Overall Acquisitions, 15 Apr 2014.

d. Plate number 101, Sheet 2 of 3, Sand Point N.A.S., Main Post Acquisition, 15 Apr 2014.

e. Plate number 102, Sheet 3 of 3, Sand Point N.A.S., Acquisitions, 10 Mar 2014.

f. Plate number 103, Sheet 1 of 3, Sand Point N.A.S., Overall Disposal, 15 Apr 2014.

g. Plate number 104, Sheet 2 of 3, Sand Point N.A.S., Main Post Disposal, 15 Apr 2014.

h. Plate number 105, Sheet 3 of 3, Sand Point N.A.S., Disposal Details, 10 Mar 2014.

i. Plate number 100, Sheet 1 of 2, Sand Point N.A.S., Main Post Acquisition, 12 May 2014.

j. Plate number 101, Sheet 2 of 2, Sand Point N.A.S., Main Post Disposal, 12 May 2014.

k. Figure 1, Eligible Parcel Locations.

l. Figure 2, Eligible Parcel Locations Cnt'd.

m. Figure 3, Eligible Parcel Locations Cnt'd.

2. This Memorandum for Record (MFR) presents the basis for the re-determination of FUDS eligible acreage for the subject property based on historical acquisition and disposal documentation.

3. The 28 February 1990 FDE states, "Sand Point NAS encompassed 518.28 acres in fee acquired between 1926 and 1948 for the Department of the Navy." The 1990 FDE also states that 195.60 acres in fee were conveyed to the City of Seattle in 1975, and prior to that conveyance, 170.92 acres in fee were conveyed to several recipients including the National Oceanic and Atmospheric Administration (NOAA). The 1990 FDE further states that the Navy retained 151.76 acres. According to the 1990 FDE, the 151.76 acre retained portion is FUDS ineligible. Thus, the 1990 FDE indicates that 366.52 acres are FUDS eligible and 151.76 acres are FUDS ineligible. (See Enclosure 1.b.)

4. Historical real estate documentation (acquisition and disposal documents) was obtained and submitted to CENWK by the Seattle District Real Estate Office on 2 May and 3 June 2013, and 3 and 11 March 2014. These documents have been uploaded to the FUDS Records Management Database under document file numbers F10WA0031--11.01_0500_a and 11.04_0500_a through 11.04_0530_a. The real estate documentation was used as a basis for the preparation of the enclosed plates and the re-determination of FUDS eligible acreage.

5. Plate number 100, Sheet 1 of 3, 15 April 2014, illustrates the overall acquisition of property for Sand Point NAS. (See Enclosure 1.c.) A large contiguous portion is located on the Sand Point peninsula. Five "satellite" portions are located to the north, west, and southwest of the main contiguous portion. This plate lists in tabular format all of the documents that support the acquisition of property for the Sand Point NAS, including deeds, civil cases, vacation ordnances, easements and permits.

6. Plate number 101, Sheet 2 of 3, 15 April 2014, shows the Sand Point NAS "Main Post" acquisition details. (See Enclosure 1.d.) The red item numbers on this plate refer to the Item numbers in the table on Plate number 100, Sheet 1 of 3, 15 April 2014. Item numbers 05, 11 and 12, although separated by roadways, are considered to be part of the contiguous main portion of Sand Point NAS. According to the 1944 map that shows conditions on 30 June 1944, Item numbers 05 and 12 were not within the installation boundaries at that time. (See Enclosure 1.a.) Item number 10, the Water Reservoir, is shown on the 1944 map as located within the installation boundaries on 30 June 1944. For purposes of this MFR, the Water Reservoir is considered to be a "satellite" portion.

7. Plate number 102, Sheet 3 of 3, 10 Mar 2014, illustrates in detail the four other "satellite" portions of Sand Point NAS. (See Enclosure 1.e.) The four other "satellite" portions are the Shearwater Housing Area, the Transmitter Station, the Radar and Beacon (RACON) Station, and the Low Frequency Navigational Aid. The red item numbers on this plate refer to the Item numbers in the table on Plate number 100, Sheet 1 of 3, 15 April 2014. Only the Transmitter Station appears within the installation boundaries of 1944.

8. Plate number 103, Sheet 1 of 3, 15 April 2014, illustrates the Sand Point NAS overall disposal picture, and includes a table that lists all of the supporting, historical, disposal documents. (See Enclosure 1.f.)

9. Plate number 104, Sheet 2 of 3, 15 April 2014, shows the disposal details of the "Main Post" area of Sand Point NAS, including the Water Reservoir "satellite" area, Item number 28. (See Enclosure 1.g.) The red item numbers refer to the Item numbers in the table on Plate number 103, Sheet 1 of 3, 15 April 2014.

10. Plate number 105, Sheet 3 of 3, 10 March 2014, shows the disposal details of the four other "satellite" portions, the Shearwater Housing Area, the Transmitter Station, the RACON Station, and the Low Frequency Navigational Aid. (See Enclosure 1.h.) The red item numbers refer to the Item numbers in the table on Plate number 103, Sheet 1 of 3, 15 April 2014.

11. Plate numbers 100 and 101, Sheets 1 of 2 and 2 of 2, dated 12 May 2014, depict the acquisition and disposal details of the Sand Point NAS "Main Post" including tables that list the acquisition and disposal documents with dates and acreage amounts. (See Enclosures 1.i. and 1.j.) These plates do not include Item numbers 25, 26, 27, 28, 30, 34, 40, 42, 43, or 45 as listed on the Disposal table on Plate number 103, Sheet 1 of 3, 15 April 2014.

12. Based on the historical documentation, as shown on the enclosed plates, FUDS **eligible** portions are summarized as follows:

Disposal Item No.	Description	Disposal Date	Eligible Acreage
25	RACON Site	10 Feb 1959	1.72
26	Low Freq Nav Aid	1 Jun 1961	1.57
27	Transmitter Site	7 Dec 1971	19.95
28	Water Reservoir	15 Apr 1974	0.88
29	NOAA Facility	19 Dec 1974	100.00
30	NARA Warehouse	2 Aug 1957	9.31
32	Magnuson Park	17 Dec 1975	195.6
34	QCD BOR to City	17 Apr 1975	2.57
40	Shearwater Housing	21 Jul 1959	1.849
42	Report of Excess	12 Jul 1965	6.44
			339.889 TOTAL

13. Figure 1 illustrates the eligible parcels for the "Main Post" area. (See Enclosure 1.k.) Figures 2 and 3 illustrate the eligible parcels for the "satellite" areas. (See Enclosures 1.l. and 1.m.)

14. Based on historical documentation, as shown on the enclosed plates, the following portions are FUDS **ineligible**:

Disposal Item No.	Description	Disposal Date	Ineligible Acreage
31	USFW/WFRC	13 Oct 1998	4.9
33	Magnuson Park	17 Mar 1999	93.1
35	QCD BOR-U of WA	27 Apr 1999	2.5
36	QCD Navy to City	18 Aug 1998	13.5
37	Railroad Spur	16 May 1975	NA
38	Univ. of WA	10 Aug 1999	5.0
39	Univ. of WA	10 Aug 1999	8.0
41	Housing	21 Apr 1998	19.0
43	Shearwater Housing	circa 1964	15.03
44	Magnuson Park	12 Dec 2002	8.2382
45	Notice of Availability	16 Apr 1965	15.96
46	NOAA Road	circa Apr 2000	11.0

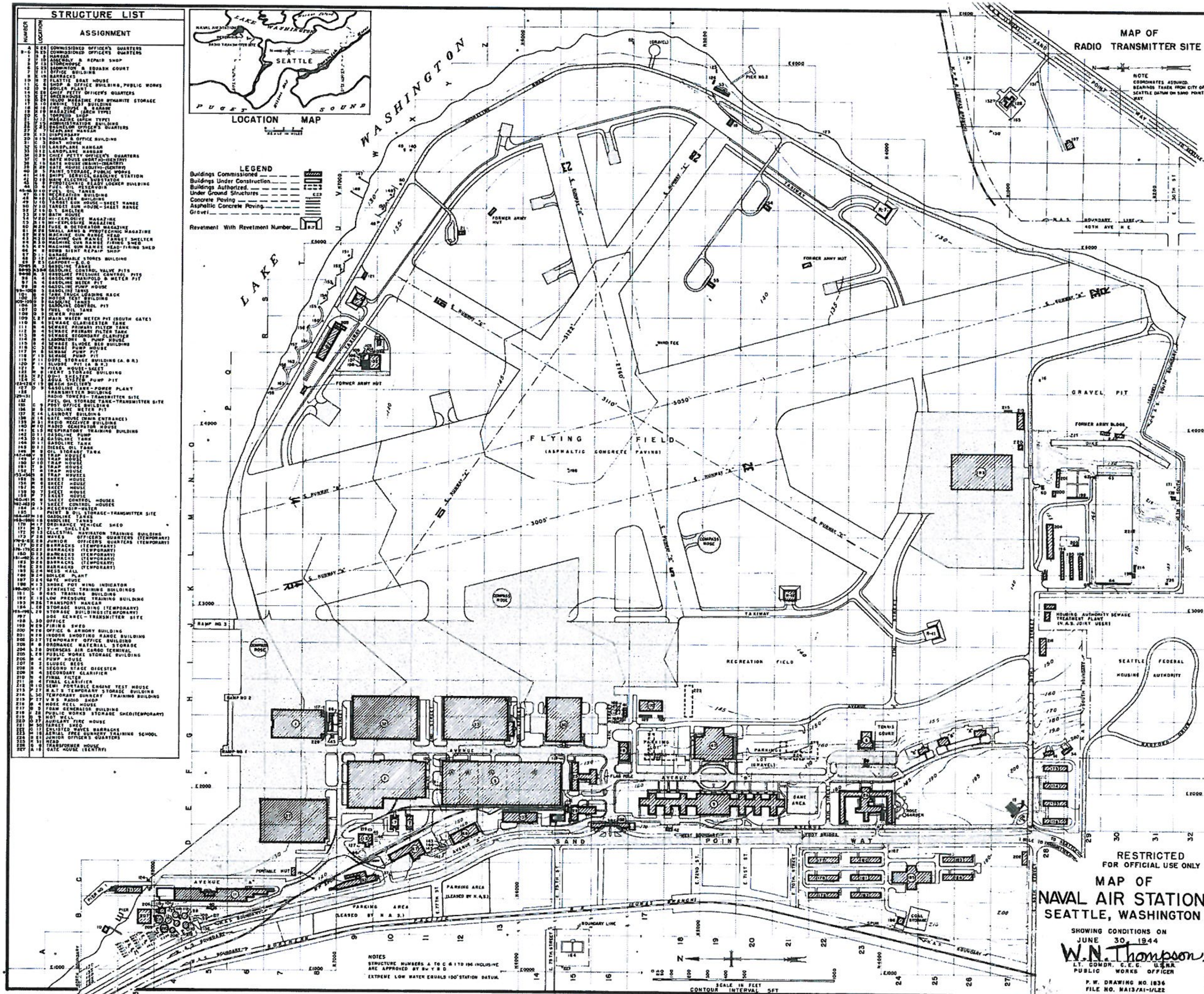
47	QCD A. Denny heirs	31 May 1941	0.50
48	Cor. QCD to City	1 Sep 1999	0.17
			196.8982 TOTAL

15. Based on historical real estate documentation, disposal item numbers 43 and 45 were declared as excess property but available information does not show that the properties were ever conveyed from General Services Administration holdings, thus it is assumed that they are FUDS ineligible, pending further information. Disposal item numbers 31, 33, 35, 36, 38, 39, 41, 44, 46, and 48 were all disposed of after 17 October 1986, making them FUDS ineligible. No documentation was found to show that disposal item 47 was declared excess or conveyed and therefore it's assumed that it is FUDS ineligible, pending further information. Historical documentation shows that disposal item number 37 is FUDS ineligible because no land was sold along with the railroad.

16. Based on historical documentation, as shown on the enclosed plates, FUDS eligible (339.889 acres) and FUDS ineligible (196.8982 acres) portions total 536.7872 acres. Figures include "satellite" portions of the Shearwater Housing Area, the Transmitter Station, the RACON Station, and the Low Frequency Navigational Aid.

MATTHEW WARD, PE, PMP
Project Manager

13 Encls
1. 1944 Map
2. FDE 2-28-90
3. Plate 100, 4-15-14
4. Plate 101, 4-15-14
5. Plate 102, 3-10-14
6. Plate 103, 4-15-14
7. Plate 104, 4-15-14
8. Plate 105, 3-10-14
9. Plate 100, 5-12-14
10. Plate 101, 5-12-14
11. Figure 1
12. Figure 2
13. Figure 3



STRUCTURE LIST

NUMBER	LOCATION	ASSIGNMENT
A	G 26	COMMISSIONED OFFICER'S QUARTERS
B-C	E 25	COMMISSIONED OFFICER'S QUARTERS
1	B 8	HANGAR
2	F 10	ASSEMBLY & REPAIR SHOP
3	F 13	STOREHOUSE
6	G 25	BADMINTON & SQUASH COURT
7	E 11	OFFICE BUILDING
8	E 19	BARRACKS
10	B 2	FLATTIE BOAT HOUSE
11	C 6	SHOP & OFFICE BUILDING, PUBLIC WORKS
12	D 9	BOILER PLANT
14	G 28	CHIEF PETTY OFFICER'S QUARTERS
15	G 27	GREENHOUSE
16	D 28	IGLOO MAGAZINE FOR DYNAMITE STORAGE
17	E 10	ENGINE TEST BUILDING
18	G 18	FIRE HOUSE & GARAGE
19	X 19	MAGAZINE (ARCH TYPE)
20	C 5	TORPEDO SHOP
21	U 12	MAGAZINE (ARCH TYPE)
25	F 17	ADMINISTRATION BUILDING
26	E 21	BACHELOR OFFICER'S QUARTERS
27	C 7	SEAPLANE HANGAR
29	E 13	DISPENSARY
30	B 15	HANGAR & OFFICE BUILDING
31	C 3	BOAT HOUSE
32	G 10	LANDPLANE HANGAR
33	G 12	LANDPLANE HANGAR
34	G 29	CHIEF PETTY OFFICER'S QUARTERS
37	C 9	GATE HOUSE (NORTH)-(SENTRY)
38	E 16	GATE HOUSE (MAIN)-(SENTRY)
39	E 29	GATE HOUSE (SOUTH)-(SENTRY)
40	D 5	PAINT STORAGE, PUBLIC WORKS
41	H 16	SHIPS' SERVICE GASOLINE STATION
42	D 18	MAIN ELECTRIC SUBSTATION
43	H 8	PYROTECHNIC READY LOCKER BUILDING
44	D 6	FUEL OIL RESERVOIR
45-46	D 10	FUEL OIL TANKS
47	G 19	RECREATION BUILDING
48	M 10	LOCALIZER BUILDING
49	U 10	TARGET GUN HOUSE-SKEET RANGE
50	V 10	TARGET GUN HOUSE-SKEET RANGE
52	Z 16	D.T. SHELTER
53	H 19	BATH HOUSE
54	V 20	HI-EXPLOSIVE MAGAZINE
55	S 19	HI-EXPLOSIVE MAGAZINE
60	M 28	FUSE & DETONATOR MAGAZINE
61	M 28	SMALL ARMS & PYROTECHNIC MAGAZINE
62	M 29	MACHINE GUN RANGE HEAD
63	M 30	MACHINE GUN RANGE TARGET SHELTER
64	K 30	MACHINE GUN RANGE FIRING SHED
65	K 29	MACHINE GUN RANGE HEAD-FIRING SHED
66	H 8	BOMB SIGHT REPAIR SHOP
67	D 11	GARAGE
68	D 12	INFLAMMABLE STORES BUILDING
69	F 23	CARPORT-C.O.Q.
70-85	A 3	GASOLINE TANKS
86-93	A 3&4	GASOLINE CONTROL VALVE PITS
94-95	A 3	GASOLINE PRESSURE CONTROL PITS
96	A 4	GASOLINE MANIFOLD & METER PIT
97	A 4	GASOLINE METER PIT
98	B 4	GASOLINE PUMP HOUSE
99-100	B 3	GASOLINE TANKS
101	B 4	TANK TRUCK LOADING RACK
102	D 7	MOTOR TEST BUILDING
103-105	D 5	GASOLINE TANKS
106	D 9	GASOLINE CONTROL PIT
107	D 5	FUEL OIL TANK
108	D 3	SEWER PUMP
109	E 27	MAIN WATER METER PIT (SOUTH GATE)
110	B 4	SEWAGE CLARIGESTER TANK
111	B 4	SEWAGE PRIMARY FILTER TANK
112	B 4	SEWAGE PRIMARY FILTER TANK
113	B 4	SEWAGE SECONDARY CLARIFIER
114	B 4	LABORATORY & PUMP HOUSE
115	B 4	SEWAGE SLUDGE BED BUILDING
116	C 3	SEWAGE PUMP HOUSE
117	H 8	SEWAGE PUMP PIT
118	F 13	SEWAGE PUMP PIT
119	F 11	DOPE STORAGE BUILDING (A. & R.)
120	F 11	SLUDGE PIT (A. & R.)
121	T 9	FIELD HOUSE-SKEET
122	R 8	INERT STORAGE BUILDING
123	X 22	OD-1 SHELTER
124	C 3	AQUA SYSTEM PUMP PIT
125-126	Y 19	BEACH SHELTERS
127	D 9	GASOLINE TANK-POWER PLANT
128		TRANSMITTER BUILDING
129-131		RADIO TOWERS-TRANSMITTER SITE
132		FUEL OIL STORAGE TANK-TRANSMITTER SITE
133	C 9	POST OFFICE BUILDING
136	B 9	GASOLINE METER PIT
137	E 14	LAUNDRY BUILDING
138	E 16	GATE HOUSE (MAIN ENTRANCE)
139	E 31	RADIO RECEIVER BUILDING
140	M 10	RADIO GENERATOR HOUSE
141	E 15	RESPIRATORY TRAINING BUILDING
142	D 11	GASOLINE PUMP
143	D 12	GASOLINE TANK
144	D 11	GASOLINE TANK
145	D 11	DIESEL OIL TANK
146	B 9	OIL STORAGE TANK
147-148	V 9	TRAP HOUSES
149	V 10	TRAP HOUSE
150	U 10	TRAP HOUSE
151	T 9	TRAP HOUSE
152	T 8	TRAP HOUSE
153-154	S 8	TRAP HOUSES
155	S 8	SKEET HOUSE
156	R 6	SKEET HOUSE
157	R 7	SKEET HOUSE
158	Q 7	SKEET HOUSE
159	P 7	SKEET HOUSE
160-161	R 8	SKEET CONTROL HOUSES
162-163	Q 7	SKEET CONTROL HOUSES
164	A 15	RESERVOIR-WATER
165		PAINT & OIL STORAGE-TRANSMITTER SITE
166-167	H 16	GASOLINE TANKS
168-169	G 16	GASOLINE TANKS
170	K 17	ORDINANCE VEHICLE SHED
171	H 31	Y-H SHELTER
172	G 13	CELESTIAL NAVIGATON TRAINING BUILDING
173	F 28	WAVES OFFICERS QUARTERS (TEMPORARY)
174-5-6	E 28	JUNIOR OFFICERS QUARTERS (TEMPORARY)
177	D 22	BARRACKS (TEMPORARY)
178-179	C 22	BARRACKS (TEMPORARY)
180	D 23	BARRACKS (TEMPORARY)
181-182	C 23	BARRACKS (TEMPORARY)
183	D 26	BARRACKS (TEMPORARY)
184	C 26	BARRACKS (TEMPORARY)
185	C 24	MESS HALL
186	B 24	BOILER PLANT
187	D 24	GATE HOUSE
188	H 15	SMOKE POT WIND INDICATOR
189-190	H 17	SYNTHETIC TRAINING BUILDINGS
191	G 9	GAS TRAINING BUILDING
192	E 19	LOW PRESSURE TRAINING BUILDING
193	H 26	TRANSPORT HANGAR
194	L 28	STORAGE BUILDING (TEMPORARY)
195-196	L 29	STORAGE BUILDINGS (TEMPORARY)
197		DOG KENNEL-TRANSMITTER SITE
198	L 30	OFFICE
199	N 29	FIRING SHED
200	N 28	OFFICE & ARMORY BUILDING
201	N 28	INDOOR SHOOTING RANGE BUILDING
202	D 27	TEMPORARY OFFICE BUILDING
203	R 6	ORDNANCE MATERIAL STORAGE
204	L 28	OVERSEAS AIR CARGO TERMINAL
205	L 29	PUBLIC WORKS STORAGE BUILDING
206	B 4	PUMP HOUSE
207	B 3	SLUDGE BEDS
208	B 4	SECOND STAGE DIGESTER
209	B 4	SECONDARY CLARIFIER
210	B 4	FINAL FILTER
211	B 4	FINAL CLARIFIER
212	B 10	SEMI PORTABLE ENGINE TEST HOUSE
213	F 27	N.A.T.S. TEMPORARY STORAGE BUILDING
214	L 30	TEMPORARY GUNNERY TRAINING BUILDING
215	F 27	V R S RADIO SHOP
216	B 4	HOSE REEL HOUSE
217	B 5	FOAM GENERATOR BUILDING
218	K 28	PUBLIC WORKS STORAGE SHED (TEMPORARY)
219	D 9	HOT WELL
220	G 27	AUXILARY FIRE HOUSE
221	M 30	TARGET SHED
222	G 12	ENLISTED WAVES BARRACKS
223	H 18	AERIAL FREE GUNNERY TRAINING SCHOOL
224	D 21	JUNIOR OFFICER'S QUARTERS
225	K 31	HEAD
226	G 9	TRANSFORMER HOUSE
227	A 18	GATE HOUSE (SENTRY)

46556

633693 51½% SEATTLE, WASH. 13-31

DEFENSE ENVIRONMENTAL RESTORATION PROGRAM
FOR FORMERLY USED SITES
FINDINGS AND DETERMINATION OF ELIGIBILITY
MAGNUSON PARK (SAND POINT NAVAL AIR STATION)
SEATTLE, WASHINGTON
PROJECT NO. F10WA003001

FINDINGS OF FACT

1. Magnuson Park, formerly part of the still active Sand Point Naval Air Station is located in Seattle, King County, Washington on the shore of Lake Washington.

2. Sand Point Naval Air Station encompassed 518.28 acres in fee acquired between 1926 and 1948 for the Department of the Navy.

3. The fully developed air station consisted of a runway, hangars, aircraft support and service facilities, ammunition storage, housing, administrative offices and various training enhancements.

4. By quitclaim deed dated December 19, 1975 (amended November 23, 1976) 195.60 acres fee were conveyed through the Department of the Interior, Bureau of Outdoor Recreation, to the city of Seattle (Department of Parks and Recreation) for Magnuson Park. (Prior to 1975, 170.92 acres fee were conveyed to several recipients including the National Oceanic and Atmospheric Administration. The 170.92 acres will be dealt with in a separate report provided sufficient background information can be obtained from the Navy.) The Navy has retained 151.76 acres for the Sand Point Naval Air Station.

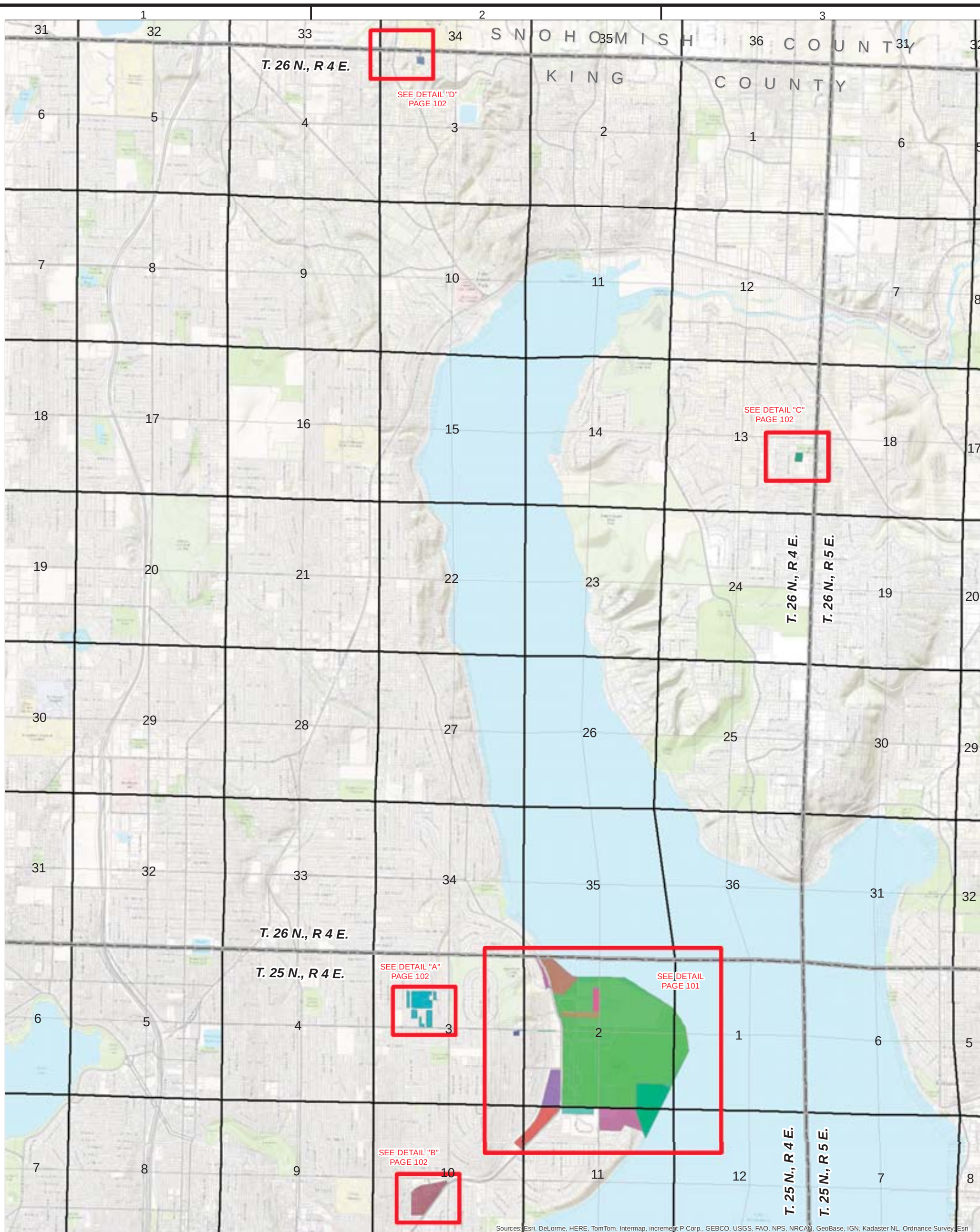
5. Most of the military structures existing on the property acquired for Magnuson Park have been removed including the runway and a variety of support buildings. Three subterranean munitions storage bunkers, and an aboveground pyrotechnic magazine remain, but are in good condition and do not constitute a hazard to park visitors or staff. There is no evidence of unsafe structures or debris, hazardous or toxic waste. or unexploded ordnance resulting from DOD use of the site.

DETERMINATION

Based on the foregoing findings of fact, the site has been determined to have been formerly used by the Navy. However, there is no evidence of unsafe conditions resulting from Navy use of the site. Therefore it is determined that an environmental restoration project is not an appropriate undertaking within the purview of the Defense Environmental Restoration Program, established under 10 USC 2701 et seq., for the reasons stated above.

2/28/90
DATE

PAT M. STEVENS IV
Brigadier General, USA
Commanding



T. 25 & 26 N., R. 4 E.,
Willamette Meridian

Legend

- King County Townships
- King County Sections
- King County ¼ Sections
- King County Parcels

Symbol	Item	Document
	1	Deed from King County
	2	Deed from King County
	3	Deed from King County
	4	Deed from King County
	5	Deed from King County
	6	Civil 1225 - US vs Leila M. Hart, et al
	7	Deed from Alice K. Denny
	8	Civil 302 - US vs State of Washington
	9	Civil 388 - US vs City of Seattle
	10	Civil 560 - US vs Sand Point Country Club
	11	Civil 668 - US vs Anna G. Neu
	12	Civil 1192 - US vs Mary H. Alvord, et al
	13	Civil 1177 - US vs A.J. Williams, et al
	14	Civil 1126 - US vs L.N. Otis, et al
	15	Civil 5085 - US vs Henry F. Moehring
	16	Miles Merritt - Sand Point Connection Rd - Vacation Ordnance
	17	Drain Line Easement from R.C. & Claire Egle
	18	Permit for Sewer Crossing from Northern Pacific Railway Company
	19	Water & Sewer Easement from Robert Baird
	20	Water Line Permit from City of Seattle
	21	Permit for Water Line Crossing from Northern Pacific Railway Company
	22	Water Line Permit from State of Washington
	23	Permit for Grade Crossing from King County
	24	Permit for Railway on Road from King County

Notes:

1. Mapping performed in NAD27, WA StatePlane, North, US Survey Feet

US Army Corps of Engineers
Seattle District

Date: 15 Apr 2014
File #: Sandpoint Acquisition.mxd
Drawn by: JEF

U.S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

SAND POINT N.A.S.
OVERALL ACQUISITION
KING COUNTY, WASHINGTON

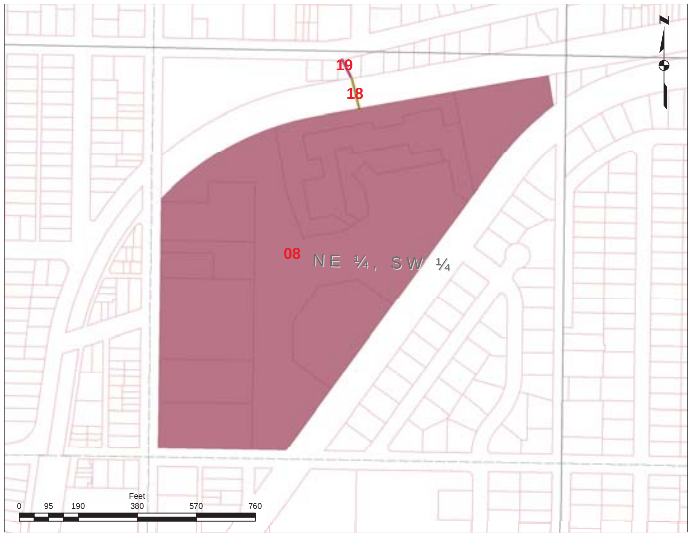
Plate number: 100
Sheet 1 of 3

IF SHEET MEASURES LESS THAN 22" X 34" IT IS A REDUCED PRINT. REDUCE SCALE ACCORDINGLY.

Enclosure 1.c.

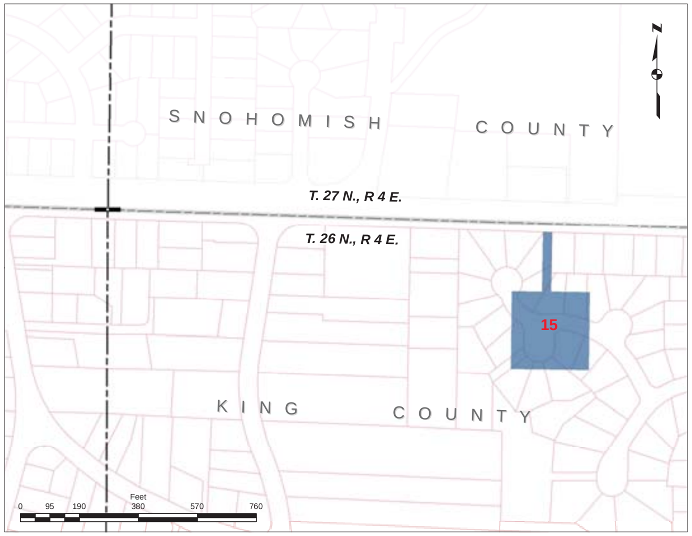
Enclosure 1.d.

Detail "A"
SHEARWATER HOUSING



Detail "B"
TRANSMITTER STATION

Detail "C"
RACON STATION



Detail "D"
LOW FREQUENCY NAVIGATIONAL AID

Legend

- Qtr Section, Found
- Section, Found
- Meander
- Vac R/W
- Gov't Harbor
- Presumed Shoreline (1925)
- Misc
- Gov't Lots
- 16th
- Qtr Section
- Section
- Township
- King Co Parcel Ext.
- Snoho_Co_Parcel_Ext

Notes:

1. Mapping performed in NAD27, WA StatePlane, North, US Survey Feet

US Army Corps of Engineers
Seattle District

Symbol	Description	Date	Appr.	Symbol	Description
		/ /			

U.S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

Designed by:
Drawn by: JEF
Checked by:
Date: 10 MAR 2014
File #:
Rev:
Prepared by:

SAND POINT N.A.S.
ACQUISITIONS
KING COUNTY, WASHINGTON

Plate number:
102
Sheet 3 of 3

IF SHEET MEASURES LESS THAN 22" X 34" IT IS A REDUCED PRINT. REDUCE SCALE ACCORDINGLY.

Path: O:\TR\cadastral\OrgProjects\FUDS - DERP\FOR KANSAS\Sand Point NAS\Project-Map\Sand Point Acquisition (3 of 3).mxd

Enclosure 1.e.

T. 25 & 26 N., R. 4 E.,
Willamette Meridian

Legend

- King County Townships
- King County Sections
- King County ¼ Sections
- King County Parcels

Symbol	Item	Document
	25	Report of Excess - RACON Lighthouse Site
	26	Report of Excess - Low Frequency Radio Navigational Aid
	27	Report of Excess - Transmitter Site
	28	QCD from HEW to City of Seattle
	29	Transfer from GSA to NOAA
	30	Report of Excess - NARA Warehouse
	31	Transfer Letter to US Fish & Wildlife
	32	QCD from BOR to City of Seattle
	33	QCD from NPS to City of Seattle
	34	QCD from BOR to City of Seattle
	35	QCD to Board of Regents of University of Washington (Parcel 7)
	36	QCD from NAVY to City of Seattle (Parcel 9A)
	37	Agreement for Sale of Railroad Trackage
	38	QCD to Board of Regents of University of Washington (Parcel 4)
	39	QCD to Board of Regents of University of Washington (Parcel 3)
	40	Report of Excess & QCD - Shearwater Housing (1.849 Ac.)
	41	QCD to City of Seattle (Parcel 5)
	42	Report of Excess (6.44 Ac.)
	43	Report of Excess with Easements - Shearwater Housing (15.03 Ac.)
	44	QCD from US thru NPS to City of Seattle (Parcel 2)
	45	Notice of Availability (15.96 Ac.)
	46	NOAA Road
	47	QCD to heirs of Alice K. Denny
	48	OPR19991214000972-1-12

Notes:

1. Mapping performed in NAD27, WA StatePlane, North, US Survey Feet

Miles
0 0.2 0.4 0.8 1.2 1.6

IF SHEET MEASURES LESS THAN 22" X 34" IT IS A REDUCED PRINT. REDUCE SCALE ACCORDINGLY.

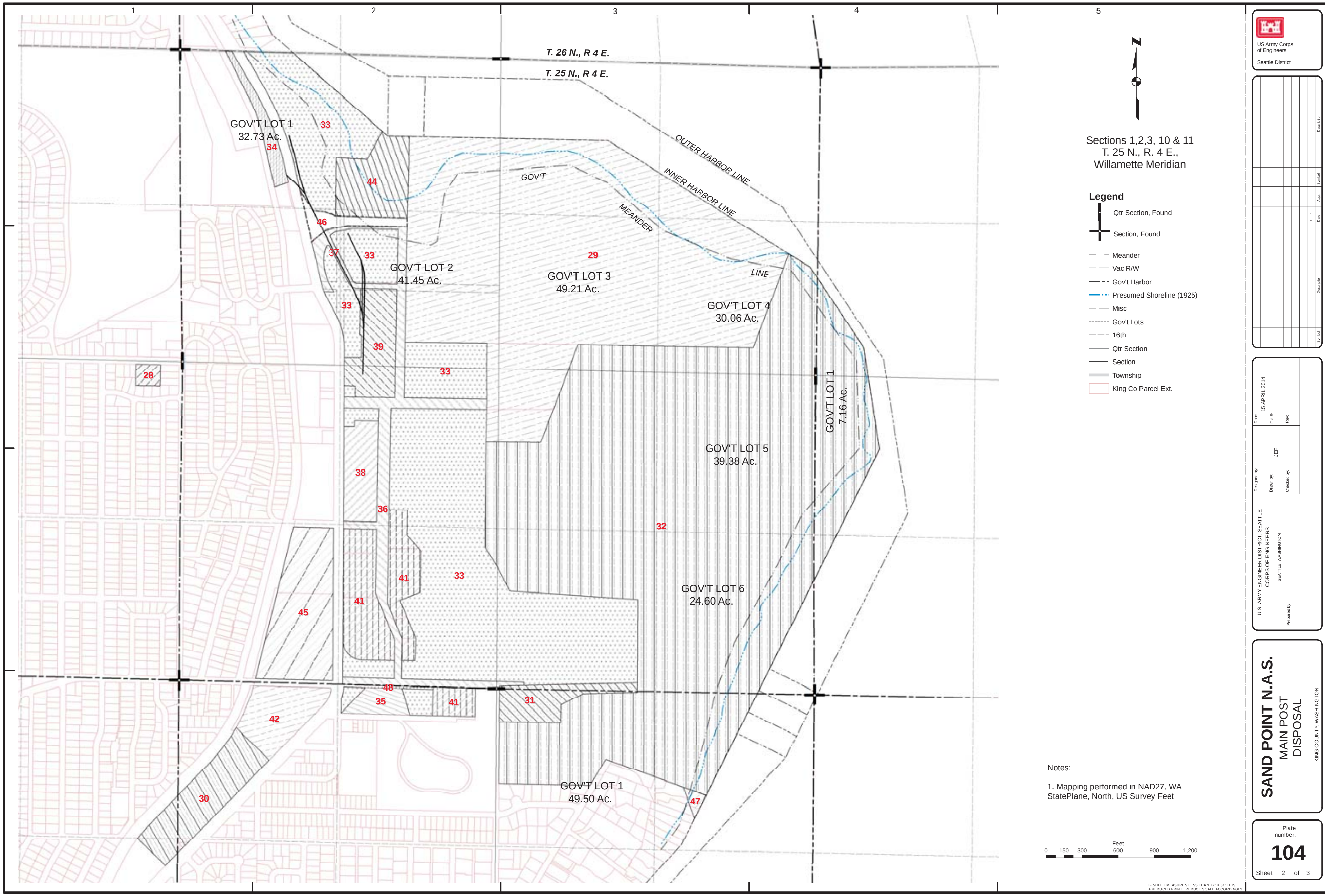
US Army Corps of Engineers
Seattle District

Date: 15 Apr 2014
File #: Sandpoint Acquisition.mxd
Drawn by: JEF

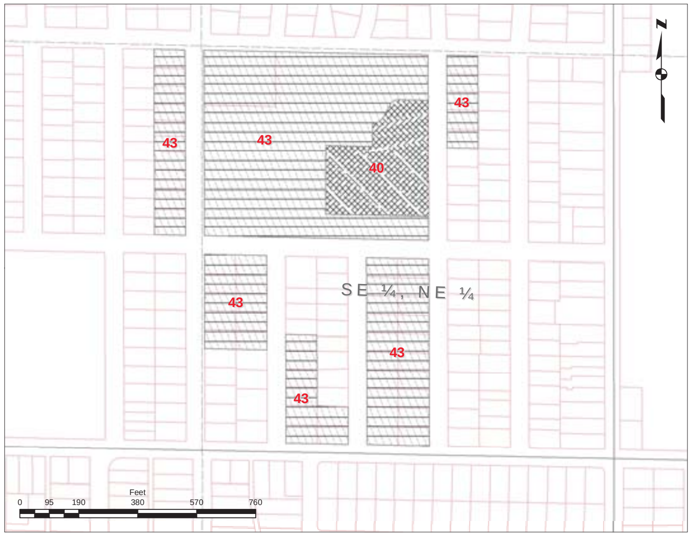
U.S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

SAND POINT N.A.S.
OVERALL DISPOSAL
KING COUNTY, WASHINGTON

Plate number:
103
Sheet 1 of 3



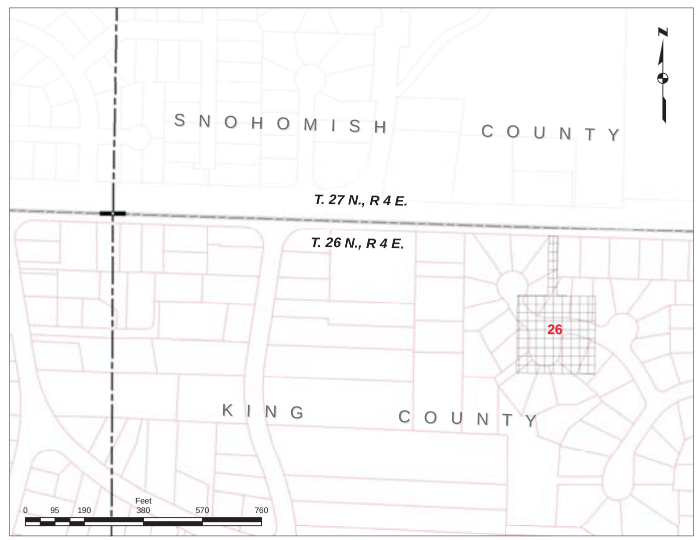
Enclosure 1.g.



Detail "A"
SHEARWATER HOUSING

Detail "B"
TRANSMITTER STATION

Detail "C"
RACON STATION



Detail "D"
LOW FREQUENCY NAVIGATIONAL AID

Legend

- Qtr Section, Found
- Section, Found
- Meander
- Vac R/W
- Gov't Harbor
- Presumed Shoreline (1925)
- Misc
- Gov't Lots
- 16th
- Qtr Section
- Section
- Township
- King County Parcels
- Snohomish County Parcels

Notes:

1. Mapping performed in NAD27, WA StatePlane, North, US Survey Feet

US Army Corps of Engineers
Seattle District

Date: 10 MAR 2014
Drawn by: JEF

U.S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

SAND POINT N.A.S.
DISPOSAL DETAILS
KING COUNTY, WASHINGTON

Plate number:
105
Sheet 3 of 3

IF SHEET MEASURES LESS THAN 22" X 34" IT IS A REDUCED PRINT. REDUCE SCALE ACCORDINGLY.

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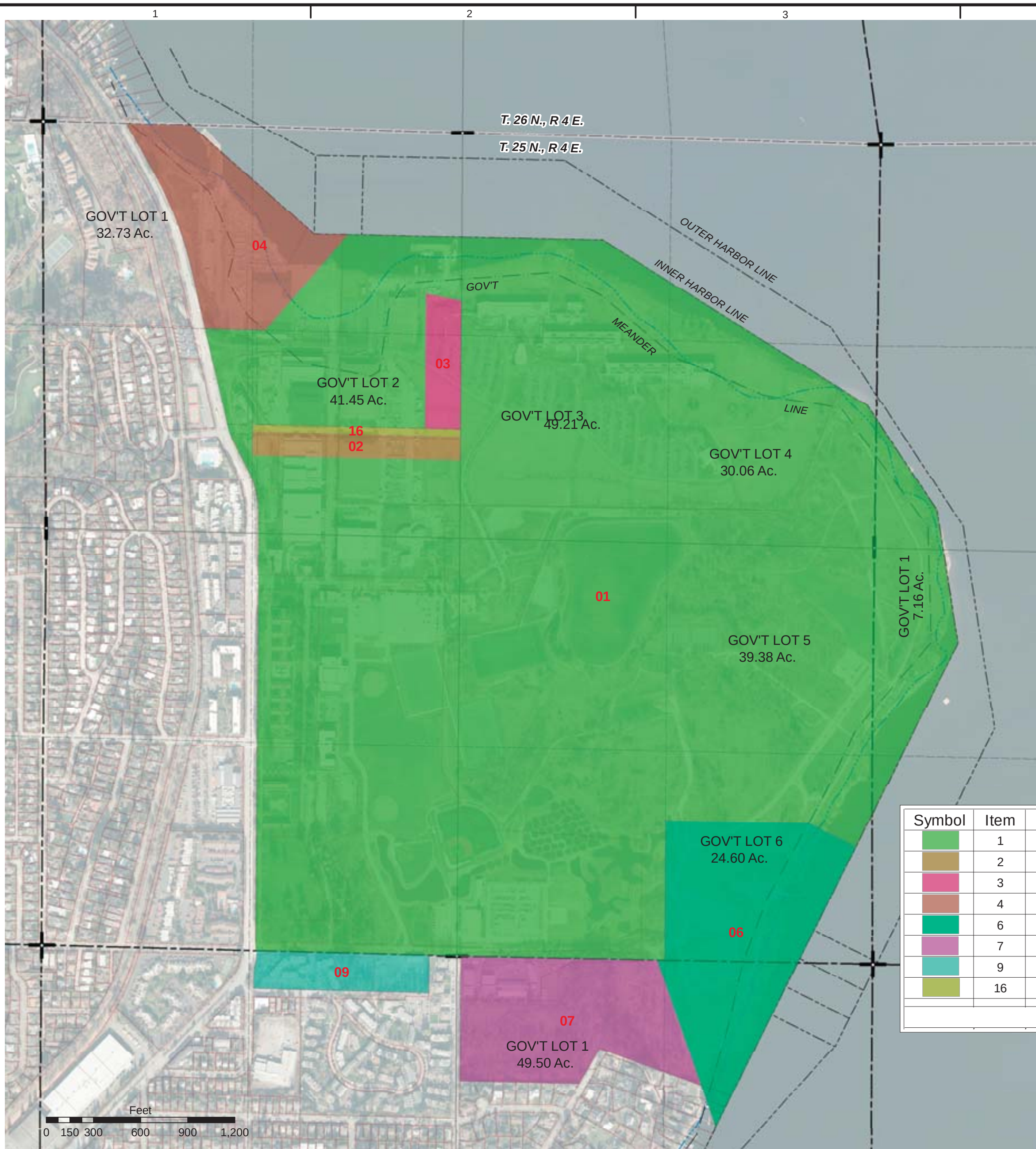
Enclosure 1.h.



Sections 1,2 & 11
T. 25 N., R. 4 E.,
Willamette Meridian

Legend

- Qtr Section, Found
- Section, Found
- Meander
- Vac R/W
- Gov't Harbor
- Presumed Shoreline (1925)
- Misc
- Gov't Lots
- 16th
- Qtr Section
- Section
- Township
- King Co Parcel Ext.

Symbol	Item	Document	Dated	Acreage
	1	Deed from King County	9-Feb-1926	(373.02)
	2	Deed from King County	5-Apr-1926	4.40
	3	Deed from King County	20-Apr-1926	(6.58)
	4	Deed from King County	26-Oct-1926	(19.28)
	6	Civil 1225 - US vs Leila M. Hart, et al	15-Aug-1938	30.42
	7	Deed from Alice K. Denny	6-Aug-1940	23.57
	9	Civil 388 - US vs City of Seattle	25-Jun-1941	(6.08)
	16	Miles Merritt - Sand Point Connection Rd - Vacation Ordnance	14-Feb-1927	

Acreage in parentheses "( )" is presumed and not listed in documentation.

Notes:

1. Mapping performed in NAD27, WA StatePlane, North, US Survey Feet

IF SHEET MEASURES LESS THAN 22" X 34" IT IS A REDUCED PRINT. REDUCE SCALE ACCORDINGLY.

US Army Corps of Engineers
Seattle District

Symbol	Description	Date	Appr.	Symbol	Description
		/ /			

U.S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

Designed by: | Date: 12 MAY 2014
Drawn by: JEF | File #:
Checked by: | Rev:
Prepared by:

SAND POINT N.A.S.
MAIN POST ACQUISITION
KING COUNTY, WASHINGTON

Plate number: **100**
Sheet 1 of 2

Path: D:\TR\cadastral\OrgProjects\FUDS - DERP\FOR KANSAS\Sand Point NAS\Project-Map\Sand Point (1 of 2).mxd

Enclosure 1.i.

Sections 1,2,3, 10 & 11
T. 25 N., R. 4 E.,
Willamette Meridian

Legend

- Qtr Section, Found
- Section, Found
- Meander
- Vac R/W
- Gov't Harbor
- Presumed Shoreline (1925)
- Misc
- Gov't Lots
- 16th
- Qtr Section
- Section
- Township
- King Co Parcel Ext.

Notes:

1. Mapping performed in NAD27, WA StatePlane, North, US Survey Feet

Symbol	Item	Document	Dated	Acreage
	29	Transfer from GSA to NOAA	19-Dec-1974	100± / 116.90
	31	Transfer Letter to US Fish & Wildlife	Circa 1998	4.90
	32	QCD from BOR to City of Seattle	17-Dec-1975	195.60
	33	QCD from NPS to City of Seattle	17-Mar-1999	93.10
	35	QCD to Board of Regents of University of Washington (Parcel 7)	27-Apr-1999	(2.50)
	36	QCD from NAVY to City of Seattle (Parcel 9A)	18-Aug-1998	13.50
	37	Agreement for Sale of Railroad Trackage	16-May-1975	3,200 feet
	38	QCD to Board of Regents of University of Washington (Parcel 4)	10-Aug-1999	5.00
	39	QCD to Board of Regents of University of Washington (Parcel 3)	10-Aug-1999	8.00
	41	QCD to City of Seattle (Parcel 5)	21-Apr-1998	19.00
	44	QCD from US thru NPS to City of Seattle (Parcel 2)	12-Dec-2002	8.2382
	46	NOAA Road	circa Apr 2000	± 11
	47	QCD to heirs of Alice K. Denny	31-May-1941	0.50
	48	OPR19991214000972-1-12	1-Sep-1999	± 0.17

Acreage in parentheses "( )" is presumed and not listed in documentation.

Feet
0 150 300 600 900 1,200

US Army Corps of Engineers
Seattle District

Description | Symbol | Appr. | Date | Description | Symbol

Date: 12 MAY 2014
File #:
Rev.:
Designed by:
Drawn by: JEF
Checked by:

U.S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON
Prepared by:

SAND POINT N.A.S.
MAIN POST
DISPOSAL
KING COUNTY, WASHINGTON

Plate number:
101
Sheet 2 of 2

IF SHEET MEASURES LESS THAN 22" X 34" IT IS A REDUCED PRINT. REDUCE SCALE ACCORDINGLY.

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Enclosure 1.j.

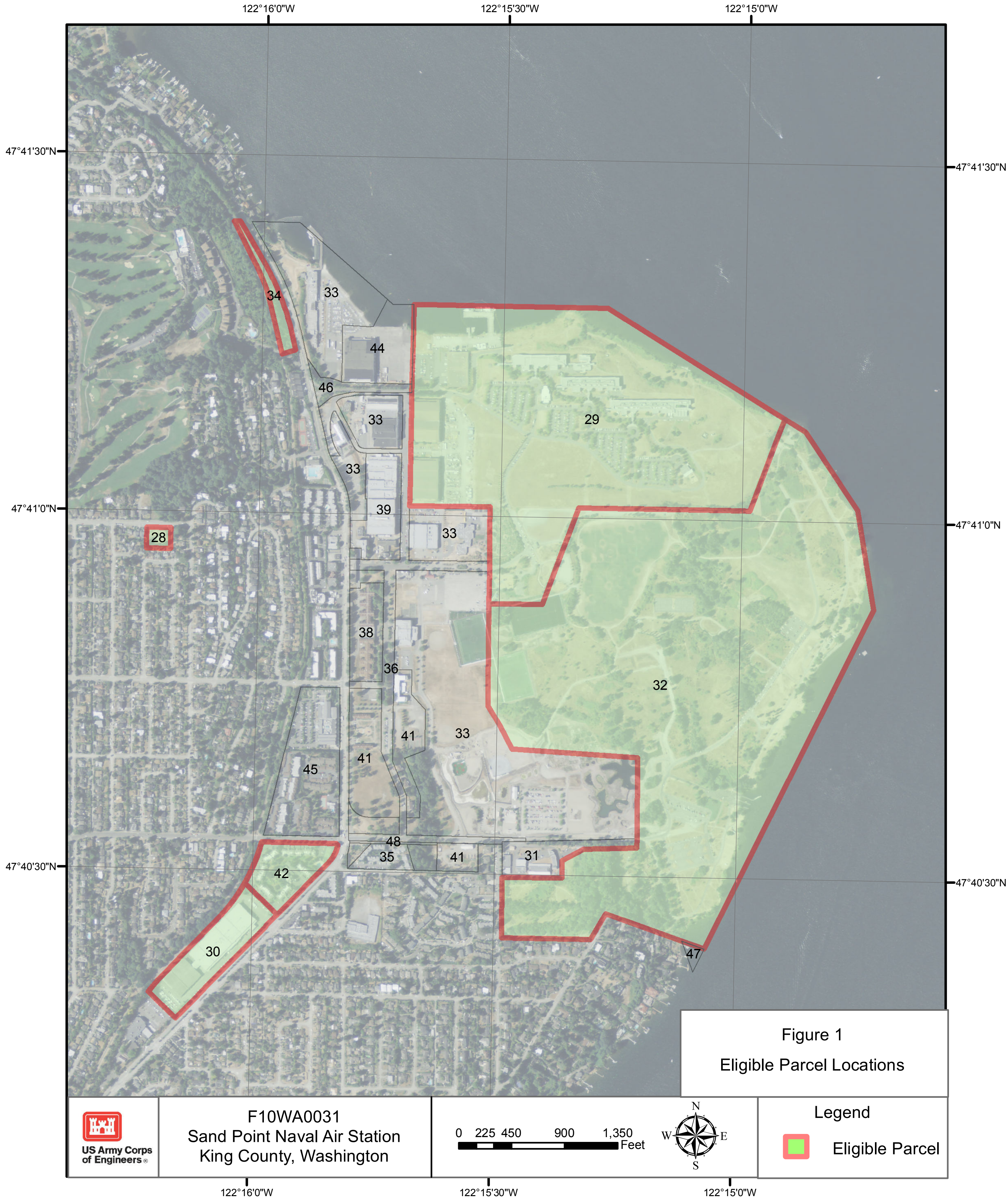


Figure 1

Eligible Parcel Locations

F10WA0031
Sand Point Naval Air Station
King County, Washington

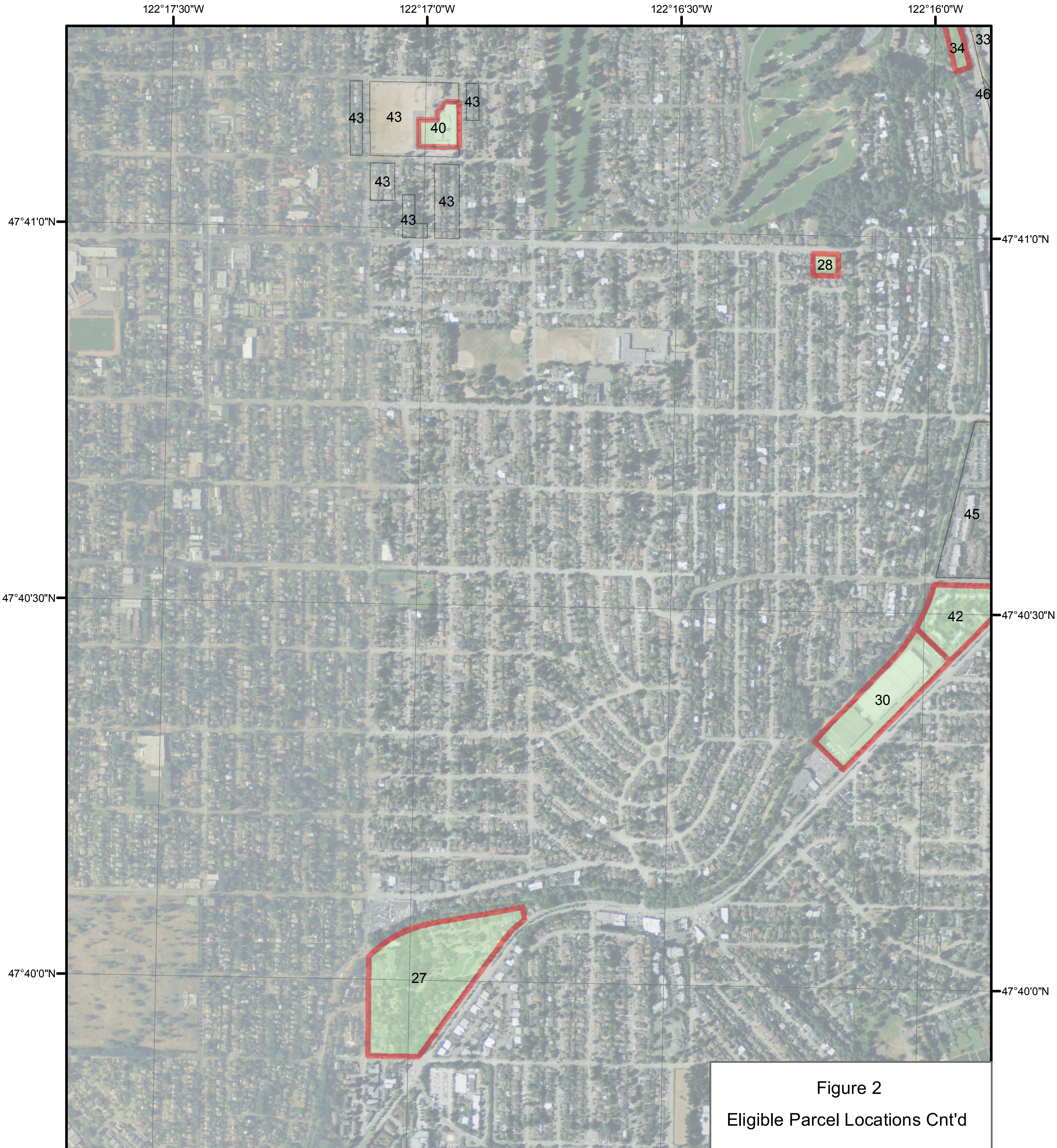


Figure 2

Eligible Parcel Locations Cnt'd

US Army Corps of Engineers

F10WA0031
Sand Point Naval Air Station
King County, Washington

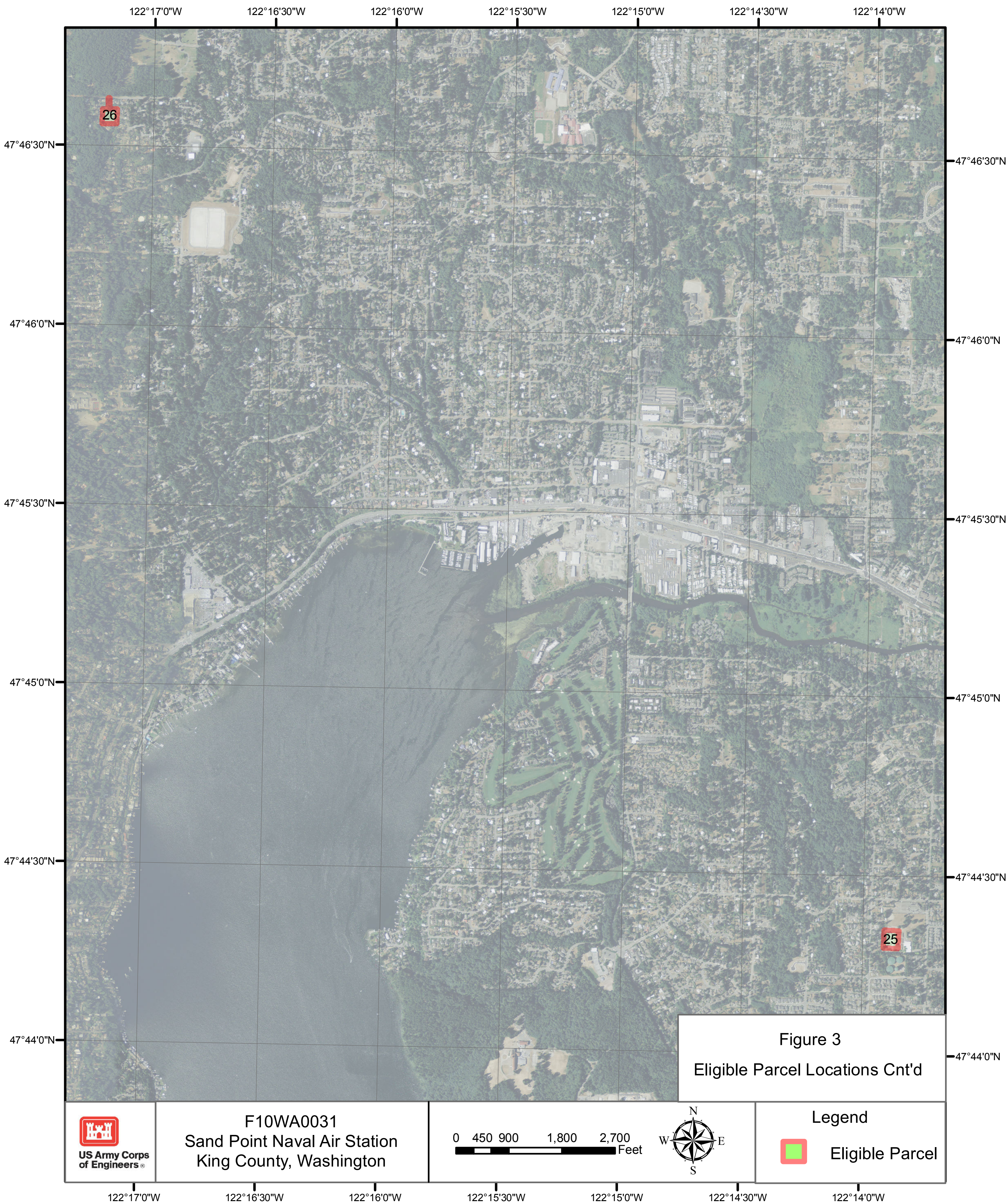
0 225 450 900 1,350 Feet

N W E S

Legend

Eligible Parcel

122°17'30"W 122°17'0"W 122°16'30"W 122°16'0"W



Enclosure 1.m.

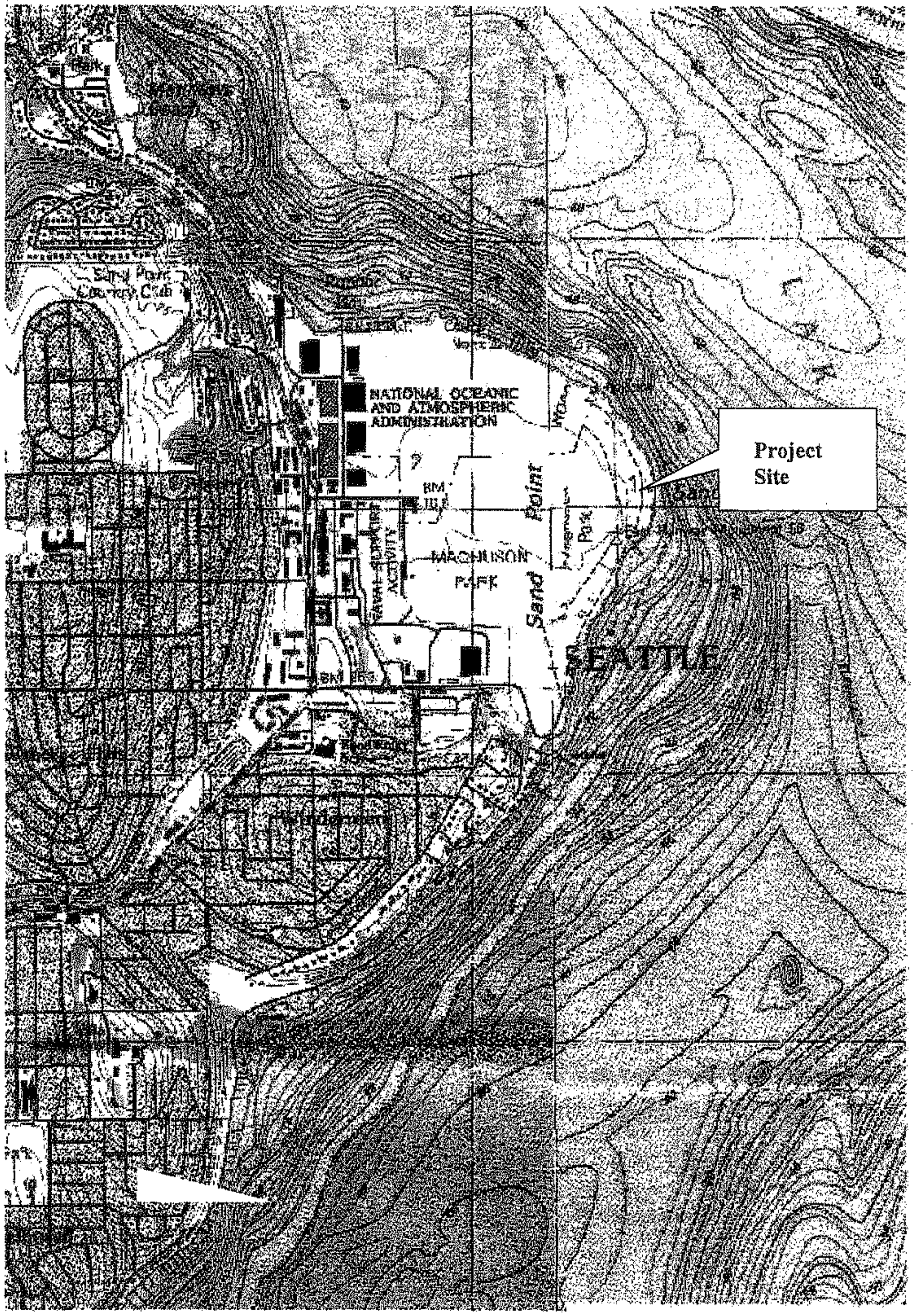
G.2. Environmental Sampling Report, April 2005

ENVIRONMENTAL SAMPLING REPORT
Magnuson Park
Seattle, Washington
HWA Project No. 2004-119-22

Prepared for
City of Seattle Dept. of Parks & Recreation

April 12, 2005

HWA GEOSCIENCES INC.
Geotechnical Engineering · Hydrogeology · Geoenvironmental Services · Inspection & Testing

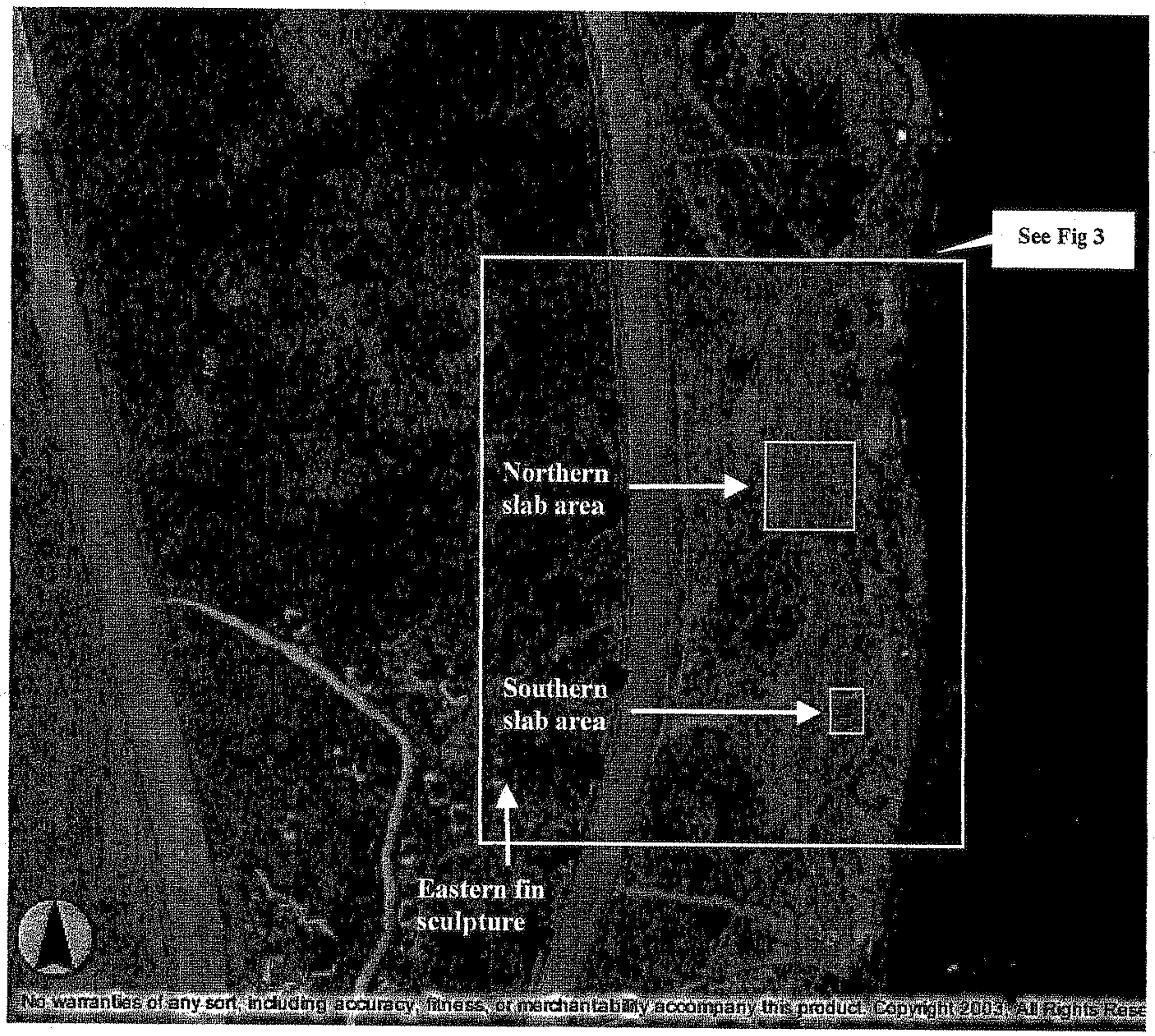


HWA GEOSCIENCES INC.

SEATTLE PARKS DEPARTMENT
MAGNUSON PARK
SEATTLE, WASHINGTON

VICINITY MAP

PROJECT NO.: 2004-119-22 FIGURE: 1



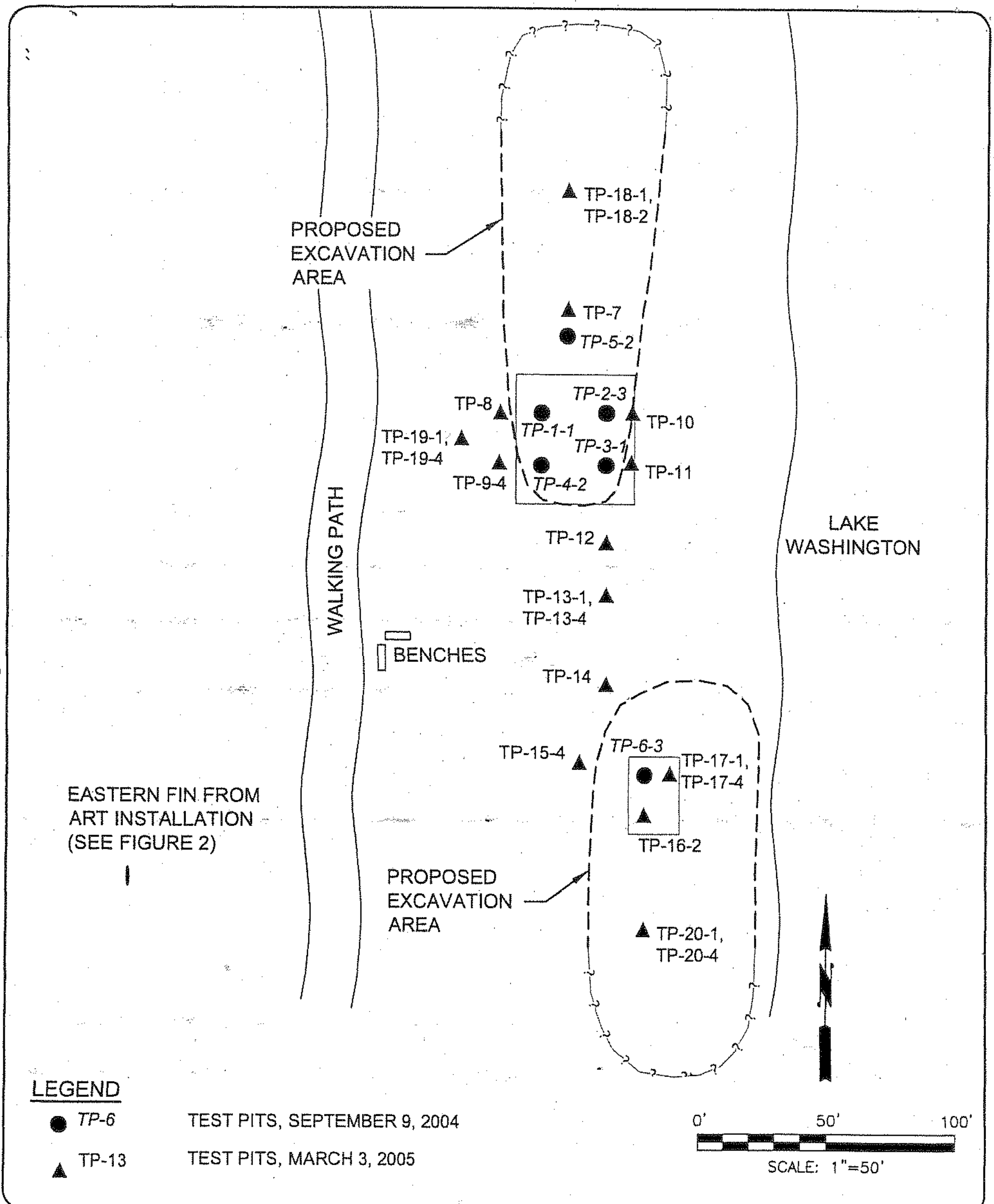
HWA GEOSCIENCES INC.

SEATTLE PARKS DEPARTMENT
MAGNUSON PARK
SEATTLE, WASHINGTON

SITE LOCATION

PROJECT NO.: 2004-119-22 FIGURE: 2

Document3.doc



HWA GEOSCIENCES INC.

ENVIRONMENTAL SAMPLING	DRAWN BY KS	FIGURE NO. 3
SEATTLE PARKS DEPARTMENT MAGNUSON PARK	CHECKED BY JS	
SEATTLE, WASHINGTON	DATE 3.14.05	PROJECT NO. 2004-119

H:\1PROJECTS\2004 PROJECTS\2004-119-22 SEATTLE PARKS DEPT\MAGNUSON PARK\DWG\2004-119.DWG

REV 02 KLS 4/5/05

Table 1
Total Petroleum Hydrocarbons
Soil Field Screening and Analytical Results

Sample*	PID (ppm)	PetroFlag (ppm)	Benzene (µg/kg)	Toluene (µg/kg)	Ethylbenzene (µg/kg)	m,p-xylene (µg/kg)	o-xylene (µg/kg)	MTBE (µg/kg)	Gasoline (mg/kg)	Diesel (mg/kg)	JP4 (mg/kg)	Lube Oil (mg/kg)	Lead (mg/kg)
TP1-1	242		<19	380	250	150	270		**560**	200	200	183	
TP2-3	117		<16	190	170	60	120		**230**	330	310	**2520**	
TP3-1			<20	440	330	99	170		**370**	170	220	**521**	
TP4-2			<22	80	81	73	690		**200**	**530**	**520**	136	
TP5-2			**140**	1300	720	4200	2800		**760**	**840**	**700**	**3901**	
TP6-3									**1400**	**1000**	**1400**	**5618**	
TP7-1	0	123											
TP7-3	212	4625											
TP8-1	11	310											
TP8-4	0	31											
TP9-1	0	0											
TP-9-4	0	192	<17	<33	<33	<67	<33	<67	<6.7	<5.5	<5.5	<11	
TP10-2	5	453											
TP10-4	1	32											
TP11-2	11	123											
TP11-4	0	160											
TP12-1	0	335											
TP12-3.5	0	284											
TP13-1	0	10	<15	<30	<30	<59	<30	<59	<5.9	<5.4	<5.4	<11	
TP13-4	0	23	<18	<35	<35	<70	<35	<70	<7.0	<5.7	<5.7	<11	
TP14-1	0	29											
TP14-4	0	0											
TP15-1	0	0											
TP15-4	30	19	<18	<35	<35	<70	<35	<70	<7.0	<5.6	<5.6	<11	
TP16-2	3	5539											37
TP16-4	6	75											
TP17-1	3	540	**74**	4100	170	1300	190	<61	23	41	14	370	
TP17-4	94	3909	**100**	370	580	2100	1300	**220**	**220**	320	200	**3300**	
TP18-1	0		<21	<41	<41	<82	<41	<82	<8.2	65	8.6	**480**	
TP18-2	0	640	<17	<33	<33	<67	<33	<67	<6.7	<6.2	<6.2	14	

TP19-1	1		<15	<30	<30	<60	<30	<60	<6.0	<5.4	<5.4	<11	
TP19-4	0		<18	<36	<36	<72	<36	<72	<7.2	<5.7	<5.7	<11	
TP20-1	0		<15	<30	<30	<60	<30	<60	<6.0	390	<21	60	
TP20-2	1	1391											
TP-20-4	0		<18	<35	<35	<71	<35	<71	<7.1	<5.7	<5.7	<11	
STEE									200	460	460	460	220
MTCA-A			30	7000	6000	9000		100	30/100**	2000			250

* TPX-n, where n = sample depth in feet
** Method A soil cleanup levels for gasoline are 100 mg/kg if no benzene is detected in the sample and 30 mg/kg if benzene is detected.
Bold - exceeds STEE value or MTCA Method A
Blank – Not analyzed / not available
STEE - Unrestricted land use criteria for Simplified Terrestrial Ecological Evaluation
MTCA-A - Ecology Chapter 173-340 WAC MTCA Method A soil cleanup levels for unrestricted land use, for reference only

Data Review

Laboratory QC included analysis of method blanks, laboratory control spikes, laboratory control spike duplicates, matrix spikes, matrix spike duplicates, blank spikes, and surrogate samples. These analyses provide information about accuracy, precision, and detection limits. ARI did not flag any results with qualifiers, which indicates that all QC results were within control limits. All samples were extracted and analyzed within holding times. Laboratory method blank analyses were all below detection limits. All data are considered useable for the intended purpose.

LIMITATIONS

The conclusions expressed by HWA are based solely on material referenced in this report. Observations were made under the conditions stated. Within the limitations of scope, schedule and budget, HWA attempted to execute these services in accordance with generally accepted professional principles and practices in the area at the time the report was prepared. No warranty, express or implied, is made. Experience has shown that subsurface soil and groundwater conditions can vary significantly over small distances. It is always possible that contamination may exist in areas that were not sampled. HWA's findings and conclusions must not be considered as scientific or engineering certainties, but rather as our professional opinion concerning the significance of the limited data gathered and interpreted during the course of the assessment. This study and report have been prepared on behalf of the Seattle Department of Parks and Recreation, for the specific application to the subject property. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent

G.3. Environmental Assessment Technical Memorandum, September 2005

ENVIRONMENTAL ASSESSMENT TECHNICAL MEMORANDUM

MAGNUSON PARK SHORELINE RENOVATION

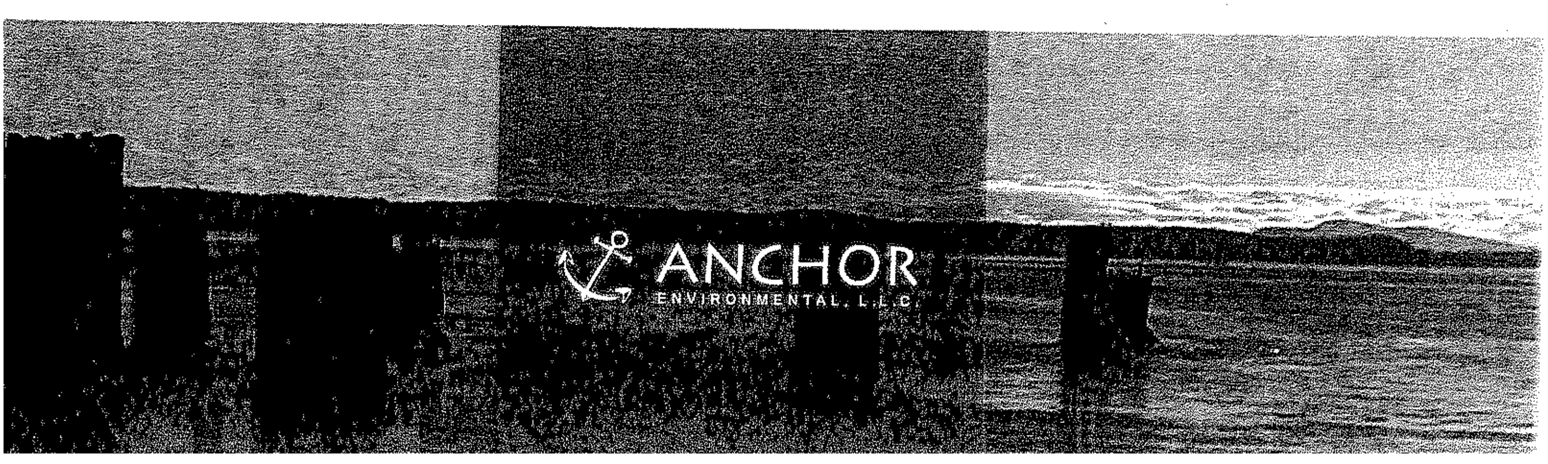
Prepared for

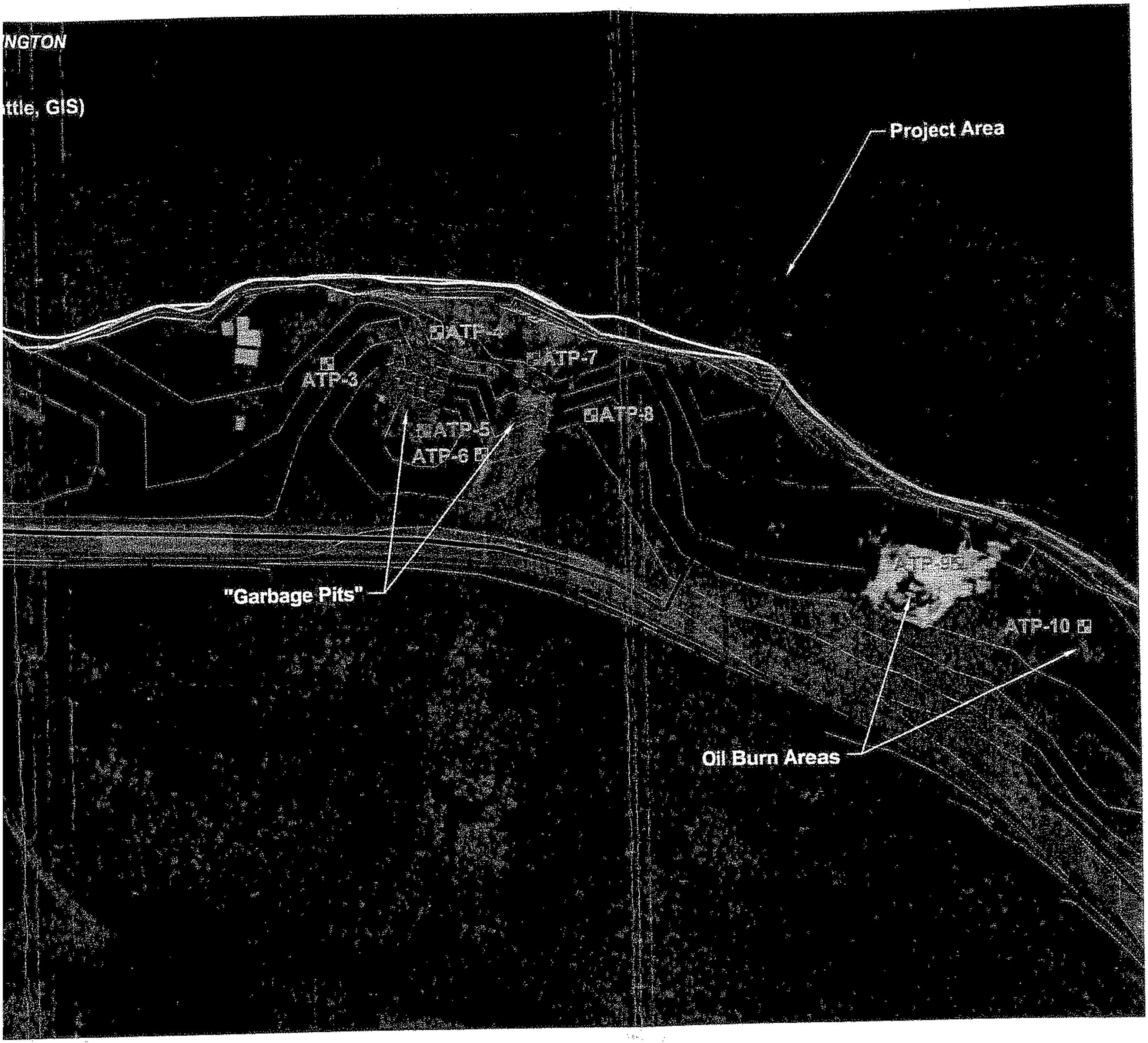
City of Seattle Department of Parks and Recreation
800 Maynard Avenue South, Third Floor
Seattle, Washington 98134

Prepared by

Anchor Environmental, L.L.C.
1423 Third Ave, Suite 300
Seattle, Washington 98101

September 2005





and Number below MTCA A Soil Cleanup Levels

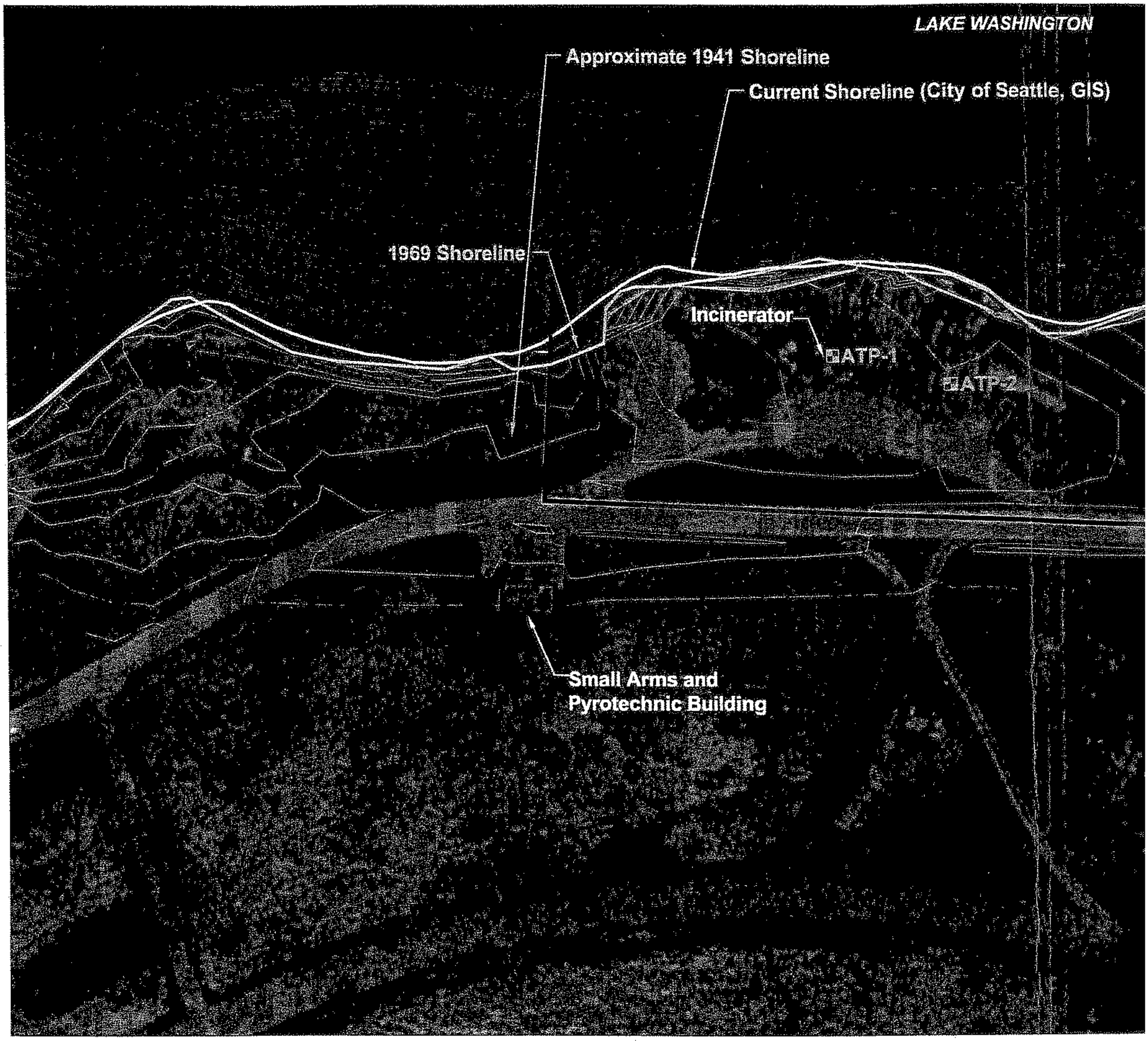
and Number above MTCA A Soil Cleanup Levels

1969 Aerial Photo

0 100

Scale in Feet

Figure 3
Test Pit Locations
Magnuson Park Shoreline Renovation



ATP-1 Test Pit Location and Number bel

ATP-2 Test Pit Location and Number abo

1969 Aerial Pho

0

Scale in Feet

ANCHOR
ENVIRONMENTAL, L.L.C.

Table 1
Soil Testing Results
Magnuson Park Shoreline Renovation
Seattle, Washington

Parameter	Analytical Method	MTCA Method A Soil Cleanup Levels for Unrestricted Land Use	Sampling Results									
			ATP-1 (4-5 feet)	ATP-2 (7-8 feet)	ATP-3 (3-4 feet)	ATP-4 (3.5-4.5 feet)	ATP-5 (3-4 feet)	ATP-6 (7-8 feet)	ATP-7 (3-4 feet)	ATP-8 (5-6 feet)	ATP-9 (2-3 feet)	ATP-10 (4-5 feet)
TPH (mg/kg)												
HCID - Gasoline Range	NWTHP-HCID		20 U	DET [1]	20 U	20 U	DET [1]	20 U	20 U	DET [1]	20 U	DET [1]
HCID - Diesel Range	NWTHP-HCID		50 U	DET	50 U	DET	DET	50 U	50 U	DET	50 U	DET
HCID - Residual Range	NWTHP-HCID		100 U	DET	DET	DET	DET J	100 U	DET	DET	100 U	DET
Gasoline Range Organics	NWTHP-Dx	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diesel Range Organics	NWTHP-Dx	2,000	NA	870 DY	31 H	110 H	600 DH	NA	29 H	830 DY	NA	2500 DY
Residual Range Organics	NWTHP-Dx	2,000	NA	1500 DO	440 O	1100 O	3400 DOJ	NA	190 O	5900 DO	NA	9700 DO
LPAHs (µg/kg)												
Naphthalene	US EPA Method 8270	5,000	2.9 U	67	2.9 U	34	140	3.4 U	26	100	2.9 U	1500 D
2-Methylnaphthalene	US EPA Method 8270		2.9 U	44	2.9 U	12	67	3.4 U	9.9	120	2.9 U	2400 D
Acenaphthylene	US EPA Method 8270		2.9 U	11	2.9 U	4.5	9.5	3.4 U	2.9 U	8.7	2.9 U	120 D
Acenaphthene	US EPA Method 8270		2.9 U	8.2	2.9 U	3.4 U	8.2	3.4 U	2.9 U	25	2.9 U	250 D
Fluorene	US EPA Method 8270		2.9 U	11	2.9 U	3.7	17	3.4 U	4.5	21	2.9 U	260 D
Dibenzofuran	US EPA Method 8270		2.9 U	10	2.9 U	4.6	37	3.4 U	5	31	2.9 U	130 D
Phenanthrene	US EPA Method 8270		2.9 U	73	2.9 U	20	110	3.4 U	40	150	2.9 U	810 D
Anthracene	US EPA Method 8270		2.9 U	14	2.9 U	4.5	13	3.4 U	4.7	25	2.9 U	140 D
HPAHs (µg/kg)												
Fluoranthene	US EPA Method 8270		3.6	84	2.9 U	21	77	3.4 U	44	120	2.9 U	200 D
Pyrene	US EPA Method 8270		3.7	120	2.9 U	37	160	3.4 U	67	160	2.9 U	430 D
Benzo(b)fluoranthene	US EPA Method 8270		5.1	210	2.9 U	22	70	3.4 U	30	45	2.9 U	83 D
Benzo(k)fluoranthene	US EPA Method 8270		3.5	130	2.9 U	16	49	3.4 U	27	31	2.9 U	47 D
Benz(a)anthracene	US EPA Method 8270		3	78	2.9 U	10	46	3.4 U	23	36	2.9 U	160 D
Chrysene	US EPA Method 8270		4.1	130	2.9 U	23	95	3.4 U	37	64	2.9 U	230 D
Benzo(a)pyrene	US EPA Method 8270	100	4	230	2.9 U	22	63	3.4 U	35	38	2.9 U	210 D
Indeno(1,2,3-cd)pyrene	US EPA Method 8270		4 U	290	2.9 U	37	56	3.4 U	27	75	2.9 U	98 D
Dibenz(a,h)anthracene	US EPA Method 8270		2.9	45	2.9 U	5.3	11	3.4 U	4.9	11	2.9 U	19 D
Benzo(g,h,i)perylene	US EPA Method 8270		4.2	340	2.9 U	60	73	3.4 U	29	98	2.9 U	270 D
Metals (mg/kg)												
Arsenic	US EPA Method 7060A	20	7.7	20.7	5.3	8.3	16.6	2	12.3	3.8	2.3	2.3
Barium	US EPA Method 6010B		152	1520	80	419	2400	50.5	369	159	44.9	41.8
Cadmium	US EPA Method 6010B	2	1.1 U	58.4	1.1 U	16.3	23	1.1 U	21.7	10.9	1.2 U	1.2 U
Chromium	US EPA Method 6010B	Cr VI=19 Cr III=2,000	35.8	125	38.5	56.1	110	21.6	47	206	32.6	35.9
Lead	US EPA Method 6010B	250	22.7 U	3690	22.8 U	240	4140	22.2 U	797	979	23 U	22.9 U
Mercury	US EPA Method 7471A	2	0.05	4.74	0.03	0.21	3.22	0.02 U	0.18	0.07	0.02	0.03
Selenium	US EPA Method 7740		1.1 U	1.2 U	1.1 U	1.3 U	1.7 U	1.3 U	1.1 U	1.1 U	1.2 U	1.2 U
Silver	US EPA Method 6010B		2.3 U	30.9	2.3 U	5	17.8	2.2 U	7.1	2.1 U	2.3 U	2.3 U
VOCs (µg/kg)												
Benzene	US EPA Method 8260B	30	4.6 U	5.5 U	5.0 U	6.2 U	8.9 U	6.0 U	4.8 U	6.0	4.7 U	4.6 U
Ethylbenzene	US EPA Method 8260B	6,000	4.6 U	5.5 U	5.0 U	6.2 U	8.9 U	6.0 U	4.8 U	4.4 U	4.7 U	4.6 U

Mercury	US EPA Method 7471A	2	0.05	4.74	0.03	0.21	3.22	0.02 U	0.18	0.07	0.02	0.03
Selenium	US EPA Method 7740		1.1 U	1.2 U	1.1 U	1.3 U	1.7 U	1.3 U	1.1 U	1.1 U	1.2 U	1.2 U
Silver	US EPA Method 6010B		2.3 U	30.9	2.3 U	5	17.8	2.2 U	7.1	2.1 U	2.3 U	2.3 U
VOCs (µg/kg)												
Benzene	US EPA Method 8260B	30	4.6 U	5.5 U	5.0 U	6.2 U	8.9 U	6.0 U	4.8 U	6.0	4.7 U	4.6 U
Ethylbenzene	US EPA Method 8260B	6,000	4.6 U	5.5 U	5.0 U	6.2 U	8.9 U	6.0 U	4.8 U	4.4 U	4.7 U	4.6 U
m,p-Xylene	US EPA Method 8260B	9,000	4.6 U	5.9	5.0 U	6.2 U	9.7	6.0 U	4.8 U	4.4 U	4.7 U	4.6 U
Toluene	US EPA Method 8260B	7,000	4.6 U	5.5 U	5.0 U	6.2 U	8.9 U	6.0 U	4.8 U	4.4 U	4.7 U	4.6 U
Acetone	US EPA Method 8260B		19 U	31	67	35	190	24 U	19 U	18 U	19 U	19 U
cis-1,2-Dichloroethene	US EPA Method 8260B		4.6 U	5.5 U	5.0 U	6.2 U	8.9 U	6.0 U	4.8 U	8.7	4.7 U	4.6 U
Trichloroethene	US EPA Method 8260B	30	4.6 U	5.5 U	5.0 U	6.2 U	8.9 U	6.0 U	4.8 U	17	4.7 U	4.6 U
Tetrachloroethene	US EPA Method 8260B	50	4.6 U	5.5 U	5.0 U	6.2 U	8.9 U	6.0 U	4.8 U	10	4.7 U	4.6 U
Chlorinated Pesticides (µg/kg)												
4,4'-DDE	US EPA Method 8081		3.4 U	4.6	3.4 U	3.4 U	43 P	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U
4,4'-DDD	US EPA Method 8081		3.4 U	19	3.4 U	8.3 P	120 P	3.4 U	4.8	11	3.4 U	3.4 U
4,4'-DDT	US EPA Method 8081	3,000	3.4 U	8.3	3.4 U	3.4 U	34	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U
Endrin Ketone	US EPA Method 8081		3.4 U	3.4 U	3.4 U	3.4 U	4.9 U	3.4 U	3.4 U	4.2 P	3.4 U	3.4 U
Endosulfan Sulfate	US EPA Method 8081		3.4 U	3.4 U	3.4 U	3.4 U	4.9	3.4 U	3.4 U	7.2	3.4 U	3.4 U
Methoxychlor	US EPA Method 8081		3.4 U	3.4 U	3.4 U	3.4 U	9.3	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U
PCBs (mg/kg)												
Aroclor 1016	US EPA Method 8082		0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U
Aroclor 1221	US EPA Method 8082		0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U
Aroclor 1232	US EPA Method 8082		0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U
Aroclor 1242	US EPA Method 8082		0.067 U	0.067 U	0.067 U	0.28	8.6 D	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U
Aroclor 1248	US EPA Method 8082		0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U
Aroclor 1254	US EPA Method 8082		0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U
Aroclor 1260	US EPA Method 8082		0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	0.12	0.067 U	0.067 U
Total Aroclors		1										

Notes:

Highlighted concentrations exceed Ecology MTCA Method A soil cleanup criteria for unrestricted land use.

1 = Results reported as gasoline range organics are due to the early portion of diesel fuel which elutes in the gasoline range (see laboratory case narrative).

U = Not detected at or above method reporting limit.

NA = Not analyzed.

J = Estimated Concentration.

D = The reported result is from a dilution.

P = The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 25% between the two analytical results.

H = The chromographic fingerprint resembles petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents.

Y = Chromographic fingerprint resembles petroleum product in approximately the correct carbon range, but elution pattern does not match calibration standard.

O = The chromographic fingerprint of the sample resembles an oil, but does not match the calibration standard.

B = The analyte was found in the associated method blank at a level that is significant relative to the sample result.

G.4. Final Site Characterization and Removal Report, October 2009

(Excerpts)

FINAL SITE CHARACTERIZATION AND REMOVAL ACTION REPORT for

RESPONSE ACTION FOR CONTAMINATED SOILS AT FORMER SAND POINT NAVAL STATION SOURCE AREAS 1 AND 2 SEATTLE, WASHINGTON

October 30, 2009

Prepared for:
Department of the Navy - Commanding Officer
Naval Facilities Engineering Command Northwest
Silverdale, Washington

NAVFAC Northwest

Prepared by:

ECC
1746 Cole Blvd, Suite 350
Lakewood, CO 80401

Prepared under:
Small Business Remedial Action Contract
Contract Number N68711-04-D-1106, CTO KR1

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FINAL
SITE CHARACTERIZATION AND REMOVAL ACTION REPORT FORMER SAND POINT NAVAL STATION SOURCE AREAS 1 AND 2 SEATTLE, WASHINGTON

Submitted by:
Environmental Chemical Corporation

Signature	10/30/09 *Date*
Brady Bigelow *Name*	*Project Manager* *Title*
Signature	10/29/09 *Date*
Bernie Wong, LGH *Name*	*EERG Project Manager* *Date*

Certification

This document was prepared under the direction and supervision of a qualified Hydrogeologist

State of Washington
Hydrogeologist
1075
Licensed Geologist
BERNARD B. WONG

Expires 05/02/2010

Washington Licensed Hydrogeologist (No. 1075)

Table of Contents

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List of Acronyms and Abbreviations

AMEC	AMEC Earth and Environmental, Inc.
APP	Accident Prevention Plan
bgs	below ground surface
BCY	bank cubic yards
CESCL	Certified Erosion and Sediment Control Lead
BMP	best management practice
COC	chemical of concern
CTO	Contract Task Order
CUL	Cleanup Levels
DQCR	Daily Quality Control Report
DRO	Diesel Range Organics
ECC	Environmental Chemical Corporation
Ecology	Washington State Department of Ecology
ERRG	Engineering/Remediation Resources Group, Inc.
IRA	Independent Removal Action
MTCA	Model Toxics Control Act
MUM	Memorandum of Understanding Meeting
NAVFAC NW	Naval Facilities Engineering Command, Northwest Division
Navy	United States Navy
NFA	No Further Action
NWTPH-Dx	Northwest Total Petroleum Hydrocarbon –Extended Diesel
OSHA	Occupational Safety and Health Administration
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PPE	personal protective equipment
PQCP	Project Quality Control Plan
PSC	Philip Services Corporation
QA	quality assurance
QC	quality control
SA	Source Area
SAP	Sampling and Analysis Plan
TEE	terrestrial ecological evaluation
TP	test pit
TPH	total petroleum hydrocarbons
USEPA	United State Environmental Protection Agency
WAC	Washington Administrative Code
WP	Work Plan
VCP	Voluntary Cleanup Plan

1.0 Introduction

This Final Site Characterization and Removal Action Report has been prepared to document removal action and restoration activities at the Former Sand Point Naval Station (Project Site) in Seattle, Washington (**Figure 1-1**). The Independent Removal Action (IRA) took place between July 13 and August 5, 2009. Environmental Chemical Corporation (ECC) performed the work through contract number N68711-04-D-1106, Contract Task Order (CTO) KR1, under Small Business Remedial Action Contract for Naval Facilities Engineering Command Northwest Division (NAVFAC NW), Silverdale, Washington. The IRA was completed pursuant to the *Final Project Work Plan, Response Action at Source Areas 1 and 2, Former Sand Point Naval Station, Seattle, Washington* (WP) (ECC, 2009a) and the Washington Administrative Code (WAC) 173-340-515, under Washington State Department of Ecology's (Ecology) Voluntary Cleanup Program (VCP). Engineering/Remediation Resources Group, Inc. (ERRG) implemented the Final WP in the field, with oversight by ECC.

Per the Final WP, the objective of the IRA was to define the horizontal and vertical extent of contamination at Source Area 1 (SA-1), Source Area 2 (SA-2), and one isolated hot spot southeast of SA-2 (GTP-E8) (**Figure 1-2**); remove and dispose of soil exceeding the Model Toxics Control Act (MTCA) Method A cleanup levels (CULs) for unrestricted land use; and grade excavated areas, as required by NAVFAC NW. **Table 1-1** lists the MTCA Method A CULs for the chemicals of concern (COCs) at the Project Site.

Based on previous site investigations documented in the report entitled *Test Excavations and Environmental Sampling, Magnuson Park Phase 2 Improvements, Wetlands Project, Seattle, Washington* (AMEC Earth and Environmental [AMEC], 2009), SA-1 primarily contained total petroleum hydrocarbons (TPH) as diesel range organics (DRO), TPH as heavy oils, arsenic, and cadmium above the MTCA Method A CULs. SA-2 had levels of arsenic, lead, and TPH as heavy oils above the applicable MTCA Method A CULs. Hot spot GTP-E8 contained TPH as heavy oils, cadmium, and lead above the MTCA Method A CULs. Although not included in the Final WP, STP-2N, located approximately ten feet north of AMEC's delineation of SA-2, also had detected arsenic and lead concentrations above the MTCA Method A CULs and was included in the IRA activities.

The IRA was accomplished by the following activities:

- Collected investigative soil samples from limited test pits within the perimeter of SA-2 (TP-1 to TP-5), within SA-2 (TP-6), and between hot spot GTP-E8 and SA-2; and excavated areas with analytical results over the CULs;
- Excavated soil containing TPH (DRO and heavy oils) and metals concentrations greater than the respective MTCA Method A CUL for unrestricted use;
- Collected representative soil samples from the endwalls and base of each excavation area to confirm that TPH (DRO and heavy oils) and metals (arsenic, cadmium, chromium III, lead and mercury) concentrations in soil were less than the MTCA Method A CUL for unrestricted use;

- Verified that polynuclear aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) were not present in soil as COCs by collecting one soil sample at each excavation area (SA-1, SA-2 and GTP-E8);
- Transported excavated soil offsite as Non-Dangerous Waste for disposal at the Allied Waste-owned, Subtitle D, Roosevelt Regional Landfill (landfill) in Goldendale, Washington;
- Pumped water from the open excavations into an onsite water storage tank to facilitate excavation;
- Transported water from the water storage tank offsite as Non-Dangerous Waste for solidification and disposal by Philip Services Corporation (PSC) (an approved, local treatment and disposal facility); and
- Graded, seeded and stabilized the excavation areas following receipt of acceptable confirmation sampling results. The grading effort was directed by the City of Seattle (City) and NAVFAC NW.

This Site Characterization and Removal Report documents the successful completion of the remedial action conducted at the Project Site and will be used to support the request for No Further Action (NFA). The report consists of the following sections:

- Section 1 - Introduction
- Section 2 - Summary of Site and Project History
- Section 3 - Remedial Action Summary
- Section 4 - Quality Control and Quality Assurance
- Section 5 - Health and Safety
- Section 6 - Conclusions and Summary of Findings
- Section 7 - References

2.0 Summary of Site and Project History

This section summarizes the events and findings leading to the remedial actions performed including site history, site description, and previous investigations for the Project Site.

2.1 Site History

The Former Sand Point Naval Station is located in northeast Seattle, Washington on a peninsula surrounded by Lake Washington (**Figure 1-1**). It is now known as Magnuson Park and is managed by the City of Seattle, Department of Parks and Recreation. Magnuson Park is a 350-acre property with historic Naval Air Station structures, athletic fields, a dog off-leash area, playgrounds, parking lots, walkways, storm water conveyance facilities, and habitat areas. The Project Site is part of the Magnuson Park Wetlands Project, which is a 43-acre redevelopment of a portion of the park that began in 2004 and includes creation of new wetlands and rehabilitation of degraded wetlands.

The Former Sand Point Naval Station was used for farming prior to King County selling the land to the United States Navy (Navy) in the late 1920s. At that time, a Naval Reserve air station also was authorized to be based at Sand Point. For nearly 50 years, the Project Site was part of an air base, aviation training center, and aircraft repair depot for the Navy. Building at the Former Sand Point Naval Station occurred between 1932 and 1942, with a majority of the building occurring during World War II from 1939 to 1942. Magnuson Park, today, includes land and buildings deeded to the city by the Navy.

2.2 Site Description

The Project Site is located in the southeastern portion of Magnuson Park and is bordered by Lake Washington shoreline to the east, NE 65th Street to the south, the former Navy Base buildings to the west, and grass playfields and the National Oceanic Atmospheric Administration campus to the north (**Figure 1-1**). The Magnuson Park Wetland site is located in an area that was formerly occupied by a surface water feature adjacent to Lake Washington, called Mud Lake, which contained peat bogs. In 1916, the water level in Mud Lake was lowered prior to construction of the Montlake Cut and Hiram Chittenden Locks within Lake Washington. Mud Lake was then filled in the 1930s and 1940s during the expansion of an airstrip constructed for the Naval Station. The layout of the Project Site is shown on **Figure 1-2**.

Soil borings, previously drilled in the area, encountered up to approximately 25 feet of fill materials overlying peat deposits in the area containing the former Mud Lake (AMEC, 2009). When present, the thickness of the peat layer ranged from two to four feet in the vicinity of the former Mud Lake. Underlying the fill and/or peat layer is a silty sand or sandy silt layer. The approximate limits of former Mud Lake were mapped using data from 2000 soil boring logs and topographic maps. Groundwater was encountered in all borings and ranged from 5.0 to 12.5 feet below ground surface (bgs).

2.3 Previous Investigations

An investigation of the Project Site area was conducted by AMEC between August and October 2008. Information presented below is summarized from the resulting *Test Pit Excavations and Environmental Sampling, Magnuson Park Phase 2 Improvements, Wetlands Project, Seattle, Washington* report submitted by AMEC to the Seattle Department of Parks and Recreation (AMEC, 2009).

During wetland creation activities at Magnuson Park in 2008, petroleum contamination was identified at the excavation site at a depth of 5 feet bgs. In July 2008 GeoEngineers, Inc. collected soil samples from the wetland construction area for chemical analysis, and the results indicated that elevated levels of TPH as DRO, TPH as heavy oils, and metals were present above the associated MTCA CULs. As a result of this sampling effort, five contamination areas (SA-1 through SA-5) were identified. The five areas were characterized by AMEC from August to October 2008, and source areas 3, 4, and 5 were remediated at that time. Two contamination areas remained (SA-1 and SA-2), as well as an identified isolated hot spot GTP-E8 southeast of SA-2 and a metals hot spot STP-2N north of SA-2.

Soil from SA-1 was found to be impacted with TPH as DRO, TPH as heavy oil, arsenic, and cadmium in excess of MTCA CULs. The most elevated concentrations of TPH as heavy oil were identified in soil samples collected from the southeast quadrant of SA-1. Soil in SA-2 was found to be impacted with TPH as heavy oils, arsenic, and lead in excess of MTCA CULs. Soil in GTP-E8 was found to be impacted with TPH as heavy oil, cadmium, and lead in excess of MTCA CULs. Soil in STP-2N had arsenic and lead concentrations detected in excess of MTCA CULs. Based on previous investigation results, AMEC concluded that chromium at the Project Site is chromium III because samples from the Project Site analyzed for chromium VI were non-detect.

Analysis of the water entering the SA-1 excavation by GeoEngineers in July 2008 indicated that the TPH as DRO and TPH as heavy oils were above the MTCA Method A CULs for groundwater. GeoEngineers, Inc. also collected a groundwater sample from SA-2, which was non-detect for TPH as DRO and TPH as heavy oils. A groundwater sample collected at SA-1 by AMEC in October 2008 did not contain detectable levels of TPH as DRO or TPH as heavy oils. None of the groundwater samples collected from SA-1 and SA-2 had metal concentrations exceeding the associated MTCA Method A CULs. Analysis of groundwater by AMEC from borings advanced in 2000 in the former Mud Lake, adjacent to Lake Washington, indicated that metal concentrations were below Surface Water Quality Standards and the National Recommended Water Quality Criteria. Minimal groundwater was encountered in the test pit excavations completed by AMEC in 2008.

3.0 Remedial Action Summary

The remedial action at the Project Site was implemented from July 13, 2009 to August 7, 2009. A combined Pre-Construction and Mutual Understanding Meeting (MUM) was held on July 9, 2009 at the site, as detailed in Section 4.1. The following sections present a chronological summary of events during the remedial action followed by a detailed description of construction activities. The MTCA Method A CULs for an unrestricted property for each COC are listed in **Table 1-1**. The following appendices are provided as documentation of project activities:

Appendix A: Construction Meetings and Inspections;
Appendix B: Tailgate Safety Meetings;
Appendix C: Daily Quality Control Reports;
Appendix D: Analytical Laboratory Reports;
Appendix E: Data Validation Report;
Appendix F: Air Monitoring Results;
Appendix G: Storm Water Inspection Forms;
Appendix H: Photographic Documentation; and
Appendix I: Waste Disposal Documentation.

Table 3-2 and **Tables 3-4 through 3-8** provide the analytical data from confirmation samples collected from each excavation area, discussed herein. **Table 3-3** provides the analytical data for the test pit investigation completed at SA-2.

3.1 Chronology of Events

Table 3-1 provides a chronology of progress and milestone events during the remedial action.

3.2 Construction Activities

To meet the objectives of the removal action, the following activities were completed at the Project Site, based on the Final WP (ECC, 2009a):

- Mobilized labor and equipment to the Project Site;
- Surveyed the Project Site prior to commencing excavation activities to identify the extent of excavation delineated by AMEC;
- Implemented erosion and sediment control measures at the Project Site;
- Constructed a stabilized haul road that was 100-feet in length and 20-feet wide that entered to the south from NE 65th Street and was routed through SA-2 and then northeast to SA-1 (**Figure 1-2**);
- Completed test pits (TP) immediately adjacent to and outside of the delineation of SA-1 for visual evaluation of soil prior to excavation of SA-1;
- Excavated SA-1 to a maximum depth of 18 feet bgs;

- Stockpiled and later disposed of soil and wood chips used by the City to backfill the previous excavation of SA-1 by AMEC, due to PAHs in the material exceeding the MTCA Method A CULs;
- Completed limited test pits within the perimeter of SA-2 (TP-1 to TP-5) and within SA-2 (TP-6), which utilized visual observations, petroleum field test kit sampling and collection of soil samples for laboratory analysis;
- Excavated isolated hot spot at GTP-E8 to a depth of eight feet bgs;
- Excavated isolated hot spot at STP-2N to a depth of nine feet bgs;
- Excavated isolated hot spots at TP-4 and TP-6 within SA-2 to a depth of nine feet bgs, based on the analytical data from the soil samples collected during the SA-2 test pit activities.
- Loaded impacted soil and investigation derived waste for transport and disposal at an offsite, approved local disposal facility;
- Pumped out and loaded stored water from excavations for offsite disposal at PSC;
- Collected and analyzed confirmation soil samples from excavation bottom and sidewalls, in accordance with the *Final Sampling and Analysis Plan, Response Action at Source Areas 1 and 2, Former Sand Point Naval Station, Seattle, Washington* (SAP) (ECC, 2009b);
- Surveyed the disturbed areas of the Project Site to complete the As-Built Post Construction Topographic Survey (**Figure 3-3**); and
- Graded areas to 4:1 slopes and seeded disturbed areas with specified seed mixes.

The following sections provide further detail of the construction activities at the Project Site.

3.2.1 Excavation Activities

On July 13, 2009, the preparatory phase inspection of the site for mobilization, set-up, and excavation activities was conducted. All utilities in the area were located, and surveyors located the planned excavation areas and surveyed topographic elevations around the areas. Also, trenching commenced for the installation of silt fences at the Project Site. On July 14, 2009, the installation of the silt fences was completed, and the stabilized haul road was installed.

The haul road was approximately 100-feet in length and 20-feet wide (**Figure 1-2**). Due to installation (by others) of a drainage swale on the north side of NE 65th Street, the alignment of the haul road was modified to enter the Project Site from further west than originally planned. Thus, the road went directly through the delineated SA-2 area.

As required by the *Construction Stormwater General Permit WAR-009132* issued by Ecology to the City of Seattle, a Certified Erosion and Sediment Control Lead (CESCL) completed weekly visual inspections to ensure that storm water best management practices (BMPs) were functioning properly. Completed storm water inspection forms are provided in **Appendix G**.

When any of the analytical parameters from a soil sample collected in an excavation were above the MTCA Method A CULs, additional excavation was completed in accordance with the Final

WP (ECC, 2009a). If a sidewall sample failed to meet the MTCA Method A CULs, an additional 10 feet of soil were excavated horizontally for approximately 25 linear feet centered along the sidewall sample area. If a bottom sample failed to meet the CULs, an additional 2 feet was excavated vertically, with the failed sample location central within an approximate 25-foot by 25-foot grid. This process continued until all soil remaining was below MTCA Method A CULs based on confirmation sample analytical results.

3.2.1.1 Source Area 1

In an attempt to delineate the extent of contamination prior to commencing excavation activities, ECC completed four test pits approximately 10-feet outside of the AMEC-delineated excavation area to the approximate north, south, east and west (**Figure 3-1**). The completion of test pits at SA-1 was a variance to the Final WP, which did not include excavating test pits at SA-1. The SA-1 test pits ranged in depth from 6.5 to 8 feet bgs adjacent to SA-1 on July 15, 2009. No petroleum odors or staining were observed in any of the test pits. These test pits are not depicted on a figure because no samples were collected for laboratory analysis.

SA-1 was excavated from July 16 to 29, 2009. The City of Seattle had previously backfilled the portion of SA-1 excavated by AMEC with soil and wood chips. This backfill material was removed and stockpiled, and three samples of the material were collected and analyzed to determine if the material could be re-used as backfill. Sample results contained PAHs exceeding MTCA Method A CULs. As a result, the material was disposed of at an approved, offsite landfill (**Appendix I**). **Table I-1,** included in **Appendix I,** summarizes the sample results from this material.

Petroleum material was observed to be seeping from the southwest corner of the SA-1 excavation on July 23, 2009. During further excavation of this area, petroleum-impacted debris, including rusted and crushed, small metal containers were encountered. The material was excavated for offsite disposal.

Soil within SA-1 was excavated until no odors or staining of the soil was observed. Onsite petroleum field test kits were used, at the discretion of the Site Superintendent, to confirm that no TPH concentrations above the CUL of 2,000 mg/kg were present prior to collection of a confirmation sample for laboratory analysis. After soil removal, an initial 12 wall soil samples and 7 bottom soil samples were collected at a maximum of every 25 linear feet to confirm that remaining soil was below the MTCA Method A CULs (**Figure 3-1**). Each sample was submitted for laboratory analysis of TPH as DRO, TPH as heavy oil, and metals (arsenic, cadmium, chromium, and mercury) per the Final SAP (ECC, 2009b).

Three soil samples had exceedences of the CULs, therefore further excavation was required at these locations. One sample was along the northeast wall and had cadmium and lead that exceeded the associated CULs. A sample collected within a sump area for SA-1 exceeded the CUL for cadmium. The third sample failed to meet the CULs for cadmium and lead and was collected from the floor of the southeast excavation. Each of the 3 areas were further excavated and re-sampled for TPH as DRO and TPH as heavy oils and metals. The samples collected from the over-excavation locations showed no exceedences of MTCA Method A CULs. The maximum depth of excavation at SA-1 was 16 feet in the sump created in the northeast corner of the excavation. **Table 3-2** summarizes the analytical results for confirmation samples collected at SA-1. Per the Final WP, one confirmation sample from SA-1 (SP01-12-JL-22-12-GB) was also analyzed for PCBs and PAHs (**Table 3-8**) to verify that neither is a COC at the Project Site. No other samples were analyzed for PCBs and PAHs within SA-1.

When the SA-1 excavation was completed and all confirmation sample results showed no further exceedances of CULs, the excavation was graded as required by NAVFAC NW and the City. The south and southeast sidewalls of SA-1 were graded into the excavation area. Water from the pond northeast of SA-1 was pumped to the drainage area north of SA-1. Then, the berm installed between the northeast pond and SA-1 was removed and graded to combine the two features. To the extent practical, all excavation walls were graded to a 4:1 slope and then seeded with the appropriate seed mixtures.

3.2.1.2 Source Area 2

In accordance with the Final WP, ECC completed a total of seven test pits on July 15, 2009 within the AMEC-delineated SA-2 and between SA-2 and the GTP-E8 hot spot. These initial test pits were used to determine if any odors or staining of soil and debris were present; however, no olfactory or visual contamination was identified. Soil was then further evaluated using onsite petroleum field test kits at three locations, which did not indicate TPH detections above the CUL of 2,000 mg/kg. These test pits are not depicted on a figure because no samples were collected for laboratory analysis.

Because no impacts were identified during the initial test pit activities, six additional test pits were excavated on July 20, 2009 within SA-2 to collect soil samples for laboratory analysis (**Figure 3-2**). These six test pits were not included in the Final WP; however, the sample collection method was completed as if SA-2 had been excavated per the Final WP, such that samples were collected every 25 linear feet. A total of 16 soil samples were collected during the test pit activities and analyzed for TPH as DRO, TPH as heavy oil, and metals per the Final WP. In addition, one field duplicate sample was collected. Discrete samples were collected between 0 to 4 feet bgs and 4 to 8 feet bgs at each of the six locations. **Table 3-3** summarizes the analytical results for the debris material and test pit samples collected at SA-2. Samples of the debris material and soil below the debris were collected in two locations (SP02-3.5-JL-20-05-G and SP02-6-JL-20-06-G). Per the Final WP, one sample was collected and analyzed for PCBs (SP02-07-JL-20-11-G), and one sample was collected and analyzed for PAHs (SP02-07-JL-20-12-G) to verify that neither is a COC at the Project Site (**Table 3-8**). No additional samples were collected for PCBs or PAHs within SA-2.

Based on the test pit excavation and the analytical results of test pit soil samples, two areas within the AMEC-delineated SA-2 were excavated on July 28, 2009. One area was located in the center of SA-2 (TP-6), which exceeded MTCA CULs for cadmium and lead. The other area was along the southeastern boundary of SA-2 (TP-4) which had concentrations of TPH as heavy oils at 7.5 feet bgs that exceeded the CUL of 2,000 mg/kg. The TP-4 excavation extended to the hot spot removal at GTP-E8. A detailed discussion of the TP-6 and TP-4 excavations is presented below.

Though no exceedences of the CULs were detected in the test pit nearest STP-2N (TP-2), STP-2N was excavated to remove the soil identified by AMEC as having metals exceeding the MTCA Method A CULs.

When the excavations were completed and all confirmation sample results showed no exceedances of CULs, the areas were graded per NAVFAC NW and City specifications and approved.

TP-6

Investigative soil samples from TP-6 were collected at 4, 6 and 7 feet bgs. The soil samples collected at the 6 foot interval had detected analytes below the associated MTCA Method A CULs. However, the soil sample collected at 4 feet bgs had detected cadmium slightly above the MTCA Method A CUL, and the soil sample collected at 7 feet bgs had detected lead above the MTCA Method A CUL (**Table 3-3**).

TP-6 was over-excavated to 9 feet bgs, and a total of five confirmation samples were collected on July 28, 2009. The samples were analyzed for TPH as DRO, TPH as heavy oils, and metals. Confirmation sample results confirmed that the remaining soil at the TP-6 site was below the MTCA Method A CULs (**Table 3-4**).

When the TP-6 excavation was completed, the area was backfilled with clean overburden at TP-6 (soil from 0 to 4 ft bgs) and quarry sprawls (taken from removal/relocation of the haul road), and sloped so that the area could again be used as a haul road.

TP-4

The soil sample collected from TP-4 during test pit activities had detected TPH as heavy oils above the associated MTCA Method A CUL (**Table 3-3**). The contaminated soil was excavated to a maximum depth of 9 feet bgs and included the removal of the exceedence of TPH as heavy oils at 7.5 feet bgs identified in TP-4 at 7.5 feet bgs. A total of seven confirmation samples were collected on July 28, 2009 from the floor and walls of the excavation for laboratory analysis. Each sample was analyzed for TPH as DRO, TPH as heavy oils, and metals. **Table 3-5** summarizes the analytical results for the confirmation samples collected at TP-4.

Confirmation sample results indicated that three samples exceeded metals MTCA Method A CULs. The soil sample collected from the north wall had arsenic in excess of the MTCA Method A CUL. The soil sample collected from the west wall showed arsenic, cadmium, and lead exceeding the respective CULs. The south wall soil sample had cadmium and lead exceeding the respective CULs. On July 31, 2009, three wall sample grids were then over-excavated ten feet horizontally and re-sampled. The soil sample results collected after the over-excavation showed no exceedences of MTCA Method A CULs (**Table 3-5**). The area was then graded to a 4:1 slope.

3.2.1.3 GTP-E8

In accordance with the Final WP, ECC completed three test pits adjacent to hot spot GTP-E8 on July 16, 2009 to determine if there was visual staining or odor. The limited test pits did not identify contamination. Based on the Final WP with adjustments based on the results of the exploratory test pits, the GTP-E8 area was excavated from July 23 to 29, 2009 (**Figure 3-2**). An oil sheen and debris were observed during excavation activities. When excavation was complete based on visual staining and odor, petroleum field test kit samples were collected from the south and north walls, where a majority of the oil sheen had been observed. The test kits did not indicate TPH levels above the CUL of 2,000 mg/kg.

Six initial confirmation samples were then collected on July 24, 2009 from the excavation and were submitted for laboratory analysis for TPH as DRO and TPH as heavy oils and metals. The maximum depth of excavation was 10 feet bgs. **Table 3-6** summarizes the analytical results for confirmation samples collected at GTP-E8. The southwest sidewall sample failed to meet the CUL for TPH (unknown hydrocarbons) of 2,000 mg/kg. Over-excavation of TPH exceedances on the south wall was completed on July 29, 2009. The additional confirmation sample results showed no exceedances of MTCA Method A CULs after the over-excavation (**Table 3-6**). Per the Final WP, one confirmation sample from GTP-E8 (SPE08-10-JL-24-06-GB) was also analyzed for PCBs and PAHs (**Table 3-8**) to verify that neither is a COC at the Project Site. No other samples were analyzed for PCBs and PAHs at GTP-E8.

When the GTP-E8 excavation was completed and all confirmation sample results showed no exceedances of CULs, the area was graded per NAVFAC NW and City specifications and approved.

3.2.1.4 STP2N

Based on data collected from test pits excavated by AMEC, an area designated STP2N with elevated metals detections located northwest of SA-2 was excavated on July 30, 2009 (**Figure 3-2**). Excavation was to a maximum depth of 9 feet bgs, and an initial six confirmation samples were collected and submitted for laboratory analysis for TPH as DRO, TPH as heavy oils, and metals. No samples were analyzed for PCBs or PAHs because neither were considered COCs for the Project Site based upon the previous sample results. **Table 3-7** summarizes the analytical results for confirmation samples collected at STP2N. One confirmation sample collected at the east wall of the excavation exceeded the MTCA Method A CUL for arsenic. Based on this exceedance, the east wall was overexcavated ten feet horizontally. A dry 10-inch diameter pipe was encountered and removed. An additional confirmation sample was collected that showed no exceedences of MTCA Method A CULs.

When the STP2N excavation was completed and all confirmation sample results showed no exceedances of CULs, the area was graded to NAVFAC NW and City specifications and approved.

3.2.2 Sampling and Analysis

Sixteen investigative soil samples (with one field duplicate), 48 soil confirmation samples (with six field duplicates), one waste water characterization sample, and three backfill material samples were collected and analyzed during excavation activities at the Project Site. Field personnel also used petroleum field test kit results to ensure that petroleum contamination was removed prior to collection and analysis of soil. Laboratory analysis of soil collected from sidewalls and floors of the excavations was used as the final determination as to whether an excavated area met MTCA Method A CULs. All sampling and analysis activities were conducted in accordance with the Project Site SAP (ECC, 2009b). The following sections summarize the sampling and analytical methods employed during this remedial action.

3.2.2.1 Confirmation Sampling

The lateral and vertical extent of contamination at SA-1 and GTP-E8 were primarily delineated during excavation. STP2N was previously identified during AMEC's investigation and was directly excavated with additional excavation performed upon receipt of the first round of analytical results. SA-2 required test pitting to collect soil samples for laboratory analysis, which resulted in two test pit locations exceeding at least one of the MTCA Method A CULs (TP-6 and TP-4) and subsequent over-excavation of these areas.

After a source area or isolated hot spot was completely delineated and excavated, a confirmation soil sample was collected every 25 feet or less along the excavation wall and from the floor, per the Final WP. Locations and depths of sample collections were documented in **Figures 3-1** and **3-2**. Confirmation samples were collected for the depth interval that appeared to have the most contamination based on olfactory and visual observation. Soil samples were collected from the center of the backhoe/excavator bucket such that the soil samples were representative of the excavation. Quality assurance/quality control (QA/QC) samples also were collected in accordance with the Final SAP (ECC, 2009b).

Confirmation soil samples were analyzed for TPH as DRO and TPH as heavy oils simultaneously by Method Northwest Total Petroleum Hydrocarbon–Extended Diesel (NWTPH-Dx) and metals by the United States Environmental Protection Agency (USEPA) SW-846 Method 6010 (USEPA, 2007). Because PCBs and PAHs had previously been detected in other areas of the Project Site, one soil sample was collected from the floor of each excavation for PCB and PAH analyses using USEPA Methods SW-846 Method 8082 and 8270C, respectively. PAH and PCB results are reported in **Table 3-8**. QA/QC samples were also collected and analyzed, in accordance with the Final SAP (ECC, 2009b).

Tables 3-2 to **3-8** present analytical results for samples collected from the Project Site.

3.2.2.2 Soil and Groundwater Characterization

The large quantity of analytical data available for the Project Site (AMEC, 2009) allowed the excavated soil to be pre-profiled for offsite disposal as Washington non-dangerous waste. The contracted waste management company for this project, Allied Waste, accepted the 2008 investigation analytical results for the disposal waste profile for its Subtitle D, Roosevelt Regional Landfill located at Goldendale, Washington. Impacted soil was trucked to the Allied Waste transfer facility in Seattle, Washington, before it was loaded into train cars and hauled to the landfill by rail.

Groundwater was encountered at the Project Site sporadically during the soil excavations. Some excavated areas encountered groundwater at 6 feet bgs, while other excavations did not encounter any water at depths up to 10 feet bgs. Groundwater that accumulated in the excavations was pumped into a water storage (Baker) tank and tested for TPH as DRO and TPH as heavy oils, metals, flashpoint, and PAHs for disposal in accordance with all Federal state, and local regulations. **Table I-2** which summarizes the sample results from the water collected is included in **Appendix I**.

3.2.3 Waste Transportation and Disposal

Approximately 4,059 tons of soil were excavated from the Project Site, based on weight tickets. Approximately 6,235 gallons of groundwater that accumulated in the excavations during site activities were also removed from the project site. All waste generated during the Response Action was transported offsite for appropriate disposal as follows:

- Excavated soil was transported offsite as non-dangerous waste, for disposal at the Subtitle D, Roosevelt Regional Landfill in Seattle, Washington. The soil was profiled for disposal using previously collected soil sample results;
- Groundwater and precipitation that collected within the excavations were removed and stored in a water storage tank (Baker Tank). A water sample was collected from the water storage tank prior to disposal to confirm that it was non-dangerous and to profile the waste stream. Water from the storage tank was transported offsite, as non-dangerous waste, for treatment and disposal by PSC.
- Spent PPE and disposable sampling equipment were disposed of with the excavated soil.

Types, volumes, and destinations of each waste stream were documented in the field logbook and on the respective Daily Quality Control Reports (DQCRs) (**Appendix C**).

3.2.4 Site Inspections and Restoration

Once sidewalls and floors of excavations were confirmed to be clean, the Project Site was graded such that sidewalls had a 4:1 slope or as requested by the NAVFAC NW and the City. No imported backfill was placed into the excavations. The SA-1 area was graded to flow to the northeast towards an existing constructed marsh. The SA-2 area was graded to flow to the southeast towards the GTP-E8 excavation and the drainage swale north of NE 65th Street. All disturbed areas were hydro-seeded with one of two seed mixes and stabilized, in accordance with the procedures described in the Project Environmental Protection Plan (ECC, 2009c). Specifically, an approved wetland mix was applied at the bottom of the two graded excavation areas up to the expected high water level, and an approved upland ecology seed mix was applied in all other disturbed areas.

ECC, NAVFAC NW, ERRG and the City completed a Pre-Final Inspection of the Project Site on August 5, 2009. All punch-list items identified in the course of the inspection were noted and addressed by ECC to ensure satisfactory completeness (**Appendix A**). ECC coordinated with NAVFAC NW for a Final Inspection of the site prior to demobilization, which was conducted immediately following the completion of the field work. The Final Inspection was completed on August 7, 2009 and was attended by the City, ECC, ERRG and NAVFAC NW. All Pre-Final punch-list items were adequately addressed and approved during the Final Inspection.

All field equipment was decontaminated on site using required decontamination procedures and inspected by ECC to ensure that it was fully decontaminated. The Project Site and adjacent areas were left free of all waste materials, rubbish or windblown debris from excavation activities prior to demobilization. Site restoration was completed on August 7, 2009.

3.2.5 Post-Construction Topographic Survey

The post-construction topographic survey was conducted by Apex Engineering of Tacoma, Washington on August 7, 2009. The post-construction topographic survey map is included as **Figure 3-3.** This survey was completed to provide a final as-built of the Project Site.

3.2.6 Terrestrial Ecological Evaluation

A terrestrial ecological evaluation (TEE) was completed for the Project Site in accordance with WAC 173-340-7490. For the purpose of the TEE, the site was classified as an industrial property, as it is located within a historic industrial/warehouse area of the former Sand Point Naval Station. Contaminant releases were related to historic industrial operations, with TPH and metals-impacted soil found in isolated areas from 4 feet to 15 feet bgs.

The Project Site should be excluded from further TEE based on the following factors:

(1) Exposure Pathway Analysis (173-340-7491(1)(c))

The site release of TPH and metals took place within the historic industrial area, where less than 1.5 acres of contiguous undeveloped land were found around these isolated contaminated areas, before the NAVFAC NW ceased operation at the site, and buildings within the industrial area were demolished and removed after the late 1990's.

(2) Point of Compliance Analysis ((173-340-7491(1)(a))

The contaminant-impacted areas were restored and incorporated into the man-made wetland areas constructed at the Project Site. All TPH- and metal-impacted soil was removed during this IRA to levels below the CULs. As a result, no contaminants are known to remain on site and any future exposure pathways to wildlife and biota have been eliminated by this IRA.

A completed TEE Exclusion Form is included in **Appendix J** of this report to document the evaluation.

4.0 Quality Control and Quality Assurance

ECC performed QA/QC in accordance with the *Final Project Quality Control Plan, Response Action at Source Areas 1 and 2, Former Sand Point Naval Station, Seattle, Washington* (PQCP) (ECC, 2009d). The purpose of this system was to ensure project objectives remained well identified and communicated throughout the response action and to identify and communicate any variance to the Final WP, caused by changing field conditions.

The QA/QC program encompassed a pre-construction meeting, and preparatory, daily and final inspections. Documentation of QA/QC is provided in the DQCRs included as **Appendix C**.

4.1 Combined Pre-Construction and Mutual Understanding Meeting

A combined Pre-Construction Meeting and MUM was held on July 9, 2009 at the Project Site. Personnel from NAVFAC NW, the City of Seattle, ECC, and ERRG attended the meeting. A site walk was completed followed by a discussion of project topics including:

- Roles and responsibilities;
- Access and security issues;
- Project schedule;
- Agreement on the Final WP;
- Execution overview;
- Submittals to, and correspondence with, NAVFAC NW;
- Permits;
- Health and Safety;
- Inquiries by the public and press;
- NAVFAC NW quality assurance; and
- Quality Control.

An attendance roster and agenda are presented in **Appendix A**. Meeting minutes were distributed to appropriate parties on July 15, 2009 and are also included.

4.2 Inspections

Inspections included preparatory and initial inspections on July 13, 2009, followed by daily inspections. Pre-Final and the follow-up Final Inspections were completed on August 5, 2009 and August 7, 2009, respectively. Documentation of the inspections is contained in **Appendix A**. The QC system ensured that the execution of the response action proceeded without significant deviation from the project plans.

5.0 Health and Safety

This section summarizes the personnel safety and monitoring results collected during the remedial action. Prior to the start of each day's construction activities, a tailgate safety meeting was held at the Project Site. These meetings emphasized particular site and operational hazards, allowed for the selection of personnel protective equipment (PPE) required for daily operations, and provided a forum for all personnel to bring safety concerns to the forefront. Daily Tailgate meeting forms are attached in **Appendix B**.

All work was performed in Modified Level D PPE as planned. The construction work and site restoration were executed without an Occupational, Safety, and Health Administration (OSHA) recordable incident or 'near-miss' event.

In accordance with the *Final Project Environmental Protection Plan, Response Action at Source Areas 1 and 2, Former Sand Point Naval Station, Seattle, Washington* (EPP) (ECC, 2009c) and the *Final Project Accident Prevention Plan, Response Action at Source Areas 1 and 2, Former Sand Point Naval Station, Seattle, Washington* (APP) (ECC, 2009e), particulate (dust) monitoring was performed and recorded. Particulate monitoring results are included in **Appendix F**. No exceedences of the 2.5-milligram per cubic meter standard occurred during field activities.

6.0 Conclusion and Summary of Findings

The IRA was completed at the Project Site under the Ecology VCP in July and August 2009, based on previous site investigations completed by AMEC between August and October 2008. The construction activities and procedures, outlined in the Final WP, were followed except as noted. At the completion of the removal action, approximately 4059 tons of contaminated soil was removed from the Project Site for proper disposal as non-dangerous waste at the Subtitle D, Roosevelt Regional Landfill in Goldendale, Washington.

Soil confirmation samples collected from each excavation at the Project Site demonstrated that soil remaining in those areas are below the MTCA Method A CULs for unrestricted land use. The SA-1 area was remediated, as planned, and soil confirmation sample results indicate that no exceedence of MTCA Method A CULs were present in the remediated area before site restoration commenced. Investigative samples collected from the six text pits completed in the SA-2 area confirmed that only limited removal of impacted soil was required within the area. Four areas within or near the SA-2 area (TP-4, TP-6, STP-2N and GTP-E8 excavations) were remediated, and all confirmation soil samples from these excavations indicated that no exceedences of MTCA Method A CULs were present in the remediated areas before site restoration commenced.

A TEE was completed for the Project Site and confirmed that remaining soil at the Project Site was protective of land-based plants and animals. The Project Site does not pose an unacceptable risk to human health and the environment. Site Closure and an NFA determination is requested by NAVFAC NW for the Project Site, based upon the requirements set forth in WAC 173-340-360.

7.0 References

AMEC, 2009. *Test Excavations and Environmental Sampling Magnuson Park Phase 2 Improvements, Wetlands Project, Seattle, Washington.* January.

ECC, 2009a. *Final Project Work Plan, Response Action at Source Areas 1 and 2, Former Sand Point Naval Station, Seattle, Washington* NAVFAC Northwest Contract N68711-04-1106, CTO KR1. April.

ECC, 2009b. *Final Sampling and Analysis Plan, Response Action at Source Areas 1 and 2, Former Sand Point Naval Station, Seattle, Washington* NAVFAC Northwest Contract N68711-04-1106, CTO KR1. April.

ECC, 2009c. *Final Project Environmental Protection Plan, Response Action at Source Areas 1 and 2, Former Sand Point Naval Station, Seattle, Washington* NAVFAC Northwest Contract N68711-04-1106, CTO KR1. April.

ECC, 2009d. *Final Project Quality Control Plan, Response Action at Source Areas 1 and 2, Former Sand Point Naval Station, Seattle, Washington* NAVFAC Northwest Contract N68711-04-1106, CTO KR1. April.

ECC, 2009e. *Final Accident Prevention Plan, Response Action at Source Areas 1 and 2, Former Sand Point Naval Station, Seattle, Washington* NAVFAC Northwest Contract N68711-04-1106, CTO KR1. April.

USEPA, 2007. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846)* February.

Table 3-1
Chronology of Important Events
Response Action at Source Areas 1 and 2
Former Sand Point Naval Station, Seattle, WA

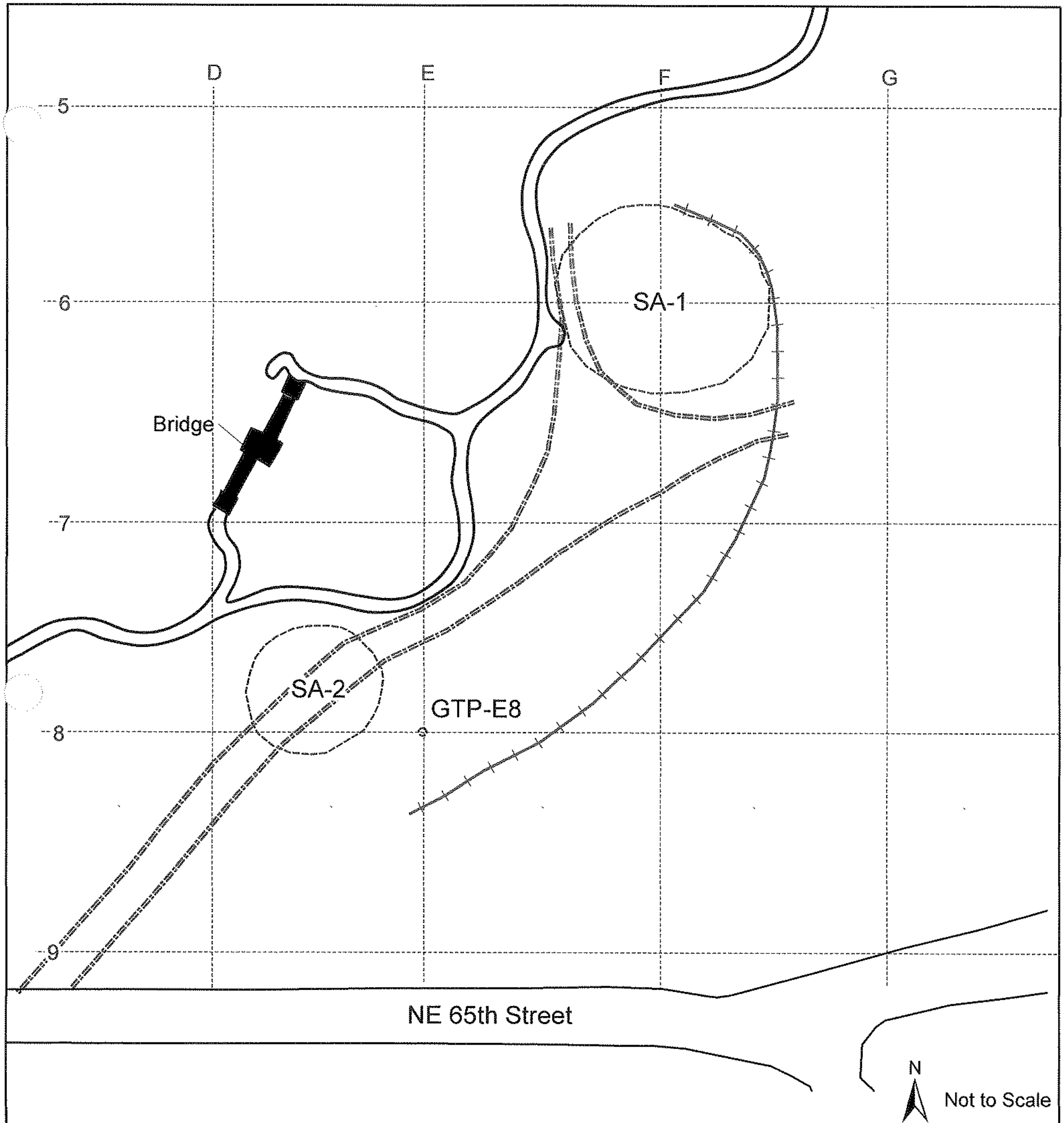
Date	Event(s)
July 9, 2009	Preconstruction Meeting
July 13, 2009	Site mobilization and setup. Commenced trenching and installation of silt fence. Initial survey of SA-1 and SA-2 completed. Performed utility search.
July 14, 2009	Continued installation of silt fence. Constructed stabilized haul road.
July 15, 2009	SA-1 and SA-2: Test pits completed.
July 16, 2009	SA-1: Commenced excavation and stockpiling of overburden material in SA-1. Set up hoses for dust control. SA-2: Completed petroleum field test kit sampling from test pits.
July 17, 2009	SA-1: Completed removal of overburden material from SW half of SA-1, and stockpiled material on visqueen SE of SA-1. Excavated NE half of SA-1and stockpiled material on the SW half of SA-1. Collected three samples of soil stockpiled SE of SA-1 and shipped to lab for analysis. Wetted and smoothed out haul road.
July 20, 2009	SA-1: Began haul-out of material. Pumped approximately 2,117 gallons of water from SA-1 excavation and stored in 21,000 gallon Baker tank. Continued dust mitigation at the site. SA-2: Collected 20 soil samples from six test pits inside and outside SA-2 delineation and shipped to lab for analysis. Held teleconference (ECC and NAVFAC NW) regarding SA-2 delineation and sampling strategy.
July 21, 2009	SA-1: Continued haul-out of material. Sloped NW and north walls of the excavation so that trackhoe could gain access and excavate the NE and SE walls. After excavation, tested sidewall material using a TPH field test kit (highest reading 1,056 ppm). Pumped approximately 557 gallons of water from SA-1 into Baker tank. Collected six confirmation samples from NW, north, and NE walls of SA-1 and shipped to lab for analysis. Continued dust mitigation at the site.
July 22, 2009	SA-1: Finished excavation (excavated southern and eastern walls). Collected five confirmation samples from the floor of excavation and shipped to lab for analysis. Received analytical results from stockpiles. Pumped approximately 472 gallons of water from SA-1 into Baker tank. Continued dust mitigation at the site.
July 23, 2009	SA-1: Noticed TPH contamination seeping from the SW corner of SA-1. Petroleum-impacted debris, including small, rusted and crushed metal containers, was unearthed. Material was excavated and stockpiled inside SA-1 for loadout. Field test analyses were performed on soil from the floor of the newly excavated area. Collected four samples from wall and floor locations and shipped to lab for analysis. SA-2: Received analytical results from SA-2 trench investigation sampling. Held conference with Navy to discuss results and test pit excavation. GTP-E8: Began excavation of hot spot and observed oil sheen and debris. Stockpiled soil on visqueen south of Baker tank. Continued dust control measures.
July 24, 2009	SA-1: Continued cleanup of visible TPH on southwest wall. Collected three confirmation soil samples of SE wall and floor. Loadout of stockpiled material adjacent to SA-1 excavation. GTP-E8: Finished GTP-E8 hot spot excavation, and collected field test kit samples from the south and north walls. Collected six confirmation samples and shipped to lab for analysis. Continued dust control measures.
July 27, 2009	SA-1: Overexcavated east wall where previous analytical results showed contaminant exceedances. Finished load out of SA-1 stockpiled materials. SA-2: Began TP4 excavation and loadout of material. GTP-E8: Loadout of GTP-E8 stockpiled materials.

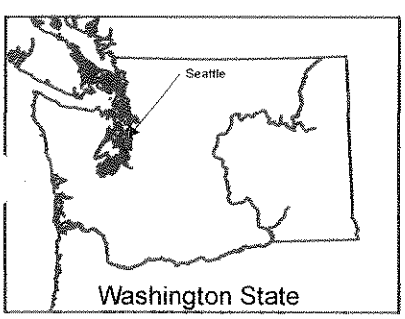
Table 3-1
Chronology of Important Events
Response Action at Source Areas 1 and 2
Former Sand Point Naval Station, Seattle, WA

Date	Event(s)
July 28, 2009	SA-1: Completed overexcavation of middle section floor grid adjacent to east wall (cadmium exceedance). Collected confirmation sample and shipped to lab for analysis. SA-2: Completed TP6 excavation. Stockpiled first four feet of clean soil and covered with visqueen. Loaded and transported four truckloads of contaminated soil to landfill (depths of 4 to 8 feet below ground surface). Remaining material was stockpiled and covered adjacent to the excavation. Confirmation samples were collected and shipped to the lab for analysis. Cordoned off excavation with construction fence. Finished TP4 excavation. Loaded and transported three loads to landfill. Collected confirmation sample and shipped to lab for analysis. Excavation secured with construction fence. GTP-E8: Load out remaining stockpile material.
July 29, 2009	SA-1: Completed excavation of metals exceedances at the SE wall. Removed six truckloads of soil from the grid floor. Vertically overexcavated grid to a minimum of two feet. Collected one confirmation sample and shipped to lab for analysis. Cordoned off excavation with construction fence. SA-2: Loadout of three loads of stockpiled soil at TP-4. Backfilled with clean soil from previous day's excavation to four feet below ground surface. Sloped north and south walls of SA-2 to gain access to SA-1 excavation. GTP-E8: Completed overexcavation of TPH exceedances at the south wall. Removed nine truckloads of soil from the grid and shipped offsite. Cordoned off excavation with construction fence.
July 30, 2009	SA-1: Excavation secured with construction fence. Awaiting results of confirmation samples. SA-2: Excavation secured with construction fence. Awaiting results of confirmation samples. GTP-E8: Excavation secured with construction fence. Awaiting results of confirmation samples. STP2N: Secured excavation with construction fence. Awaiting results of confirmation samples.
July 31, 2009	SA-1: Excavation secured with construction fence. Confirmation sample results received and showed no exceedances of CULs. Dewatered excavation sump where overexcavation was performed. SA-2: Confirmation sample results received and showed no exceedances of CULs. TP6 excavation backfilled with clean soil and sloped. Excavation secured with construction fence. TP4: Confirmation sample results received and three samples exceeded MTCA metals CULs. Overexcavated three wall sample grids an additional 10 feet horizontally. Loaded and transported 14 loads of soil offsite. Stockpiled remainder of soil excavation. GTP-E8: Excavation secured with construction fence. Confirmation sample results received and showed no exceedances of CULs. STP2N: Excavation secured with construction fence. Confirmation sample results received and one sample exceeded MTCA metals CULs. Overexcavated one sample grid 10 feet horizontally and removed a 10-inch diameter dry pipe. Stockpiled excavated soil and covered with visqueen.
August 3, 2009	SA-1: Excavation secured with construction fence. South and SE side of SA-1 was graded into the excavation area. Berm area between pond on NE side of SA-1 and the SA-1 area was excavated to open the berm, and the area was graded to a 4:1 slope. Excess contaminated soil was loaded and removed from the site.
August 4, 2009	SA-1: Continued grading area. Cut back soil from area between pond on NE side of SA-1 and the SA-1 area to gain more fill material. Graded area. SA-2: Final confirmation sample results received and showed no exceedances of CULs. Moved quarry spallings from roadway to the STP2N excavation. Temporary access road: Graded to allow for removal of Baker Tank (SE of GTP-E8 in bibswale).
August 5, 2009	SA-2: Graded entire area from the construction fence west of SA-2 and tapered slope into the SA-2 excavation. Pre-final inspection of Project Site.
August 6, 2009	Emptied and cleaned Baker tank and removed it from the site. SA-1: Finished grading using soil where water storage (Baker) tank sat.

Table 3-1
Chronology of Important Events
Response Action at Source Areas 1 and 2
Former Sand Point Naval Station, Seattle, WA

Date	Event(s)
	SA-2: Finished grading using soil where water storage (Baker) tank sat.
August 7, 2009	Finished grading entire area. Removed remaining silt fence, steel posts, and trash. Removed two loads of uncontaminated debris/soil from the site. Completed final survey of the site. Completed hydro-seeding with wetland and upland seed mixes. Decontaminated heavy equipment and parked it awaiting pickup. Final inspection of Project Site.





Legend

- Proposed Extent of Excavation
- Grid from AMEC Investigation
- Haul Road
- Silt Fence
- Paved Walking Path

Figure 1-2
Response Action Site Layout

Former Sand Point Naval Station
Seattle, Washinton

NAVFAC
NAVFAC Northwest

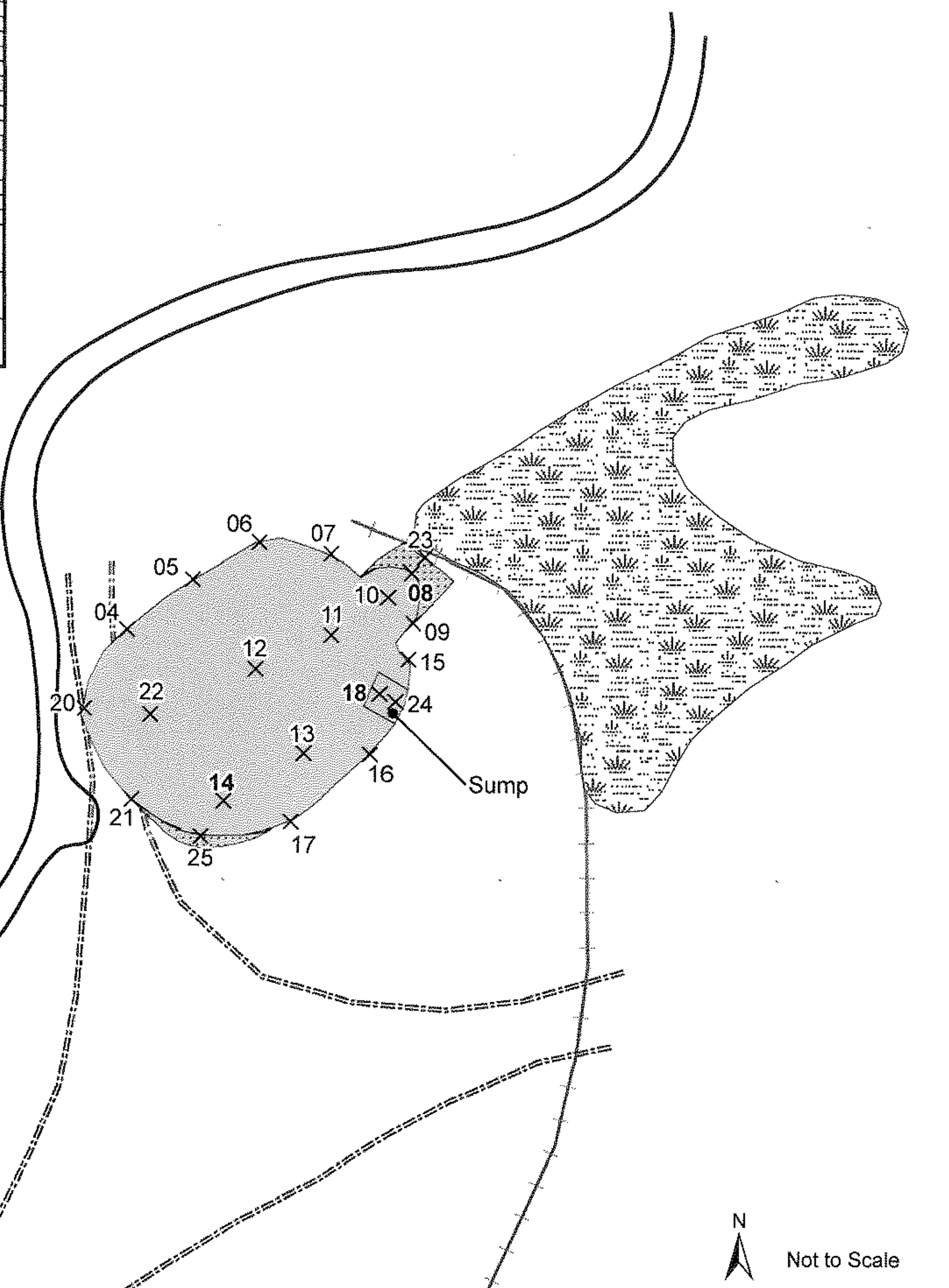
Drawn By: MJ	Checked By: KN	Modified By: MJ
Date Drawn: 08/26/2009	Date Checked: 10/28/2009	Date Modified: 10/28/2009

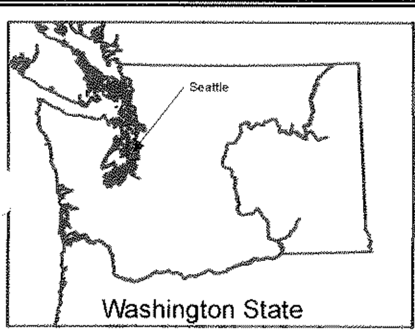
SA-1 EXCAVATION		
DESIGNATION ON FIGURE	FIELD SAMPLE ID	SAMPLE LOCATION
	SP01-01-JL-17-01-G-SP	Soil Stockpile
	SP01-01-JL-17-02-G-SP	Soil Stockpile
	SP01-01-JL-17-03-G-SP	Soil Stockpile
04	SP01-04-JL-21-04-GW	West Wall
05	SP01-04-JL-21-05-GW	Northwest Wall
06	SP01-10-JL-21-06-GW/FD	North Wall
07	SP01-08-JL-21-07-GW	North Wall
08	SP01-07-JL-21-08-GW	Northeast Wall
09	SP01-05-JL-21-09-GW	East Wall
10	SP01-12-JL-22-10-GB	East Center
11	SP01-12-JL-22-11-GB	East Center
12	SP01-12-JL-22-12-GB	Center
13	SP01-12-JL-22-13-GB	West Center
14	SP01-12-JL-22-14-GB	Southeast Center
15	SP01-07-JL-23-15-GW	East Wall
16	SP01-07-JL-23-16-GW	East Wall
17	SP01-07-JL-23-17-GW	East Wall
18	SP01-14-JL-23-18-GB	Sump
	SP01-02-JL-23-19-GB	Water Sample from Baker Tank
20	SP01-10-JL-24-20-GW	Southwest Wall
21	SP01-10-JL-24-21-GW	South. Wall
22	SP01-12-JL-24-22-GB	Southwest Center
23	SP01-14-JL-28-23-GW	Over-excavation Sample for 08 (Wall Sample Grid)
24	SP01-16-JL-28-24-GB	Over-excavation Sample for 18 (Floor Sample Grid)
25	SP01-14-JL-29-25-GB	Over-excavation Sample for 14 (Floor Sample Grid)

Note: /FD at the end of a field sample ID *indicates that a field duplicate also was* collected at this location.

Refer to Tables 3-2 and 3-8 for analytical laboratory results.

Sample exceeded CUL(s)





Legend

Wetland Area/ Pond

SA-1 Excavation

Over-excavated Area

Sample Location and Number

Haul Road

Silt Fence

Paved Walking Path

Figure 3-1
Excavation and Sampling at SA-1

Former Sand Point Naval Station
Seattle, Washington

ECC NAVFAC NAVFAC Northwest

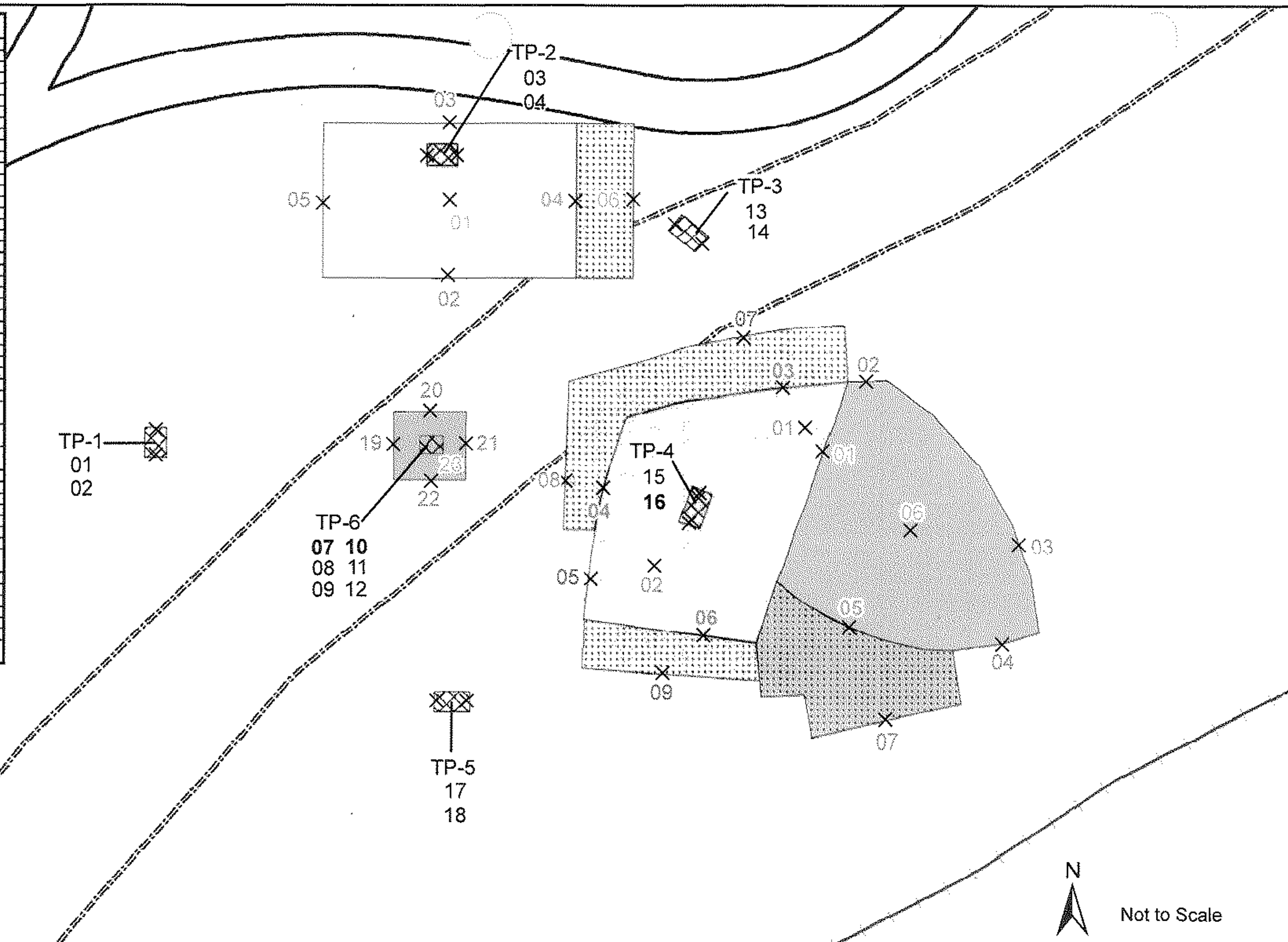
Drawn By: MJ	Checked By: KN	Modified By: MJ
Date Drawn: 08/26/2009	Date Checked: 10/01/2009	Date Modified: 10/02/2009

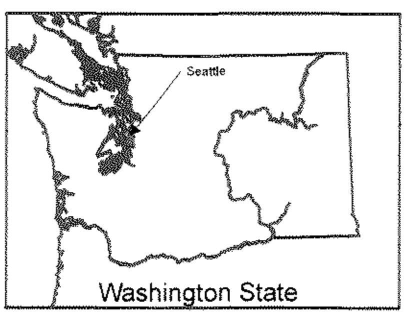
DESIGNATION ON FIGURE	SAMPLE ID	SAMPLE LOCATION
SA-2 TEST PITS		
01	SP[illegible]-JL-20-01-BWC	TP1
02	SPO2-08-JL-20-02-BWC	TP1
03	SPO2-3.5-JL-20-03-BWC	TP2
04	SPO2-06-JL-20-04-BWC	TP2
05	SPO2-3.5-JL-20-05-G	TP2
06	SPO2-06-JL-20-06-G	TP2
07	SPO2-04-JL-20-07-BWC	TP6
08	SPO2-04-JL-20-08-G	TP6
09	SPO2-06-JL-20-09-G	TP6
10	SPO2-07-JL-20-10-BWC	TP6
11	SPO2-07-JL-20-11-G	TP6 (PCBs only)
12	SPO2-07-JL-20-12-G	TP6 (PAHs only)
13	SPO2-04-JL-20-13-BWC/FD	TP3
14	SPO2-08-JL-20-14-BWC	TP3
15	SPO2-04-JL-20-15-BWC	TP4
16	SPO2-7.5-JL-20-16-BWC	TP4
17	SPO2-04-JL-20-17-BWC	TP5
18	SPO2-08-JL-20-18-BWC	TP5
TP6 EXCAVATION		
19	SPO2-06-JL-28-19-GW	West Wall
20	SPO2-09-JL-28-20-GW	North Wall
21	SPO2-09-JL-28-21-GW/FD	East Wall
22	SPO2-09-JL-28-22-GW	South Wall
23	SPO2-09-JL-28-23-GB	Floor, Center
TP4 EXCAVATION		
01	SPTP4-09-JL-28-01-GB	North Floor
02	SPTP4-09-JL-28-02-GB/FD	South Floor
03	SPTP4-08-JL-28-03-GW	North Wall
04	SPTP4-09-JL-28-04-GW	West Wall
05	SPTP4-08-JL-28-05-GW	Southwest Wall
06	SPTP4-09-JL-28-06-GW	South Wall
07	SPTP4-04-JL-31-07-GW	Over-excavation of North Wall
08	SPTP4-07-JL-31-08-GW	Over-excavation of West Wall
09	SPTP4-07-JL-31-09-GW	Over-excavation of South Wall
GTP-E8 EXCAVATION		
01	SPE08-04-JL-24-01-GW	West Wall
02	SPE08-05-JL-24-02-GW	Northwest Wall
03	SPE08-04-JL-24-03-GW/FD	Northeast Wall
04	SPE08-07-JL-24-04-GW	Southeast Wall
05	SPE08-04-JL-24-05-GW	Southwest Wall
06	SPE08-10-JL-24-06-GB	Floor
07	SPE08-07-JL-29-07-GW/FD	Over-excavation of South Wall
STP2N EXCAVATION		
01	SPSTP2N-09-JL-28-01-GB	Center, Floor
02	SPSTP2N-09-JL-28-02-GW	South Wall
03	SPSTP2N-06-JL-28-03-GW	North Wall
04	SPSTP2N-04-JL-28-04-GW	East Wall
05	SPSTP2N-06-JL-28-05-GW	East Wall
06	SPSTP2N-04-JL-31-06-GW/FD	Over-excavation of West Wall

Note: /FD at the end of a field sample ID indicates that a field duplicate also was collected at that location.

Refer to Tables 3-3 to 3-8 for analytical laboratory results.

Sample exceeded CUL(s)





Legend

GTP-E8 Excavation

TP4 Excavation

TP6 Excavation

STP2N Excavation

SA-2 Test Pits

Over-excavated Area

Sample Location and Number

Haul Road

Silt Fence

Paved Walking Path

Figure 3-2
Excavation and Sampling at SA-2 (Including TP-1 to TP-6, GTP-E8, and STP2N)
Former Sand Point Naval Station
Seattle, Washington

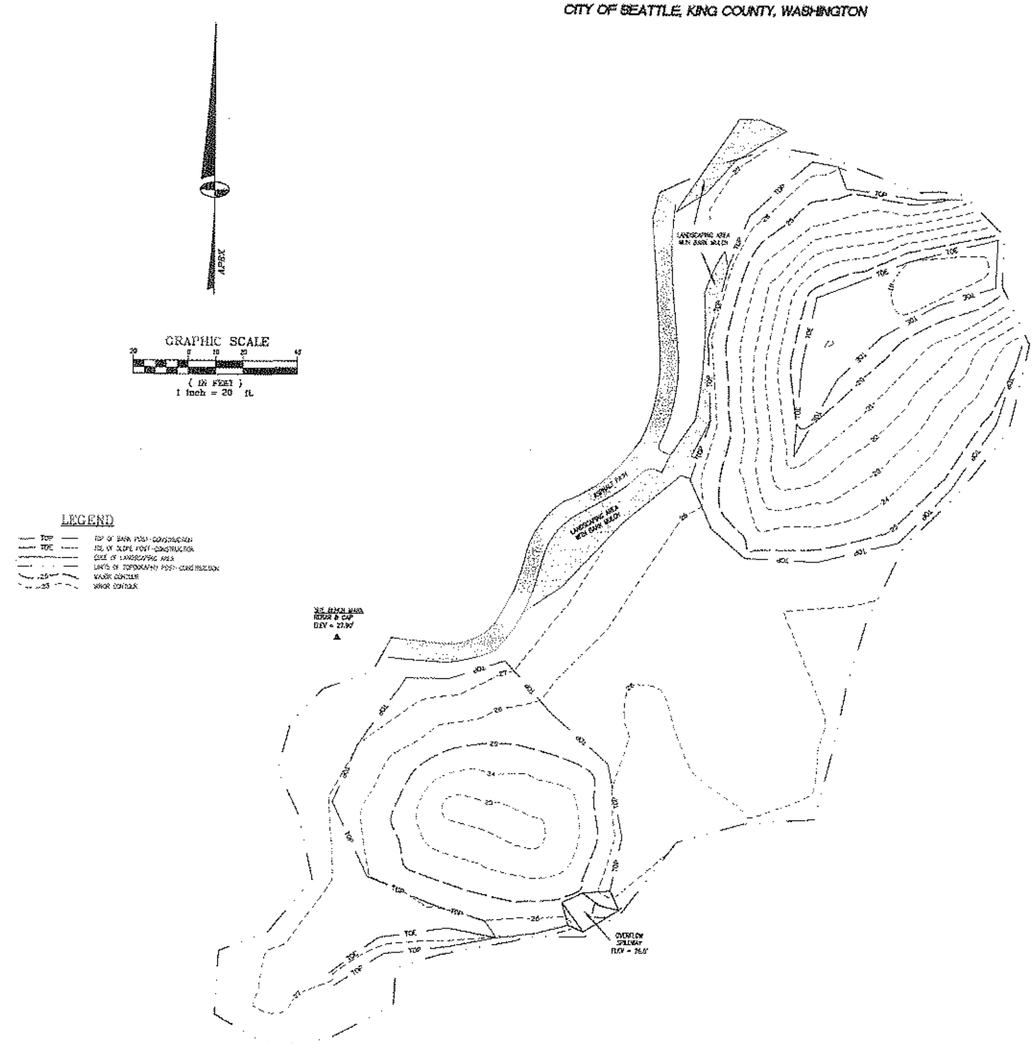
NAVFAC Northwest

Drawn By: MJ	Checked By: KN	Modified By: MJ
Date Drawn: 08/26/2009	Date Checked: 10/01/2009	Date Modified: 10/02/2009

SANDPOINT

POST-CONSTRUCTION TOPOGRAPHIC SURVEY

A PORTION OF SECTION 2, TOWNSHIP 25 NORTH, RANGE 4 EAST OF THE WILLAMETTE MERIDIAN
CITY OF SEATTLE, KING COUNTY, WASHINGTON



VERTICAL DATUM

ASSUMED DATUM PER MAGNUSON PARK AS-BUILT SURVEY SUPPLIED BY CLIENT, CAD FILE NAME "DMASTER_06.DWG"

DESC: MONUMENT #1, 2" BRASS DISK SET IN CONCRETE WITH PUNCH, 17' WEST OF CATCH BASIN IN GRASS AREA IN CENTERLINE OF OLD ASPHALT ROAD +/-560' NE OF THE SOUTH END OF GOVERNMENT CALIBRATION BASELINE MONUMENT.

ELEVATION = 16.38'

BASIS OF BEARINGS

HELD NORTH 12°55'17" EAST BETWEEN FOUND MONUMENTS #1 AND #2 RESPECTIVELY. SAID MONUMENTS WERE PREVIOUSLY ESTABLISHED AS PART OF THE MAGNUSON PARK AS-BUILT SURVEY FOR THE NAVY AND COORDINATE VALUES WERE SUPPLIED TO APEX ENGINEERING PLLC FOR THIS SURVEY, CAD FILE NAME "DMASTER_06.DWG"

MON #1	MON #2
243541.72	249776.60
1297256.97	1297310.88

METHODS AND EQUIPMENT

SURVEY PERFORMED WITH A 1" TOTAL STATION, USING TRAVERSE AND RADIAL SURVEY METHODS. SURVEY MEETS OR EXCEEDS ACCURACY REQUIREMENTS CONTAINED IN W.A.C. 332.130.090.

SURVEYOR'S NOTES

1. DATA FOR THIS SURVEY WAS GATHERED BY FIELD TRAVERSE UTILIZING ELECTRONIC DATA COLLECTION. TOPOGRAPHIC DATA WAS COLLECTED 08-07-09.
2. CONTOUR INTERVALS ARE ONE-FOOT AND ARE COMPUTER GENERATED FROM GROUND FIELD TOPOGRAPHY GATHERED FOR THIS SURVEY UTILIZING ELECTRONIC DATA COLLECTION.
3. APEX ENGINEERING PLLC, ASSUMES NO LIABILITY FOR ANY SUBSURFACE CONDITIONS OR FEATURES THAT MAY EXIST THAT ARE UNDETECTABLE AND/OR NOT VISIBLE.
4. THE PURPOSE OF THIS SURVEY IS TO PROVIDE A TOPOGRAPHIC BASE MAP OF THE CONDITIONS WITHIN THE OVER EXCAVATION AREA AFTER CONSTRUCTION HAS BEEN COMPLETED IN ORDER TO DETERMINE QUANTITIES OF CONTAMINATED SOIL REMOVED DURING CONSTRUCTION.
5. QUANTITY OF DIRT REMOVED DURING CONSTRUCTION WAS 2,436 CU. YARDS.

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THIS MAP CORRECTLY REPRESENTS A TOPOGRAPHIC SURVEY MADE BY ME OR UNDER MY DIRECTION AND THAT TO THE BEST OF MY KNOWLEDGE REPRESENTS THE TOPOGRAPHIC FEATURES AS THEY EXIST ON THE GROUND AS OF 08/07/2009.

KENNETH N. SWINDAMAN P.L.S. #[illegible] — 08/19/2009 DATE

PROJECT MANAGER: K. SWINDAMAN SIGNATURE:

REV NO	REVISION DESCRIPTION	DATE	BY

DESIGN
DRAWN TJM
CHECKED
SEC 2 T 25N R 4E
DWG NO 31718-EQ.DWG
DATE 08-19-09
SCALE 1" = 20'

DATE SEALED

TITLE
Figure 3-3
SANDPOINT
POST-CONSTRUCTION TOPOGRAPHIC SURVEY

CLIENT/OWNER
ENGINEERING/REMEDIATION RESOURCES GROUP
1700 WESTLAKE AVENUE NORTH
SEATTLE, WA 98109

Apex Engineering PLLC
2601 South 35th, Suite 200
Tacoma, Washington 98409-7479
(253) 473-4494 FAX: (253) 473-0599

SHEET 1 OF 1
FILE NO 31718

G.5. Census Tract Information

USA.COM

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Search State, County, City, Zip Code, or Area Code

USA.com / Washington / King County / Seattle / Census Tract 002200

Census Tract 002200
Basic Information
Population and Races
Income and Careers
Housing
Seattle, WA
King County
Washington State
Seattle, Tacoma, Bellevue Area

Census Tract 002200 in King County, Washington

Basic Information | Population and Races | Income and Careers | Housing

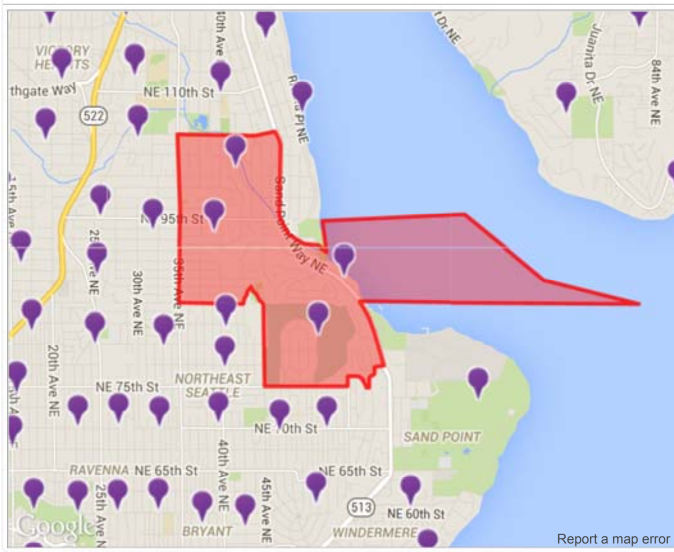
Population	5,286 (2010), see rank
House Units	2,271, see rank
Race	Whites:82.9%, Hispanics:3.6%, Blacks:1.4%, Asians:10.4%, Others:5.4%
Population Density:	3,216.34/sq mi, see rank
Median Household Income:	$106,641, see rank
Median House Price:	$550,300, see rank
Time Zone:	Pacific GMT -8:00 with Daylight Saving in the Summer
Land Area:	1.07 sq mi, see rank
Water Area:	0.57 sq mi (34.97%), see rank
State:	Washington
Area:	Seattle-Tacoma-Bellevue, WA
County:	King County
City:	Seattle
School District:	Seattle School District

Hot Rankings

The Richest Census Tracts Nearby
House Price Ranking Nearby
Population Ranking Nearby
Fastest / Slowest Growing Cities in WA
High / Low WA Cities by Males Employed
High / Low WA Cities by Females Employed
Best / Worst Cities by Crime Rate in WA
Richest / Poorest Cities by Income in WA
Expensive / Cheapest Homes by City in WA
Most / Least Educated Cities in WA

Census Tract 002200 Map, Border, and Nearby Locations

Census Block Groups Map View. Full data. Click icon to show name.



Show More Locations on the Map

Census Blocks*
Census Block Groups*
Census Tracts*
Zip Codes
School Districts
Cities
Counties
Metro Areas
States

* Census Blocks, Census Block Groups, and Census Tracts are geo areas that are normally smaller than the size of a city. Census Blocks provide block and community level information. They are great for understanding areas within a city.

Census Tract 002200 Block Groups

WA0330022001 Seattle
WA0330022002 Seattle
WA0330022003 Seattle
WA0330022004 Seattle

*A census tract is a geographic area defined by the United States Census Bureau and used for the census. A census tract normally covers a smaller area than a city or zip code. On average, a census tract has around 4,200 residents. Census tracts are more uniformly distributed in terms of the number of residents than cities or zip codes. Also, the census tract demographic data is nearly 100% complete vs. less than 70% coverage of demographic data for cities and zip codes. Therefore using census tracts is an excellent way to compare and study smaller scale locations inside and across multiple states. For example understanding the different areas of a large city or comparing neighborhoods in one city to neighborhoods in another city. Census tracts can be further divided into census block groups and then finally census blocks for understanding locations in a block and a community level respectively.

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Census Tract 002400
- Basic Information
- Population and Races
- Income and Careers
- Housing

Seattle, WA

King County

Washington State

Seattle, Tacoma, Bellevue Area

Census Tract 002400 in King County, Washington

Basic Information | Population and Races | Income and Careers | Housing

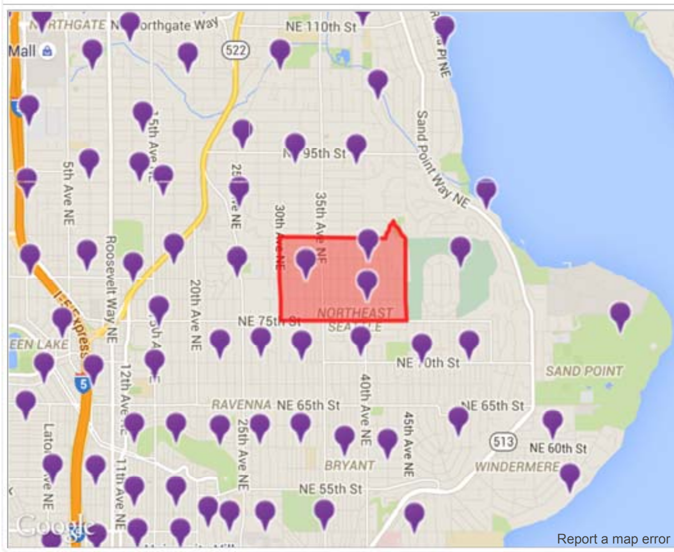
Population	2,972 (2010), see rank
House Units	1,294, see rank
Race	Whites:83.6%, Hispanics:3.1%, Blacks:1%, Asians:9.2%, Others:6.2%
Population Density:	7,869.77/sq mi, see rank
Median Household Income:	$83,922, see rank
Median House Price:	$483,600, see rank
Time Zone:	Pacific GMT -8:00 with Daylight Saving in the Summer
Land Area:	0.38 sq mi, see rank
Water Area:	0.00 sq mi (0.00%), see rank
State:	Washington
Area:	Seattle-Tacoma-Bellevue, WA
County:	King County
City:	Seattle
School District:	Seattle School District

Hot Rankings

- The Richest Census Tracts Nearby
- House Price Ranking Nearby
- Population Ranking Nearby
- Fastest / Slowest Growing Cities in WA
- High / Low WA Cities by Males Employed
- High / Low WA Cities by Females Employed
- Best / Worst Cities by Crime Rate in WA
- Richest / Poorest Cities by Income in WA
- Expensive / Cheapest Homes by City in WA
- Most / Least Educated Cities in WA

Census Tract 002400 Map, Border, and Nearby Locations

Census Block Groups Map View. Full data. Click icon to show name.



Show More Locations on the Map

- Census Blocks*
- **Census Block Groups***
- Census Tracts*
- Zip Codes
- School Districts
- Cities
- Counties
- Metro Areas
- States

* Census Blocks, Census Block Groups, and Census Tracts are geo areas that are normally smaller than the size of a city. Census Blocks provide block and community level information. They are great for understanding areas within a city.

Census Tract 002400 Block Groups

WA0330024001 Seattle WA0330024002 Seattle WA0330024003 Seattle

*A census tract is a geographic area defined by the United States Census Bureau and used for the census. A census tract normally covers a smaller area than a city or zip code. On average, a census tract has around 4,200 residents. Census tracts are more uniformly distributed in terms of the number of residents than cities or zip codes. Also, the census tract demographic data is nearly 100% complete vs. less than 70% coverage of demographic data for cities and zip codes. Therefore using census tracts is an excellent way to compare and study smaller scale locations inside and across multiple states. For example understanding the different areas of a large city or comparing neighborhoods in one city to neighborhoods in another city. Census tracts can be further divided into census block groups and then finally census blocks for understanding locations in a block and a community level respectively.

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Local Data Search

Search State, County, City, Zip Code, or Area Code

Census Tract 003900 in King County, Washington

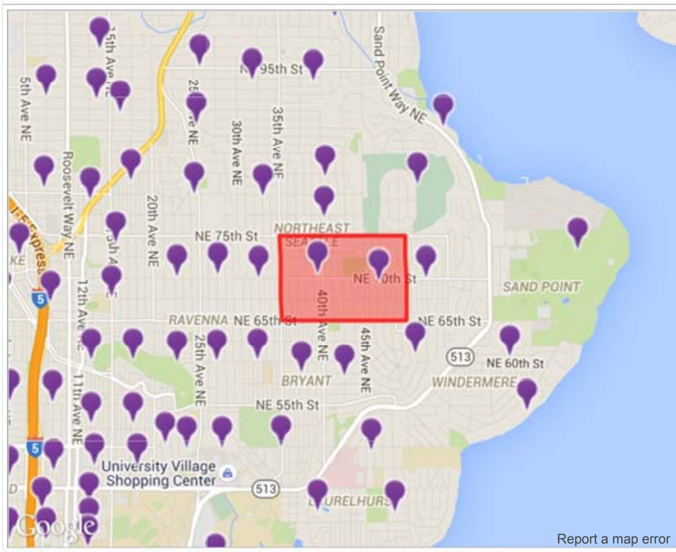
Population	2,772 (2010), see rank
House Units	1,191, see rank
Race	Whites:79.8%, Hispanics:4.2%, Blacks:1.5%, Asians:11.8%, Others:7%
Population Density:	7,372.56/sq mi, see rank
Median Household Income:	$92,560, see rank
Median House Price:	$552,300, see rank
Time Zone:	Pacific GMT -8:00 with Daylight Saving in the Summer
Land Area:	0.38 sq mi, see rank
Water Area:	0.00 sq mi (0.00%), see rank
State:	Washington
Area:	Seattle-Tacoma-Bellevue, WA
County:	King County
City:	Seattle
School District:	Seattle School District

Hot Rankings

- The Richest Census Tracts Nearby
- House Price Ranking Nearby
- Population Ranking Nearby
- Fastest / Slowest Growing Cities in WA
- High / Low WA Cities by Males Employed
- High / Low WA Cities by Females Employed
- Best / Worst Cities by Crime Rate in WA
- Richest / Poorest Cities by Income in WA
- Expensive / Cheapest Homes by City in WA
- Most / Least Educated Cities in WA

Census Tract 003900 Map, Border, and Nearby Locations

Census Block Groups Map View. Full data. Click icon to show name.



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- States

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Census Tract 003900 Block Groups

WA0330039001 Seattle

WA0330039002 Seattle

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Census Tract 004000 in King County, Washington

Population	2,690 (2010), see rank
House Units	1,340, see rank
Race	Whites:78.6%, Hispanics:3.8%, Blacks:5.4%, Asians:9.2%, Others:6.8%
Population Density:	1,073.72/sq mi, see rank
Median Household Income:	$73,924, see rank
Median House Price:	$542,100, see rank
Time Zone:	Pacific GMT -8:00 with Daylight Saving in the Summer
Land Area:	1.01 sq mi, see rank
Water Area:	1.50 sq mi (59.82%), see rank
State:	Washington
Area:	Seattle-Tacoma-Bellevue, WA
County:	King County
City:	Seattle
School District:	Seattle School District

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Population Ranking Nearby
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Best / Worst Cities by Crime Rate in WA
Richest / Poorest Cities by Income in WA
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Most / Least Educated Cities in WA

Census Tract 004000 Map, Border, and Nearby Locations

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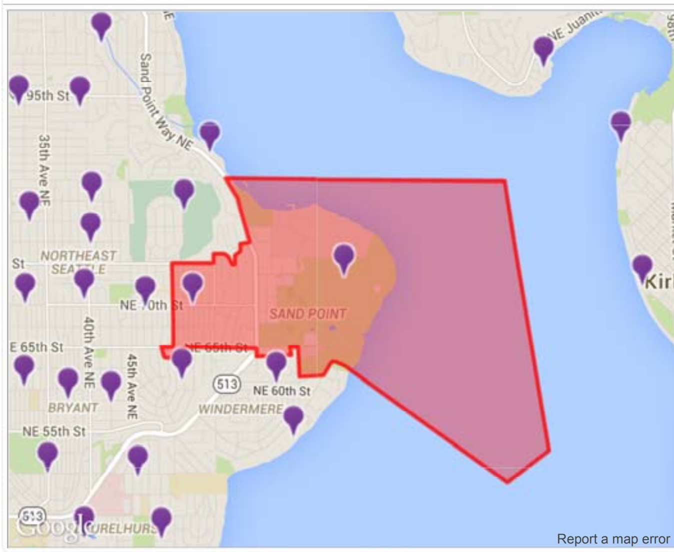

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Census Tract 004000 Block Groups

WA0330040001 Seattle   WA0330040002 Seattle

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USA.com / Washington / King County / Seattle / Census Tract 004100

Census Tract 004100
- Basic Information
- Population and Races
- Income and Careers
- Housing

Seattle, WA

King County

Washington State

Seattle, Tacoma, Bellevue Area

Census Tract 004100 in King County, Washington

Basic Information | Population and Races | Income and Careers | Housing

Population	7,789 (2010), see rank
House Units	3,280, see rank
Race	Whites:83.6%, Hispanics:2.8%, Blacks:0.7%, Asians:10.5%, Others:5.2%
Population Density:	2,261.02/sq mi, see rank
Median Household Income:	$110,038, see rank
Median House Price:	$888,000, see rank
Time Zone:	Pacific GMT -8:00 with Daylight Saving in the Summer
Land Area:	1.26 sq mi, see rank
Water Area:	2.18 sq mi (63.38%), see rank
State:	Washington
Area:	Seattle-Tacoma-Bellevue, WA
County:	King County
City:	Seattle
School District:	Seattle School District

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House Price Ranking Nearby
Population Ranking Nearby
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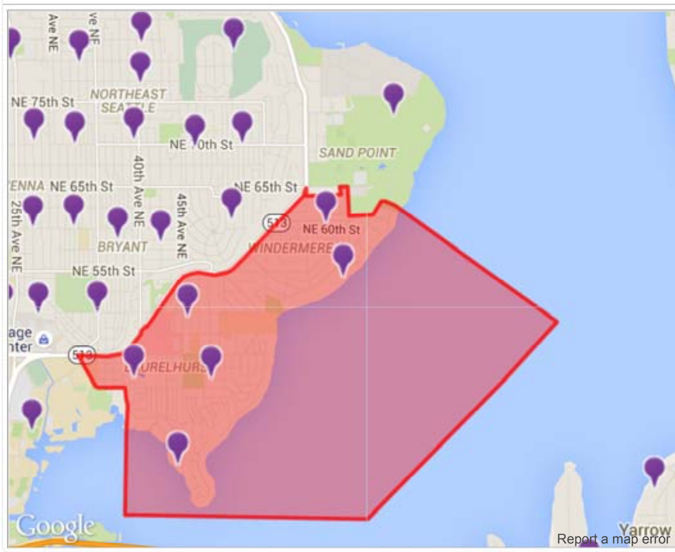
High / Low WA Cities by Males Employed
High / Low WA Cities by Females Employed
Best / Worst Cities by Crime Rate in WA
Richest / Poorest Cities by Income in WA
Expensive / Cheapest Homes by City in WA
Most / Least Educated Cities in WA

Census Tract 004100 Map, Border, and Nearby Locations

Census Block Groups Map View. Full data. Click icon to show name.



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Census Tract 004100 Block Groups

WA0330041001 Seattle	WA0330041002 Seattle	WA0330041003 Seattle
WA0330041004 Seattle	WA0330041005 Seattle	WA0330041006 Seattle

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USA.com / Washington / King County / Seattle / Census Tract 004200

Census Tract 004200
Basic Information
Population and Races
Income and Careers
Housing
Seattle, WA
King County
Washington State
Seattle, Tacoma, Bellevue Area

Census Tract 004200 in King County, Washington

Basic Information | Population and Races | Income and Careers | Housing

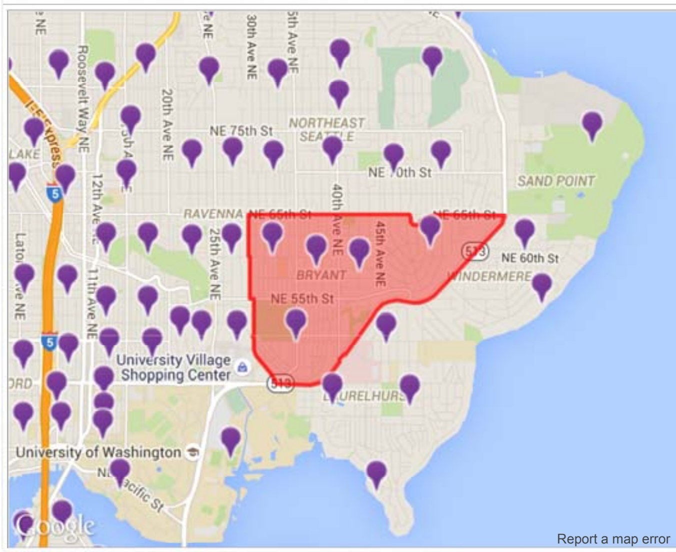
Population	7,618 (2010), see rank
House Units	3,285, see rank
Race	Whites:81.6%, Hispanics:4%, Blacks:2.6%, Asians:9%, Others:6.8%
Population Density:	8,007.50/sq mi, see rank
Median Household Income:	$105,158, see rank
Median House Price:	$605,000, see rank
Time Zone:	Pacific GMT -8:00 with Daylight Saving in the Summer
Land Area:	0.95 sq mi, see rank
Water Area:	0.00 sq mi (0.00%), see rank
State:	Washington
Area:	Seattle-Tacoma-Bellevue, WA
County:	King County
City:	Seattle
School District:	Seattle School District

Hot Rankings

The Richest Census Tracts Nearby
House Price Ranking Nearby
Population Ranking Nearby
Fastest / Slowest Growing Cities in WA
High / Low WA Cities by Males Employed
High / Low WA Cities by Females Employed
Best / Worst Cities by Crime Rate in WA
Richest / Poorest Cities by Income in WA
Expensive / Cheapest Homes by City in WA
Most / Least Educated Cities in WA

Census Tract 004200 Map, Border, and Nearby Locations

Census Block Groups Map View. Full data. Click icon to show name.



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Census Tract 004200 Block Groups

WA0330042001 Seattle
WA0330042002 Seattle
WA0330042003 Seattle
WA0330042004 Seattle
WA0330042005 Seattle

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G.6. History Summaries

G.6.1 History Summary - University of Washington

HISTORY SUMMARY SAND POINT PENINSULA

PRE-EURO AMERICAN SETTLEMENT
- Native American group associated with "hloo-weelth-AHBSH" peoples inhabited three longhouses along Wolf Bay, immediately south of Sand Point

MID-1800S EXPLORATION
- 1850, first likely Euro-American sighting of peninsula, name Sand Point used
- 1855, U.S. Government Land Office surveyed Sand Point

EURO-AMERICAN SETTLEMENT
- 1868, William Goldmyer homesteaded 81 acres immediately south of Pontiac Bay
- 1886-90, shipyard, Pontiac Brick and Tile Company, Pontiac Post Office established northwest part of peninsula
- 1914, Pontiac Brick and Tile Company closed
- 1910s to early 1920's, four families resided northwest portion of Sand Point
- 1918 to 1926, Carkeek Park located on the northwestern part of peninsula

EARLY AIRFIELD DEVELOPMENT
- Late 1910s to 1920s King County acquired small farms on Sand Point peninsula
- June 19, 1920, groundbreaking ceremony with symbolic tree cutting and first aircraft landing, station size 400 acres
- Apr.-Sep. 1924, four Army Air Corps planes began and ended "round-the-world flight" from Sand Point
- 1926, Carkeek Park sold to King County then deeded the peninsula to the Navy
- September 13, 1927, Lindbergh and Spirit of St. Louis visit, attendance 50,000
- 1928-29, constructed Buildings 2, 5A, 5B, 5C, 5D, 9, 20
- Early to mid-1930s, WPA transported hundreds of loads of soil for landing facilities
- 1936-39, constructed Bldgs 6, 15, 18,, 25, 26, 27, 29, 30, 31, 41, 330, 331, 332, expanded Building 9
- 1937, Pontiac Bay (3 acres) filled in to construct Building 27 and adjacent tarmac

SECOND WORLD WAR
- 1939, airfield grading involved moving more than 1,500,000 cubic yards soil
- 1940-41, runways paved with asphalt, main runway 400 feet wide, 3,700 feet long
- 1941-42, barracks, rec center, motor shop, gatehouse constructed, size 540 acres
- 1941, aircraft prohibited to carry live bombs due to new adjacent neighborhoods
- 1942, Sand Point Housing Project constructed (Radford Court Student Apartments)
- 1943-44, Buildings 193 (hangar), 40, 141/192, 222-224 (barracks) constructed

POST-WAR
- 1947, rumored that NAS Seattle to be closed due to creation of Air Force
- 1950, station scheduled for deactivation, delayed due to Korean War
- 1950, U.S. Fish and Wildlife Service established research laboratory NE 65th St.
- 1952, base closed except for Naval Reserve activities late 1950s, rumors of jet aircraft use, requiring extended runways, jet fuel storage
- 1965 - "Outdoor Recreation and Open Space Plan", Seattle Park Department and Seattle Planning Commission, identified Naval Air Station for major park development
- 1969, main airstrip resurfaced and extended to 4,800 feet, estimated cost $500,000

MILITARY TO CIVILIAN CONVERSION
- June 30, 1970, air station deactivated, all flight operations ended, surplus 347 acres
- 1975, 196 acres of the station transferred to the City of Seattle for Sand Point Park
- 1975, Sand Point Park Master Plan, proposed 75-acre Sports Meadow, tennis courts; neighborhood park, maintenance complex, and restaurant.
- December 1975, Sand Point Park dedication including ceremonial tree planting
- Late 1970s, demolition of runways, tarmac and taxiways, totaling 120 acres
- May 1977, park renamed in honor of Senator Warren Grant Magnuson
- Mid to late 1980s, Kite Hill construction, 40,000 tons of demolished runway and soil
- Late 1980s - "Sand Point Site Development Master Plan, Naval Station Puget Sound", proposed using Naval Station Puget Sound for support facilities.
- 1989 - "Master Plan Update Magnuson Park" by Seattle Parks and Recreation".
- 1991 - U.S. Base Realignment and Closure Commission recommends closure Naval Station Puget Sound, requested City of Seattle to lead reuse plan development.

CONCEPTUAL PLANNING, DESIGN, CONSTRUCTION
- 1993 – Res. 28832, adopted Community Preferred Reuse Plan for Sand Point.
- September 1995, Naval Station Puget Sound officially closed including transfer of 90 acres to City of Seattle and University of Washington
- 1997 – Res. 29429, approved Sand Point Physical Development Management Plan
- 1999 - Publication of "Sand Point Blue Ribbon Committee".
- 1999 – Res. 30063, additional guidance on design for Magnuson Park.
- 2001 – Res. 30293, additional guidance on design for Magnuson Park
- 2004-2006 - Full City Council approval of the wetland and sports fields master plan.

Source: http://courses.washington.edu/fm328/Fieldtrip%20Material/Peninsulahistory_PublicComps.pdf

G.6.2 History Summary - City of Seattle

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- Off-Leash Areas
- Park History
- Park Rangers
- Smoking Ban

WARREN G. MAGNUSON PARK
History - Pre-Euro American Settlement

< Warren G. Magnuson Park < History

Warren G. Magnuson Park Information: (206)684-4946
Park Address: 7400 Sand Point Way NE, Seattle, WA 98115 > directions
Administrative office visiting address: 6310 NE 74th St, bldg 30 southeast offices
Administrative office mail: 6310 NE 74th St., Suite 109E, Seattle, WA 98115

Native American group possibly associated with the "hloo-weelth-AHBSH" peoples inhabited three longhouses on the shores of Wolf Bay, immediately south of Sand Point. Identified the following places near or on the Sand Point peninsula:

- small prairie (BEbqwa'bEks) near the current Windermere community
- Mud Lake "wee-SAHL-pubsh" (Wisa'lpEbc) which may mean "plowed place"
- Sand Point "sqwab" (SqWsEb)
- northern shore near Pontiac Bay "T!uda'xEde" or "plant with small, inedible white berries"
- Pontiac Bay, "Sla'gwElagwEts" or "cedar bark where it grows"
- channel connecting Mud Lake to Lake Washington "TCHAAHL-ko" (Tc!aa'Lqo) "hidden water"

History « **Pre-Euro American Settlement** » Mid 1800s Exploration

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SEATTLE PARKS AND RECREATION

WARREN G. MAGNUSON PARK

History - Mid 1800s Exploration

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WARREN G. MAGNUSON PARK

- 1850 first likely Euro-American sighting of the peninsula by Isaac Ebey (1818-1857), afterwards the name Sand Point used for the area
- 1855 -August, John R. Neal or William A. Strickler from the U.S. Government Land Office, and a five-member crew, surveyed Sand Point
- Described the following natural and geographic features in and around Sand Point:
  - From the approximate point of 55th Avenue NE and NE 65th Street, heading east they encountered an alder grove which extended to the north and south
  - One-quarter mile further east they encounter a Douglas fir forest with trees ranging in size from two to six feet in diameter.
  - At approximately NE 65th Street and Sand Point Way NE, the surveyors entered a swamp that extended nearly to Lake Washington. Wetlands stretched from this point one-quarter mile to the north (approximately NE 70th Street)
  - Following a section line due north along 55th Avenue they encountered fir trees ranging from two to six feet in diameter and cedar trees at least 40 inches in diameter
  - Along this one mile section they crossed two streams both about 20 inches wide, one just north of NE 75th Street and another just north of NE 80th Street. Both streams emptied into a bay later called Pontiac Bay
  - Surveyors noted a small lake within the swamp (later called Mud Lake)

Pre-Euro American Settlement « **Mid 1800s Exploration** » Euro-American Settlement

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History - Euro-American Settlement

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Figure 1
Carkeek Park - Pontiac Bay, 1920

- 1868, late summer: William Goldmyer homesteaded 81.45 acres of land located immediately south of Pontiac Bay. Records noted that the land had a two-foot wide stream flowing through it. Goldmyer likely logged the old growth trees and, with his brother Henry, established a farm on about 19 acres.
- 1886 a shipyard was established by ship's carpenter Edward F. Lee near Pontiac Bay.
- 1889 Pontiac Brick and Tile Company established a brickyard due to deposits of clay in the banks west of Sand Point
- 1890 Pontiac Post Office opened
- 1914, Pontiac Brick and Tile Company permanently closed
- Starting in 1904, new residents moved to areas near Pontiac Bay, likely due to two fresh water streams that emptied into the bay. From the late 1910s to the early twenties, at least four families resided at Sand Point
- 1918 to 1926, Carkeek Park located on the northwestern part of peninsula

Mid 1800s Exploration « **Euro-American Settlement** » Early Airfield Development

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WARREN G. MAGNUSON PARK

History - Early Airfield Development

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WARREN G. MAGNUSON PARK

- Late 1910s to early 1920s King County commissioners began acquiring small farms on the peninsula
- June 19, 1920, ground breaking ceremony held that included a symbolic tree cutting and the first aircraft landing
- July 1920, congressional committee traveled to Sand Point via boat for a second dedication, and they cruised along the brush beach and walked through the woods over the entire site
- 1923, the U.S. Army leased the field from the Navy and erected a sheet iron hangar (Building 1, demolished by NOAA in 1970s or 1980s) that was shipped from California to Sand Point
- 1924, aircraft squadrons of the "Battle Fleet" established a camp at the location
- April-September 1924, four Army Air Corps planes, began and ended a "round-the-world flight" from Sand Point
- September 28, 1924, World Flight reception, estimated public attendance 40,000.
- September 1925, King County Commissioners authorized clearing of a landing strip 500 hundred feet wide and 2640 feet long, followed by grading, leveling and sowing in grass. Pilots seeded the runway to give it a more reliable turf surface, which nevertheless turned to mud in the winter and dust in the summer. Clarence Blethen of The Seattle Times paid for piping to be laid and for ditches to be dug divert water runoff.
- 1926, Sand Point was still no more than a series of farms, a field served as a runway, the station commander worked out of a farm house (Imbree residence), and naval aviation cadets were billeted in a chicken house
- Mid-1926, King County jail inmates used to clear trees and undergrowth to expand the airstrip
- October 1926, Carkeek family sold Carkeek Park to King County, which in turn deeded the entire peninsula to the U.S. Navy for developing a Naval Air Station (approximately 411 acres)
- September 13, 1927, visit by Charles Lindbergh and the aircraft, Spirit of St. Louis. Estimated public attendance 50,000.
- 1928-29, constructed Buildings 2, 5A, 5B, 5C, 5D, 9, 20 (incorporated into Building 11)
- 1929, seaplane runway constructed near the shore of Pontiac Bay
- 1930 Building 12 constructed, the central steam plant
Early to Mid-1930s, coordinating with the Works Progress Administration (WPA), the Navy trucked in hundreds of loads of fill to develop expanded landing facilities. Hundreds of WPA workers covered most of the point's "gently rolling land,", buried what remained of Mud Lake and the marsh, and eliminated Pontiac Bay. This fill material was graded and much of it covered with a slab of concrete for landing strips.

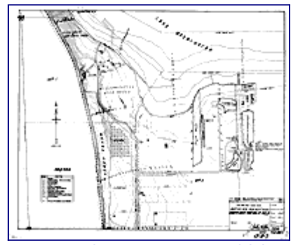

Figure 2: Pontiac Bay, 1926 (PDF)

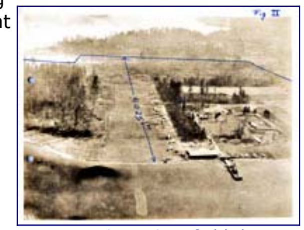

Figure 3: NAS Airfield, late 1920s, early 1930s (PDF)

Figure 4: NAS Map 1927, dated May 7, 1927 (PDF)

Figure 5: Pontiac Bay, Buildings 1, 2; Building 9 in background near 74th Street entrance (PDF)

- 1936-39, constructed Buildings 6, 15, 18, 25, 26, 27, 29, 30, 31, 41, 330, 331, 332. Expansion of Building 9. Constructed munitions storage Buildings 19, 21 (Figure 8: Overview May 1938).
- 1937, Pontiac Bay (approximately 2.7 acres) filled in to construct Building/Hangar 27 and adjacent tarmac.

Euro-American Settlement « **Early Airfield Development** » Second World War Period

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WARREN G. MAGNUSON PARK
History - Second World War Period

< Warren G. Magnuson Park < History

Warren G. Magnuson Park Information: (206)684-4946
Park Address: 7400 Sand Point Way NE, Seattle, WA 98115 > directions
Administrative office visiting address: 6310 NE 74th St, bldg 30 southeast offices
Administrative office mail: 6310 NE 74th St., Suite 109E, Seattle, WA 98115


Figure 6: Overview Looking to North, dated February 1941 (PDF)


Figure 6b: Naval Air Station Seattle, 1944 (PDF 1.3M)

- 1939, Commander A. W. Radford noted in a memo that grading of the airfield involved more than 1,500,000 cubic yards
- August 1940-September 1941, runways were paved with asphalt. Main runway 400 feet wide, 3,700 feet long, another 300 by 3,000 feet, and three others 200 by 3,000 feet. Eventually, five runways were constructed and offered eight landing directions. Concrete warmup strip was 200 by 1,800 feet. Likely constructed munitions storage, Buildings 54, 55 World War II, peak work force 7,400 military personnel and civilians
- November 1941, station size at 459.62 acres
- 1941, reported that many new barracks were constructed, "the product of months in which tractors and bulldozers moved earth night and day". Likely Buildings 173-176 southeast corner of NE 65th Street/Sand Point Way NE; Buildings 177-184 northwest corner NE 65th Street/Sand Point Way NE (demolished before 1953); Building 185, footbridge over Sand Point Way NE from end of Building 9 to a point south of NE 70th Street
- 1941-42, constructed Buildings 47 (recreation center), 67 (motor shop), 138 (gatehouse, brig). Likely constructed officers bathhouse, Building 53 (now picnic shelter 2), base expanded to 537.5 acres
- 1941, Seattle urban development had come close enough to the base that aircraft were no longer permitted to carry live bombs
- 1942, station size at 471.11 acres
- 1942, construction began on the Sand Point Housing Project (located south of NE 65th Street and site of the current day Radford Court Student Apartments
- 1943, main runway expanded to 5,050 feet long
- 1943-44, constructed Buildings 193 (hangar), 40, 141/192, 222-224 (barracks)
- 1945, constructed Building 275 (boathouse shed)

Early Airfield Development « **Second World War Period** » Post-War Period

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WARREN G. MAGNUSON PARK

Figure 7: Oblique view to the west, dated May 1953 (PDF)

- Post-1945, constructed enlisted men's bathhouse, Building 311 (now picnic shelter 1)
- 1947, rumors that NAS Seattle to be closed due to creation of U.S. Air Force
- September 1950, base scheduled for deactivation, delayed to Korean War
- 1950s, Area Development Plan (dated, November 1953) shows that field lighting was installed and removed for each football season at the south end of the current Sand Point Fields. At the north end of these fields, there was a softball and baseball diamond.
- 1950, U.S. Fish and Wildlife Service established a research laboratory in surplus Navy buildings south of NE 65th Street, east of 65th Avenue NE
- 1952, the Navy closed the base except for Naval Reserve activities
- 1953, Master Shore Development Plan for NAS Seattle estimated plant value at $70 million, station size at 450.31 acres
- Late 1950s, rumors of stationing jet aircraft a NAS Seattle, would need extension of runways and construction of jet fuel storage
- 1963, station size at 494.68 acres, Shearwater Housing
- 1966, station population included 482 active duty, 1,471 reserve naval personnel, 318 civilians
- 1967, relocation of Coast Guard Air Station from Port Angeles.
- 1969, the main airstrip was resurfaced and extended from the southeast to northwest shore, a length of 4,800 feet (estimated cost $500,000).

Second World War Period « **Post-War Period** » Military to Civilian Conversion

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WARREN G. MAGNUSON PARK

History - Military to Civilian Conversion

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Figure 8: Gold Cup Hydroplane Race, August 1974 (PDF)

Figure 9: Naval Support Facility Seattle, 1978 (PDF)

Figure 10: Construction of NOAA Campus 1981-82 (JPG)

- 1970, the Navy announced that it would retain a small portion of Naval Air Station Seattle and 347 acres would be declared surplus for other purposes.
- June 30, 1970, the U.S. Navy deactivated the Naval Air Station, ended all flight operations, and renamed as Naval Support Activity - Seattle.
- Late 1970s, construction begun on National Oceanic and Atmospheric Administration - Western Administrative Support Center
- August 1974, Seattle Gold Cup Hydroplane Race. Estimated attendance: 30,000-35,000. Event parking on remaining tarmac, event considered a failure due to first-time for admission charge, parking/traffic control problems
- 1975, 312.5 acres surplused: 117 acres transferred to National Oceanic and Atmospheric Administration (NOAA), 196 acres transferred to the City of Seattle for Sand Point Park
- 1975 - Sand Point Park Master Plan, proposed development of 75-acre Sports Meadow, tennis courts; neighborhood park; maintenance complex, and restaurant.
- December 1975, dedication of Sand Point Park including the planting a ceremonial tree
- 1976 - "Sand Point Park: A Final Statement on Impact". Proposed demolition of structures and runways, development of a sports meadow and drained playfields, North Cove Swimming Beach, boating center, and interior circulation system.
- Late 1970s, demolition of runways, tarmac and taxiways, approximately 120 acres
- May 1977, park renamed in honor of Senator Warren Grant Magnuson
- 1979, athletic field improvements designed by U.S. Navy for Sand Point recreation fields, to include two baseball fields and one running track around a football field. Lighting was designed for the football field (8 poles 65-feet tall with six fixtures), including a scoreboard and loudspeakers. Uncertain why this project was not constructed.
- 1980-82, construction of NOAA Western Administrative Support Center
- Mid to late 1980s, construction of Kite Hill from 40,000 tons of demolished runway and earth near the site of historic Sand Point Head
- 1983 - "Base Exterior Architecture Design Guide, Naval Station Seattle, Washington". Identified aesthetic measures to upgrade the appearance of the base.
- 1983, 4.48 acres surplused to the U.S. Fish and Wildlife Service for the Western Fisheries Research Center
- 1983, completion and dedication of NOAA campus and Art Walk, including five public art sculptures
- 1985, Naval Support Facility - Seattle, housed the offices of the Navy's supervisor of shipbuilding, a recruiting office and a public-relations office. Work Force: 1,000 military personnel and 1,182 civilians.
- May 1987 (Memorial Day weekend), Boy Scout Exposition, estimated attendance 28,000
- October 1986, base redesignated as Naval Station Puget Sound

- Late 1980s - "Sand Point Site Development Master Plan, Naval Station Puget Sound", proposed using Naval Station Puget Sound for support facilities.
- 1989 - "Master Plan Update Magnuson Park" by Seattle Parks and Recreation".
- April 1990, 19th Annual University of Washington, Native American Student Association Pow Wow, estimated attendance 45,000
- April 1991, 20th Annual University of Washington, Native American Student Association Pow Wow, estimated attendance 45,000
- April 1991, Naval Station Puget Sound recommended for closure under the Base Realignment and Closure Act (BRAC)

Post-War Period « **Military to Civilian** » Conceptual Planning, Design, Construction

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Sand Point Naval Air Station: 1920-1970

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Under a variety of official designations, Sand Point, a peninsula in north Seattle that juts into Lake Washington, served for almost 50 years as an air base, aviation training center, and aircraft repair depot for the U.S. Navy. Growing eventually to more than 400 acres, the Sand Point Naval Air Station hosted at its peak during World War II more than 5,600 Naval personnel, more than 2,400 civilian workers, and hundreds of aircraft. Units trained at Sand Point participated in some of the critical battles in the Pacific war.

Sand Point, 1928
Courtesy Naval Station Puget Sound at Sand Point

King County's Gift to the Navy

At the time of the U.S. entry into World War I, the U.S. Navy wanted a base for aircraft to serve as the "eyes of the fleet" and to create an air umbrella over the naval bases and yards in Puget Sound. Captain Luther E. Gregory received the assignment to find a suitable site and he ultimately fixed upon Sand Point. Elected officials of King County and members of the Seattle Chamber of Commerce learned of this and remembered when a group of Army airplanes had visited the area on a Liberty Bond tour and landed on the Jefferson Park Golf Course, the only available landing field.

King County Commissioner Claude Ramsey championed development of the Sand Point Naval Air Station

World War I ended before the Navy made a decision, but a group of veterans with flying experience headed by Capt. Frank Fretwell (1882-1937) began to lobby King County for an airport at Sand Point (the location was at that time outside the city limits). They cited the following advantages:

- Its location on Lake Washington made it easily discernible from the air.
- The fresh water site was both free from tidal action and not subject to flooding.
- The peninsula allowed takeoffs and landings free of obstructions such as buildings and power poles.
- Access by rail and by sea.
- Favorable prevailing winds.

First hangars and control tower at Sand Point, ca. 1928
Courtesy Naval Station Puget Sound at Sand Point

In the spirit of boosterism expressed in the building of Fort Lawton (1898) and in the construction of the *U.S.S. Nebraska* (1900), King County commissioners began acquiring the small farms on the site. On June 19, 1920, local officials and Navy officers held a ground breaking ceremony which included a symbolic tree cutting. As part of the festivities, air mail pioneer Edward Hubbard (1889-1928) landed a plane at Sand Point with King County Commission chairman Claude C. Ramsay (1865-1930) as passenger.

The plan to develop Sand Point encountered opposition from supporters of an Army air field just north of Camp Lewis, echoing other competitions between Seattle and Tacoma for preeminence on Puget Sound. Committed to an airport at Sand Point, King County commissioners authorized construction of an air strip. Army Major Henry Kress Muhlenberg (1886-1967), an assistant professor of military tactics at the University of Washington and a pilot, offered his assistance. On October 8, 1921, he flew a Curtiss JN-4H "Jenny" biplane from Camp Lewis to Sand Point and made the first military landing there on a 500 foot dirt strip.

Despite the lack of official funding, local Army and Navy officers worked to develop an air base. King County paid to ship a prefabricated Army hangar to the property from California. Pilots seeded the runway to give it a more reliable turf surface, which nevertheless turned to mud in the winter and dust in the summer. Clarence Blethen (1879-1941) of *The Seattle Times* paid for ditches to be dug to catch runoff.

The Navy could not accept the site without an act of Congress. A joint Congressional committee visited the property and reported back on January 31, 1921, that it agreed with the Navy that Sand Point was the best choice for a base for heavier-than-air equipment. The wording of the report supported the development of conventional, as opposed to rigid and non-rigid lighter-than-air craft. (In 1971 during Seafair, the Goodyear Blimp visited Sand Point in one of the last occasions when it functioned as an airport.)

It took until July 13, 1922, for the Navy to accept 268 acres from the county on a 10-year lease at $1 a year. Congress authorized $800,000 for initial development as a joint Army and Navy airfield. The Navy completed the first permanent hangar on April 6, 1923, when the base complement was the UW Army ROTC Jenny and six Naval Reserve airplanes.

Around the World in 174 Days

Sand Point's first serious mission came a year later when it was chosen as the beginning and ending points for the first circumnavigation of the globe by air. On April 7, 1924, after two weeks of preparation, four Douglas biplanes headed to Alaska and around the world. Two of the planes completed the 26,345-mile journey on September 28, 1924. Fifty thousand people came out to Sand Point to greet them.

On May 11, 1925, the Chief of Naval Operations formally established a Naval Air Reserve squadron at Sand Point. On March 4, 1926, Congress authorized the Navy to accept "without cost," fee simple, 413 acres as a naval air station, one of only five naval air stations in the nation. By this time, King County had spent $500,000 acquiring and developing the property.

Chicken House and Kitchen

In 1926, Sand Point was still no more than a series of farms. A field served as a runway. The station commander, an active duty Naval officer, worked out of a farm house. Three reserve officers assisted him. Reservists met one evening a week for drills, and on Sundays, they flew, whatever the weather. Naval aviation cadets were billeted in a chicken house and the supply officer ran his department out of a kitchen.

Through the 1920s, Sand Point grew slowly with the addition of enlisted men's barracks and other buildings. The facility's principal mission was to train reservists, who performed valuable services such as aerial mapping of Alaska and Washington. Although the base had a turf runway, the damp climate rendered it unreliable most of the year. Most aircraft operations were by amphibious and float planes. In 1931, the full-time complement was 31 Marines and eight Naval personnel who operated 14 airplanes.

During the Great Depression, funding for the station was short. Executive Officer Lt. H.B. Hutchinson recalled buying cinders in $50 lots. When he had enough to pave a runway, he borrowed a steam shovel from Bremerton to complete the job. Improvement of the

Laying granite blocks as part of runway, shop and storehouse construction, Sand Point, 1930
Courtesy United States Navy

First Naval buildings at Sand Point, ca. 1930

Early class of Naval Reserve pilots at Sand Point, 1930

U.S. Navy Lt. Commander J.H. Chapman, first commanding officer of the Sand Point Naval Air Station, 1926

facility slowed during these years, but by the end of 1935 the Navy, with the assistance of civilian agencies such as the Civilian Conservation Corps, had increased the number of buildings to 17.

In addition to the Navy and Marine Reservists who used Sand Point, fleet air units landed at the field when making cross country flights or when the fleet visited Puget Sound. Commercial aviation also took advantage of Sand Point's unique location. In 1939, Pan American Airways began Clipper service to Alaska from county park land at Matthews Beach, just north of Sand Point Naval Station, with four-engined Sikorski S-42 flying boats. Pan Am also used Sand Point hangars and runways. Sand Point witnessed the development of the big Boeing Model 314 flying boats as they were tested from Matthews Beach and Boeing engineers used the Navy seaplane ramp at least once for repairs.

That same year, five active Navy patrol squadrons, each with six multi-engined flying boats capable of long-range reconnaissance and attack, were assigned to the base. The station's mission expanded to include the overhaul of aircraft. More than 600 sailors were stationed at Sand Point. The commander expressed a concern about the need for wholesome recreation for his men because, "I find that moving pictures alone cannot compete with the attractions of Seattle night life."

World War II

On December 8, 1939, President Franklin D. Roosevelt (1881-1945) declared a national emergency in response to the outbreak of World War II. The following July, $4 million was authorized by Congress to improve Naval Air Station (NAS) Seattle, more than all the improvements to that date. By June 1941, four month aviation service schools were turning out radiomen, aviation metalsmiths, and aviation machinists. By this time, Seattle had encroached upon the facility enough to require that aircraft no longer carry live bombs and Naval Air Station Whidbey Island was established to handle the arming of aircraft for combat. The cinder runways were paved with asphalt: Eventually, five runways offered eight landing directions. Sand Point serviced aircraft from *H.M.S. Warspite* for the British Royal Navy.

With the attack on Pearl Harbor on December 7, 1941, NAS Seattle relinquished its patrol squadrons for combat duty in the North Pacific. Twelve planes arrived in Kodiak just in time to help beat back Japanese attacks on Dutch Harbor and then to continue missions against the Kurile Islands, part of the Japanese homeland.

Sand Point operations and staff ballooned during the war years: The daily population rose to 8,000 civilian and military personnel. NAS Seattle also hosted several headquarters functions, a weather center, a communications center, and an overseas terminal for the Naval Air Transport Service. One hundred and fifty shops at the station provided necessary repairs and modifications for fleet aircraft. As shipyards in Tacoma and Vancouver produced escort aircraft carriers (CVEs) at a rate of one every two weeks - 50 in three years - Sand Point provided aviation supplies from propellers to parachutes. Men and planes from aircraft carriers, battleships, and cruisers visiting Puget Sound stayed at the station.

Final Decades

Peace came in August 1945. NAS Seattle found itself in a substantially reduced mission and by June 1946, the combined military and civilian staff dropped to about 3,000. Vast quantities of surplus supplies flooding onto the station and Sand Point became responsible for the preservation of 89 flying boats at Renton. Repair and overhaul of aircraft continued through the 1940s, but the Navy announced that the base would close permanently on September 1, 1950.


U.S. Navy Lt. H. A. Beswick, first pilot instructor at Sand Point


Officer's quarters at Sand Point, 1930s
Postcard


Sand Point, 1955
Courtesy United States Navy


African American sailors report for duty at Naval Air Station Sand Point, 1944
Photo by U.S. Navy, Courtesy National Archives

World events once again overtook the station when the Korean War erupted in June 1950. Closure plans were first held "in abeyance" then canceled as the base went to a six-day work week overhauling and modifying aircraft, training reservists, supporting operations at Whidbey Island, and supplying the fleet. That conflict ended in 1953 and so did the station's responsibility for overhauling aircraft. The number of civilian employees dropped from 1800 to 200.

The facility returned to its original role as a Naval Reserve training base. Sand Point reservists were recalled to active duty for the Berlin and Cuban Missile Crises in 1961. In the 1960s, the station and its tenant units won many awards for efficiency, safety, and readiness.

The development of the combat-ready naval air station on Whidbey Island made Sand Point superfluous as an air base, however. The end as a naval air station came in 1970, when flight operations ceased. By that time, the base hosted elements of the U.S. Fish and Wildlife Service, the Civil Air Patrol, the U.S. Postal Service, the U.S. Public Health Service and, once again, the U.S. Army. Sand Point changed to the Naval Station Seattle.

The boosters who worked so hard to build a naval air station may have sowed the seeds for the facility's demise by placing it so close to Seattle. The city continued to extend its boundaries beyond what were once farms accessible only by rail and muddy ruts. As early as 1936, citizens demanded that the Navy deploy a fleet of patrol boats on Lake Washington to prevent collisions between boaters and amphibious aircraft. Just before World War II, citizens obtained a prohibition against aircraft carrying bombs off Sand Point runways, and this meant that Sand Point could not directly support combat operations.

The Jive Bombers band, Sand Point Naval Air Station, May 2, 1944
Photo by U.S. Navy, Courtesy National Archives (Image No. 80-G-233282)

Barracks, Sand Point Naval Air Station, Seattle, 1950s
Postcard

Sources:
Naval Station Puget Sound at Sand Point, (Seattle: U.S. Navy, 1993).
Note: This essay was corrected on September 25, 2014.

By David Wilma, April 03, 2000

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Location: 7215 SANDPOINT WY NE, Seattle 98115
Resp. Unit: NORTHWEST
Lat / Long: 47.682 -122.264
Facility-Site ID: 69852392
UST Site ID: 8668

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
NOL	Removed	11/1/1972		1	B Unleaded Gasoline
PREMIUN UNLE	Operational	6/25/1995	10,000 to 19,999 Gallons	1	B Unleaded Gasoline
REG	Removed	11/1/1972		1	A Leaded Gasoline
SNL	Removed	6/1/1978		1	B Unleaded Gasoline
UNLEADED	Temporarily Closed	6/25/1995	10,000 to 19,999 Gallons	1	B Unleaded Gasoline

Site Name: BUDGET RENT A CAR SYSTEM, INC.
Alternate Name(s): BUDGET RENT A CAR OF WA & OR, BUDGET RENT A CAR ROOSEVELT, BUDGET RENT A CAR SYSTEM, BUDGET RENT A CAR SYSTEM, INC., BUDGET RENT-A-CAR

Location: 6000 ROOSEVELT WAY NE, Seattle 98115
Resp. Unit: NORTHWEST
Lat / Long: 47.672 -122.319
Facility-Site ID: 43331481
UST Site ID: 9892

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
1	Operational	1/1/1975	5,000 to 9,999 Gallons	1	B Unleaded Gasoline
2	Operational	1/1/1975	5,000 to 9,999 Gallons	1	B Unleaded Gasoline

Site Name: CENTURYLINK QC
Alternate Name(s): CENTURYLINK QC, LAKEVIEW CO 070303, US WEST - LAKEVIEW CO 070303, US WEST COMMUNICATIONS W00303, USWCOM Seattle Lakeview Co

Location: 1208 NE 64TH ST RM 415, Seattle 981156722
Resp. Unit: NORTHWEST
Lat / Long: 47.675 -122.317
Facility-Site ID: 46969632
UST Site ID: 10003

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
1-POWER	Removed	12/31/1964	2,001 to 4,999 Gallons	1	M Bunker C
2-POWER	Closed in Place	1/1/1955	5,000 to 9,999 Gallons	1	D Diesel
3-POWER	Closed in Place	1/1/1975		1	D Diesel
98-POWER	Operational	9/23/1998	2,001 to 4,999 Gallons	1	D Diesel

Site Name: GUS COOPER SERVICES
Alternate Name(s): GUS COOPER SERVICES

Location: 7501 ROOSEVELT WAY NE, Seattle 981154220
Resp. Unit: NORTHWEST
Lat / Long: 47.683 -122.319
Facility-Site ID: 89659242
UST Site ID: 3331

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
1	Removed	1/1/1985	111 TO 1,100 Gallons	1	G Used Oil/Waste Oil
2	Removed	12/31/1964		1	B Unleaded Gasoline
3	Removed	12/31/1964		1	B Unleaded Gasoline

*Active Facilities have at least one tank with status of "Operational", "Deferred", "Temporarily Closed", or "Red Tag".

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
4	Removed	12/31/1964		1	B Unleaded Gasoline
5	Removed	12/31/1964		1	A Leaded Gasoline
6	Operational	6/28/1989	10,000 to 19,999 Gallons	1	B Unleaded Gasoline
7 SUPUN	Operational	6/28/1989	10,000 to 19,999 Gallons	1	B Unleaded Gasoline
8 REG	Operational	6/28/1989	10,000 to 19,999 Gallons	1	A Leaded Gasoline

Site Name: RICK'S CHEVRON GROCERY **Alternate Name(s):** RICK'S CHEVRON, RICK'S CHEVRON GROCERY, RICKS CHEVRON, RICKS CHEVRON GROCERY

Location: 8506 5TH AVE NE, Seattle 98115 **Resp. Unit:** NORTHWEST **Lat / Long:** 47.691 -122.323 **Facility-Site ID:** 41179492 **UST Site ID:** 27

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
1	Removed	7/15/1967	2,001 to 4,999 Gallons	1	B Unleaded Gasoline
2	Removed	7/15/1967	2,001 to 4,999 Gallons	1	B Unleaded Gasoline
3	Removed	7/15/1977	5,000 to 9,999 Gallons	1	A Leaded Gasoline
4	Operational	4/15/1996	10,000 to 19,999 Gallons	1	B Unleaded Gasoline
5	Operational	4/15/1996	5,000 to 9,999 Gallons	1	B Unleaded Gasoline
6	Operational	4/15/1996	5,000 to 9,999 Gallons	1	B Unleaded Gasoline

Site Name: SALMONS SERVICE CENTER **Alternate Name(s):** SALMONS SERVICE CENTER, Salmons Service Centers, SALMONS SERVICE CENTERS INC 2

Location: 2424 NE 65TH ST, Seattle 981157051 **Resp. Unit:** NORTHWEST **Lat / Long:** 47.675 -122.301 **Facility-Site ID:** 36528565 **UST Site ID:** 97259

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
1	Operational	3/1/1974	5,000 to 9,999 Gallons	1	B Unleaded Gasoline
2	Operational	3/1/1974	10,000 to 19,999 Gallons	1	B Unleaded Gasoline
3	Removed	12/31/1964		1	B Unleaded Gasoline
4	Removed	12/31/1964		1	B Unleaded Gasoline
THREE	Operational	7/1/1988	5,000 to 9,999 Gallons	1	B Unleaded Gasoline

Site Name: SAND POINT COUNTRY CLUB **Alternate Name(s):** SAND POINT COUNTRY CLUB

Location: 8333 55TH AVE NE, Seattle 98115 **Resp. Unit:** NORTHWEST **Lat / Long:** 47.689 -122.269 **Facility-Site ID:** 17599159 **UST Site ID:** 3926

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
#1	Removed	12/31/1964		1	A Leaded Gasoline
A	Operational	1/1/1991		1	D Diesel
B	Operational	1/1/1991		1	B Unleaded Gasoline

Site Name: SPE PROPERTIES LLC
Alternate Name(s): SHELL # 23774, SHELL 12100, SHELL 2501 75TH, SEATTLE, Shell Station121000, SPE Properties 10, LLC, SPE PROPERTIES LLC, TEXACO STATION 5877

Location: 2501 NE 75TH, Seattle 981154675
Resp. Unit: NORTHWEST
Lat / Long: 47.683 -122.302
Facility-Site ID: 66383785
UST Site ID: 3318

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
1	Removed	1/1/1991	111 TO 1,100 Gallons	1	G Used Oil/Waste Oil
10	Removed	2/28/1992	111 TO 1,100 Gallons	1	G Used Oil/Waste Oil
2	Removed	1/1/1991		1	B Unleaded Gasoline
3	Removed	1/1/1991		1	B Unleaded Gasoline
4	Removed	1/1/1991		1	B Unleaded Gasoline
5	Removed	1/1/1991		1	A Leaded Gasoline
6	Operational	3/1/1992	10,000 to 19,999 Gallons	1	B Unleaded Gasoline
7	Operational	3/1/1992	10,000 to 19,999 Gallons	1	B Unleaded Gasoline
8	Operational	3/1/1992	10,000 to 19,999 Gallons	1	A Leaded Gasoline
9	Operational	3/1/1992	10,000 to 19,999 Gallons	1	B Unleaded Gasoline

Location: 812 NE 65TH ST, Seattle 981155540
Resp. Unit: NORTHWEST
Lat / Long: 47.675 -122.320
Facility-Site ID: 29211653
UST Site ID: 4444

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
1 10000	Operational	1/1/1983	10,000 to 19,999 Gallons	1	B Unleaded Gasoline
2 10000	Operational	1/1/1983	10,000 to 19,999 Gallons	1	B Unleaded Gasoline
3 10000	Operational	1/10/1983	10,000 to 19,999 Gallons	1	B Unleaded Gasoline
4 10000	Operational	1/10/1983	10,000 to 19,999 Gallons	1	D Diesel

Site Name: WATERS SPIRIT
Alternate Name(s): BILL WATERS TEXACO SERVICE, TEXACO WATER'S, WATERS SPIRIT

Location: 9500 35TH AVE NE, Seattle 981152504
Resp. Unit: NORTHWEST
Lat / Long: 47.697 -122.292
Facility-Site ID: 26232719
UST Site ID: 6956

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
1	Removed	10/1/1974	5,000 to 9,999 Gallons	1	B Unleaded Gasoline
2	Removed	10/1/1974	5,000 to 9,999 Gallons	1	B Unleaded Gasoline
3	Removed	10/1/1974	2,001 to 4,999 Gallons	1	B Unleaded Gasoline
4	Removed	10/1/1974	2,001 to 4,999 Gallons	1	A Leaded Gasoline
5	Removed	10/1/1974	111 TO 1,100 Gallons	1	G Used Oil/Waste Oil
6	Operational	9/11/1995	10,000 to 19,999 Gallons	1	B Unleaded Gasoline
6	Operational	9/11/1995	10,000 to 19,999 Gallons	1	B Unleaded Gasoline
7	Operational	9/11/1995	5,000 to 9,999 Gallons	1	B Unleaded Gasoline

*Active Facilities have at least one tank with status of "Operational", "Deferred", "Temporarily Closed", or "Red Tag".

7	Operational	9/11/1995	5,000 to 9,999 Gallons	1	B Unleaded Gasoline

Site Name: **WEDGEWOOD CHEVRON** **Alternate Name(s):** CHEVRON NO 9 7258, CHEVRON USA 97258, WEDGEWOOD CHEVRON

Location: 7300 35TH AVE NE, Seattle 98115 | **Resp. Unit:** NORTHWEST | **Lat / Long:** 47.681 -122.290 | **Facility-Site ID:** 92733183 | **UST Site ID:** 5231

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
1	Removed	1/1/1983		1	A Leaded Gasoline
2	Removed	1/1/1983		1	B Unleaded Gasoline
3	Removed	1/1/1983		1	B Unleaded Gasoline
4	Removed	12/31/1964		1	
5	Removed	1/1/1983	111 TO 1,100 Gallons	1	G Used Oil/Waste Oil
6	Removed	1/1/1900		1	
L665318	Operational	11/6/1995	10,000 to 19,999 Gallons	1	B Unleaded Gasoline
L665319	Operational	11/6/1995	10,000 to 19,999 Gallons	1	B Unleaded Gasoline
L665320	Operational	11/6/1995	10,000 to 19,999 Gallons	1	B Unleaded Gasoline

Site Name: **WTD - BELVOIR PUMP STATION** **Alternate Name(s):** WTD - BELVOIR PUMP STATION, WTD BELVOIR PUMP STATION

Location: 3901 NE SURBER DR, Seattle 98115 | **Resp. Unit:** NORTHWEST | **Lat / Long:** 47.657 -122.287 | **Facility-Site ID:** 4665390 | **UST Site ID:** 619162

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
1	Operational	8/1/2004		1	D Diesel

Site Name: **WTD - MATTHEWS BEACH PUMP STATION** **Alternate Name(s):** MATTHEWS BEACH PUMP STATION, WTD - MATTHEWS BEACH PUMP STATION, WTD MATTHEWS BEACH PUMP STATION

Location: 9310 SANDPOINT WAY NE, Seattle 98115 | **Resp. Unit:** NORTHWEST | **Lat / Long:** 47.696 -122.278 | **Facility-Site ID:** 98641998 | **UST Site ID:** 10083

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
1	Operational	8/22/2005	2,001 to 4,999 Gallons	1	D Diesel
MATTBPS-1	Removed	1/1/1967	111 TO 1,100 Gallons	1	
MATTBPS-2	Removed	1/1/1967	111 TO 1,100 Gallons	1	G Used Oil/Waste Oil
MATTBPS-3	Change in Service	1/1/1967		1	

RegulatedUSTs2014_ActiveFacilities

*Active Facilities have at least one tank with status of "Operational", "Deferred", "Temporarily Closed", or "Red Tag".

G.7.2 Regulated USTs - Inactive Facilities

4	Removed	12/31/1964		1	B Unleaded Gasoline

Site Name: THOMPSON PROPERTIES INC
Alternate Name(s): THOMPSON PROPERTIES INC
Location: 9709 3RD AVE NE STE 114, Seattle 981159999
Resp. Unit: NORTHWEST
Lat / Long: 47.700 -122.327
Facility-Site ID: 77164518
UST Site ID: 102029

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
1	Removed	12/31/1964	111 TO 1,100 Gallons	1	A Leaded Gasoline
2	Removed	12/31/1964	111 TO 1,100 Gallons	1	A Leaded Gasoline
3	Removed	12/31/1964	111 TO 1,100 Gallons	1	B Unleaded Gasoline

Site Name: UNOCAL 3921
Alternate Name(s): 3921, UNOCAL 3921, Unocal SS 3921, UNOCAL STATION 3921
Location: 9418 - 35TH NE, Seattle 981153623
Resp. Unit: NORTHWEST
Lat / Long: 47.697 -122.292
Facility-Site ID: 46936387
UST Site ID: 8449

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
1	Removed	12/31/1964		1	B Unleaded Gasoline
2	Removed	12/31/1964		1	A Leaded Gasoline
4	Removed	12/31/1964	111 TO 1,100 Gallons	1	G Used Oil/Waste Oil
TK 1	Removed	12/31/1964		1	B Unleaded Gasoline
TK 2	Removed	12/31/1964		1	B Unleaded Gasoline
TK 4	Removed	12/31/1964	111 TO 1,100 Gallons	1	G Used Oil/Waste Oil

Site Name: UPENIEKS SHELL SERVICE INC
Alternate Name(s): UPENIEKS SHELL SERVICE INC, Upenieks Tire Dist Inc
Location: 9801 LAKECITY WAY NE, Seattle 981152348
Resp. Unit: NORTHWEST
Lat / Long: 47.700 -122.303
Facility-Site ID: 93846279
UST Site ID: 1033

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
1	Removed	12/31/1964		1	B Unleaded Gasoline
2	Removed	12/31/1964		1	A Leaded Gasoline
3	Removed	12/31/1964		1	B Unleaded Gasoline
4	Removed	12/31/1964	111 TO 1,100 Gallons	1	G Used Oil/Waste Oil

Site Name: US DEPT OF COMMERCE NOAA WASC AFSD
Alternate Name(s): NOAA WESTERN REG CTR, US DEPT OF COMMERCE - NOAA, US DEPT OF COMMERCE NOAA WASC AFSD, US DOC NOAA WASC AFSD, US DOC NOAA Western Regional Center
Location: 7600 SANDPOINT WAY NE, Seattle 981156349
Resp. Unit: NORTHWEST
Lat / Long: 47.684 -122.264
Facility-Site ID: 35337461
UST Site ID: 501

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
1-D	Removed	10/1/1981	2,001 to 4,999 Gallons	1	D Diesel

4-B	Exempt	12/31/1964	111 TO 1,100 Gallons	1	R Unknown
4-D	Removed	10/1/1982	111 TO 1,100 Gallons	1	D Diesel
8-D	Removed	10/1/1982	1,101 to 2,000 Gallons	1	B Unleaded Gasoline
8-GR	Removed	10/1/1982	1,101 to 2,000 Gallons	1	A Leaded Gasoline
8-GU	Removed	10/1/1982	111 TO 1,100 Gallons	1	B Unleaded Gasoline

Site Name: US NAVY STATION SEATTLE
Alternate Name(s): NAVAL STATION SANDPOINT CLOSURE, NAVAL STATION SEATTLE PIER 91 QTRS B, US NAVAL STATION SEATTLE, US NAVY Seattle Naval Station, US NAVY STATION SEATTLE, USN Supervisor of Shipbuild
Location: 7500 SAND POINT WY NE, Seattle 981155007
Resp. Unit: NORTHWEST
Lat / Long: 47.683 -122.263
Facility-Site ID: 32189519
UST Site ID: 6280

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
143	Closed in Place	12/31/1964		1	
144	Closed in Place	12/31/1964		1	B Unleaded Gasoline
145	Closed in Place	12/31/1964		1	B Unleaded Gasoline
166	Closed in Place	12/31/1964		1	
167	Closed in Place	12/31/1964		1	
168	Closed in Place	12/31/1964		1	
169	Closed in Place	12/31/1964		1	
206	Removed	12/31/1964	111 TO 1,100 Gallons	1	I Hazardous Substance
29	Removed	1/1/1974	111 TO 1,100 Gallons	1	D Diesel
310-A	Removed	12/31/1964	111 TO 1,100 Gallons	1	G Used Oil/Waste Oil
340-A	Removed	12/31/1964		1	A Leaded Gasoline
340-B	Removed	12/31/1964		1	B Unleaded Gasoline
340-C	Removed	12/31/1964		1	B Unleaded Gasoline
345	Removed	1/1/1975	111 TO 1,100 Gallons	1	G Used Oil/Waste Oil
403	Removed	1/1/1970	111 TO 1,100 Gallons	1	D Diesel
406	Removed	6/20/1988	111 TO 1,100 Gallons	1	D Diesel

Site Name: VIACOM CABLEVISION
Alternate Name(s): COMCAST CABLE COMMUNICATIONS SEA ROOSEVE, TCI CABLEVISION OF WA INC, VIACOM CABLEVISION
Location: 8914 ROOSEVELT WAY NE, Seattle 981153043
Resp. Unit: NORTHWEST
Lat / Long: 47.693 -122.319
Facility-Site ID: 87766643
UST Site ID: 2567

Tank Name	Tank Status	Install Date	Capacity Range	Compartment #	Substance Stored
1	Removed	10/20/1974		1	B Unleaded Gasoline

Site Name: VITAMILK DAIRY SEATTLE
Alternate Name(s): TANKER ALLEY, TANKER ALLEY VITAMILK DAIRY, Vitamilk Dairy - Tanker Alley, VITAMILK DAIRY SEATTLE
Location: 437 NE 71ST
Resp. Unit: NORTHWEST
Facility-Site ID: 65618338

G.7.3 Leaking Underground Storage Tanks List - NOAA

King County

City of SEATTLE

Cleanup Site:	**US DEPT OF COMMERCE - NOAA**	**Cleanup Site ID:**	8834	**Latitude:**	47.684
	7600 SAND POINT WAY NE	**Facility ID:**	35337461	**Longitude:**	-122.264
	SEATTLE 98115				View Vicinity Map
Unit:	US DEPT OF COMMERCE - NOAA	**Unit Type:** Upland	**Process Type:** Independent Action		* cuID: 8526
Release:		* Historic Release ID:	430501	UST ID: 501	LUST ID: 4684

Detail:

Release Status	Date
LUST - Cleanup Started	5/7/1997
LUST - RCU	5/19/1997
LUST - Cleanup Started	7/1/2011

Media Affected	Contaminant Type	Status
Groundwater	Benzene	C
Groundwater	Petroleum-Gasoline	C
Groundwater	Petroleum-Other	C
Soil	Benzene	RB
Soil	Petroleum-Diesel	RB
Soil	Petroleum-Gasoline	RB
Soil	Petroleum-Other	RB

About the Leaking Underground Storage Tanks Site List:

The Cleanup Status assigned by the Department of Ecology to a Leaking Underground Tank Site is based on an informal review of the information we have received regarding the cleanup. A formal review could determine that the site has not been cleaned up to Model Toxics Control Act standards. Formal reviews including potential No Further Action determinations are available under the fee-based Voluntary Cleanup Program.

LUST = Leaking Underground Storage Tank
UST = Underground Storage Tank

Cleanup Status Definitions:

Awaiting Cleanup -- Discovered or reported release, yet no active cleanup measures taken; or,
Site check (identified the source) begun or completed, yet no active cleanup measures taken; or,
Site characterization begun or completed, yet no active cleanup measures taken.

Cleanup Started -- Responsible party has initiated physical, biological, or chemical management of release (e.g. soil excavated, groundwater pumped, vapors extracted, free product removed, oxygen added, etc.). Site investigations and emergency responses (e.g. venting explosive vapors, providing bottled water) do not qualify as activities under Cleanup Started.

Monitoring -- Groundwater monitoring is the only activity occurring at the site; or, Site has been characterized, only low levels of soil and/or groundwater contamination remain, and natural attenuation is the chosen cleanup method; or,
Confirmational monitoring following active cleanup measures.

No Further Action (NFA) -- Cleanup report has been formally reviewed by Ecology under the fee-based Voluntary Cleanup Program and resulted in a No Further Action status; and, Institutional controls may have been required due to soil contamination that may remain under existing structures or in otherwise inaccessible areas.

No Further Action (NFA) Determination II / SHA -- No further action based on an Initial Investigation (II) or Site Hazard Assessment (SHA).

Notification -- Used to track when Ecology is notified of a new LUST release. WAC 173-340-450 (2)(a) requires UST owners / operators to report confirmed releases to Ecology within 24 hours.

Reported Cleaned Up (Historic Data Only) -- Owner or consultant reports that contamination has been cleaned up; and/or.
Some soil contamination may remain under existing structures or in otherwise inaccessible areas if groundwater is not threatened and there has been no migration of contamination into the structure; and,
Cleanup report has not been formally reviewed by Ecology. A formal review could determine that the site has not been cleaned up to MTCA standards.

Contaminant Type Key:

B - Below Cleanup Level
C - Confirmed Above Cleanup Level
S - Suspected
R - Remediated; RA - Remediated-Above; RB - Remediated-Below

LustList2014

G.7.4 Leaking Underground Storage Tanks List - Naval Station Sandpoint

King County

City of SEATTLE

Cleanup Site:	**NAVAL STATION SANDPOINT CLOSURE**	**Cleanup Site ID:**	8699	**Latitude:**	47.683
	7500 SAND POINT WAY NE	**Facility ID:**	32189519	**Longitude:**	-122.263
	SEATTLE 98115-5007				View Vicinity Map
Unit:	NAVAL STATION SANDPOINT CLOSURE	**Unit Type:** Upland	**Process Type:** Independent Action		* cuID: 8391
Release:		* Historic Release ID:	5066	UST ID: 6280	LUST ID: 3300

Detail:

Release Status	Date
LUST - Cleanup Started	6/1/1995

Media Affected	Contaminant Type	Status
Soil	Petroleum-Other	RB

G.7.5 No Further Action Site List - Naval Station Seattle, Pier 91

Detail Data:	Record Type	Date	Basis			
	NFA	10/3/2011	NFA-Initial Investigation			
Metro Self Storage	NE 89TH ST & 23RD AVE NE SEATTLE	98115		☐	4405	2009438
Detail Data:	Record Type	Date	Basis			
	NFA	7/9/2007	NFA-Site Hazard Assessment			
MITCHELL ESTATE	7307 56TH AVE NE SEATTLE	98115-6224		☑	3126	4284973
Detail Data:	Record Type	Date	Basis			
	NFA	4/9/2003	NFA-Voluntary Cleanup Program Review			
ML GRAHAM CO	9011 LAKE CITY WAY NE SEATTLE	98115-3297		☑	6109	45339634
Detail Data:	Record Type	Date	Basis			
	NFA	11/10/2004	NFA-Voluntary Cleanup Program Review			
MOSBACHER AG PROPERTY	7001 35TH AVE NE SEATTLE	98115		☐	4241	1704
Detail Data:	Record Type	Date	Basis			
	NFA	2/12/1996	NFA-Independent Remedial Action Program Review			
MOSBAUER AMER GEN 14365	7001 35TH AVE NE SEATTLE	98115		☐	8693	31946666
Detail Data:	Record Type	Date	Basis			
	NFA	2/12/1996	Historic LUST NFA			
Murphys Auto Service	7301 5TH AVE NE SEATTLE	98115-5327		☑	5840	29844248
Detail Data:	Record Type	Date	Basis			
	NFA	11/14/2001	NFA-Voluntary Cleanup Program Review			
NAVAL STATION SEATTLE PIER 91 QTRS B	7500 SAND POINT WAY NE SEATTLE	98115-5007		☐	8700	32189519
Detail Data:	Record Type	Date	Basis			
	NFA	10/3/2011	NFA-Initial Investigation			
NORDBY RESIDENCE FORMER	1503 NE 75TH ST SEATTLE	98115		☑	937	3479759

G.7.6 No Further Action Site List - Navy Station Sand Point

Detail Data:	**Record Type**	**Date**	**Basis**			
	NFA	9/11/2001	NFA-Voluntary Cleanup Program Review			
US Navy Station Sand Point	7700 SAND POINT WAY NE			☐	1359	2214
	SEATTLE		98115			
Detail Data:	**Record Type**	**Date**	**Basis**			
	NFA	4/26/1996	Cleanup Completed, not on HSL			
Warren Westlund Buick 1st Ave	9600 1ST AVE NE			☑	6633	75815391
	SEATTLE		98115			
Detail Data:	**Record Type**	**Date**	**Basis**			
	NFA	10/3/2011	NFA-Initial Investigation			
	NFA	4/24/2001	NFA-Voluntary Cleanup Program Review			
WAUGH TUDOR RESIDENCE	2103 70TH ST NE			☐	1702	38991888
	SEATTLE		98115			
Detail Data:	**Record Type**	**Date**	**Basis**			
	NFA	11/6/1997	NFA-Independent Remedial Action Program Review			
WESCO AUTO BODY SUPPLY	9428 LAKE CITY WAY NE			☐	9892	61625589
	SEATTLE		98115-3269			
Detail Data:	**Record Type**	**Date**	**Basis**			
	NFA	10/3/2011	NFA-Initial Investigation			
WESTERN PROPERTIES	5200 ROOSEVELT WAY NE			☑	6164	48726939
	SEATTLE		98115			
Detail Data:	**Record Type**	**Date**	**Basis**			
	NFA	6/14/2004	NFA-Voluntary Cleanup Program Review			
WHINIHAN PROPERTY	9050 SANDPOINT WAY NE			☑	4672	61598227
	SEATTLE		98115			
Detail Data:	**Record Type**	**Date**	**Basis**			
	NFA	10/4/2000	NFA-Voluntary Cleanup Program Review			

G.8 Norden Bombsight Information

REPAIR & MAINTENANCE PROCEDURES

When sights came in from Bomber Command for repair, the procedure was to visually inspect the exterior. Damage was assessed to determine if they warranted further inspection. If exterior damage was so great and could not easily put in order, the sight was shelved for possible use for parts.
The sight would now be tested for accuracy by putting it on a calibration stand. The stand was very heavy and was made of cast iron. The base was flat and had a vertical column about three inches + in diameter. The column had a flat surface on top of it on which the sight was mounted. The height was such that a technician could lean over slightly to put his eye on the padded eye piece,

CALIBRATION

The sighting telescope indices would be set at zero and a look down the telescope at the calibration stand base would tell us where a small mirror (about two inches in diameter) should be placed. The mirror had three adjustable legs. Using them and a tiny, high bubble resolution level, the mirror was made to be level in all 360 degrees
This was a difficult procedure and was hard to maintain due to vibrations from heavy trucks and planes taking off and landing nearby. But a miracle took place, someone, I don't think from our shop, had a brilliant idea. A small deep saucer type dish had several pounds of mercury put into it and it became an ever level mirror. Give that man a medal.

When a telescope sighting was taken, the bottom of the telescope was seen inside a series of several small circles. The image of the bottom of the telescope and the circles had to be concentric. If they were not, the telescope had to be manually adjusted until they were. The indices was set on zero and now the real work began.

As a natural law the vertical axis of a gyroscope preceses in an orderly North-East direction. As the sighting telescope with its cross hairs is connected to the gyroscope, the precession has to be within acceptable limits. The power to the gyro is turned on and a cross hair sighting is taken with the cross hairs centered on a grid located on the base of the precession stand. Two minute readings ,using a stop watch are taken and the N-S precession of he cross hairs must be within acceptable limits. If they are not an adjustment to the gyro rotor must be made.

This was generally done by adding weight to appropriate spots on the rotor, sometimes just the marking of a soft lead pencil would be sufficient, if not paper thin washers were applied. When the result of this procedure was deemed correct, sometimes a second pair of eyes checked for absolute accuracy. This calibration insured that the cross hairs would stay on target despite the movements of the plane while on the bombing run of about forty five seconds. A spring powered hand operated device attached to the sight assured that the cross hairs stayed on target at all times during the bombing run. The coiled spring on this device sometimes had to be re bent, we had special pliers with bent jaws.
My nomenclature has not been good during this explanation, please excuse my dimmed memory.
The gyroscope rotor was heavy and cup shaped. Inside the cup area was a tiny elec. motor which supplied the power to spin it. The power to the motor was supplied by two very thin wires, we called them pig tails. When all checks and tests were made and found to be correct, the bombsight was now operational. The log book was signed and it was put in storage.

After the invasion on D-Day and an air field in Cambrai, France was secured, our service was deployed from Stanstead England to Cambrai. There was a civilian technician from the Norden Co. that could be consulted if it was necessary.

Now, I shall relate some incidents that happened along the way.
When in Lowry Field, Colo. we were called mess kit repairmen.

In Europe the elect current was 220 volts, this meant we had to use a rectifier to get the 12 or 24 volts needed for our repair work. In England, we had a fairly large apparatus with a glass (ten gallon size) container which glowed violet when turned on. This was lost in transit when we shipped to France. We absolutely had to have a rectifier. There was a British base close by and after going there and telling them our tale of woe, a generous supply Sgt. loaned us one. Now get this-- it was about the size of a DVD player and weighted about four pounds and we could dial any voltage we desired. When ours finally turned up a hoist was required to put it in place.

When changing stations, I goofed off to spend a night in London; this was the first night that the buzz bombs came in. Guess who left London the next morning.
Because the shop had to be warm in order to calibrate to calibrate the sights (metal expansion) Bomber Command always made sure that we had coal to use.

The war is over, a helluva experience but one not to repeat.
After a relatively short length of time, I lost contact with my bombsight buddies. The bonds between repairmen are not like the bonds

between soldiers who experienced combat together

 This is the calibration stand that Mr. Hurry was talking about. Just click on the image for a larger picture. If you know where I can find a calibration stand for our museum please let me know at taigh@twinbeech.com.

Click here to read an account of the training and combat experiences of one of our countries greatest generation heroes: Bentley Weitzman, Bombardier, 5th Air Force, 380th Bomb Group, 530th Bomb Squadron

G.9 BRAC Environmental Baseline Survey Environmntal Risk Classifications

Table ES-1
Environmental Risk Classifications

Classification (Based on the information/documentation available at the time of the survey)	Classification Number	Buildings/Areas
Areas where no storage, release, or disposal of hazardous substances or petroleum products has occurred (including no migration of these substances from adjacent areas).	1	Bldgs. 44, 204, 222, 224, 344
Areas where only storage of hazardous substances or petroleum products has occurred (but no release, disposal, or migration from adjacent areas has occurred).	2	Bldgs. 2, 5, 6, 9, 11, 12, 15, 18, 25, 27, 29, 30, 38/138, 40, 41, 47, 193, 223, 244, 310, 345, 406, 407, and 3 USTs (Nos. 29, 345, 403)
Areas where storage, release, disposal, and/or migration of hazardous substances or petroleum products has occurred, but at concentrations that do not require a removal or a remedial action.	3	Bldgs. 67, former Bldg. 137, stormwater outfall area, 100,000-gallon UST, avgas line under tarmac east of Bldg. 11, and former plating shop area of Building 2.
Areas where storage, release, disposal, and/or migration of hazardous substances or petroleum products has occurred, and all remedial actions necessary to protect human health and the environment have been taken (including use of deed restrictions).	4	Bldg. 98, Auto Hobby Shop (Bldg. 310), pesticide residue tank (Tank 206), former equipment shed (Bldg. 206), former avgas/mogas tank farm and sewage treatment facilities, Tanks 12A, 12B, 12C, 12D, 2, 310A, 340A, 340B, and 340C, and brig UST (No. 406). Tanks 166, 167, 168, 169, 143, 144, and 145
Areas where storage, release, disposal, and/or migration of hazardous substances or petroleum products has occurred, removal and/or remedial actions are under way, but all required remedial actions have not yet been taken.	5	None
Areas where storage, release, disposal, and/or migration of hazardous substances or petroleum products has occurred, but required response actions have not yet been implemented.	6	None

Table ES-1 (Continued)
Environmental Risk Classifications

Classification (Based on the information/documentation available at the time of the survey)	Classification Number	Buildings/Areas
Areas that have not been evaluated.	7	Bldgs. 26N, 26S, 31, 42, 69, 109, 119, 192, 195, 228, 275, 299, 307, 308, 330, 331, 332, 333, 334, 342, 401, 402, 404, 408, 409.

G.10 Navy Low Level Radiation Cleanup

G.10.1 Fact Sheet - Navy: Time Critical Removal Action

FACT SHEET

Time Critical Removal Action Former Naval Station Puget Sound at Sand Point, Seattle, Washington

DEPARTMENT OF ECOLOGY
State of Washington

Project Contacts
If you have any questions or concerns about environmental activities, please feel free to contact any of the project representatives:

Ms. Cindy O'Hare
BRAC Environmental Coordinator
NAVFAC NW
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101
cindy.ohare@navy.mil
(360) 396-0014

Mr. Ching-Pi Wang
Washington State Department of Ecology
3190 160th Avenue SE
Bellevue, WA 98008-5452
(425) 649-7134

Mr. Leo Wainhouse
Washington State Department of Health
111 Israel Rd SE
Tumwater, WA 98501
(360) 236-3213

Regulatory Agencies Concur on Cleanup Plan
The Navy, the Washington State Department of Ecology and the Washington State Department of Health concur on the selected cleanup action presented in the Action Memorandum, which will be available for public comment from May 27-June 27, 2013.

Public Meeting: May 29, 2013, 5 p.m. to 8 p.m.
The City of Seattle will host a U.S. Navy Environmental Restoration Program public meeting on May 29, 2013, to present and explain the time critical removal action for the former Naval Station Puget Sound at Sand Point. Written comments will be accepted at the meeting. The meeting will be held from 5 p.m. to 8 p.m.

Introduction

This Fact Sheet describes actions associated with the time critical removal action (TCRA) for the former Naval Station Puget Sound (NAVSTA PS) at Sand Point in Seattle, Washington (Figure 1). The areas of focus for this TCRA are the central portion of the second floor of Building 2 and limited piping under the first floor; the "South Shed" of Building 27; the catch basins south of Building 27, and soil adjacent to the areas of Buildings 2, 12, and 27. Both the Building 27 South Shed and portions of Building 2 where contamination was identified are currently vacant. The main hangar area of Building 27 is an indoor multi-sport facility, which is operated by Arena Sports and open to the public; Building 2 is mainly vacant, with the exception of the hangar portion that is used for storage by the City of Seattle Parks and Recreation Department, and a north wing which houses offices and workshops for the job training program, Seattle Conservation Corps.

The TCRA is being conducted to address radium-226 (Ra-226), cesium-137 (Cs-137), and/or strontium-90 (Sr-90) contamination found during the 2010 investigation of the Building 27 South Shed, Building 2, and areas outside of Buildings 2, 12, and 27. The TCRA is intended to remove radiological contamination in these areas.

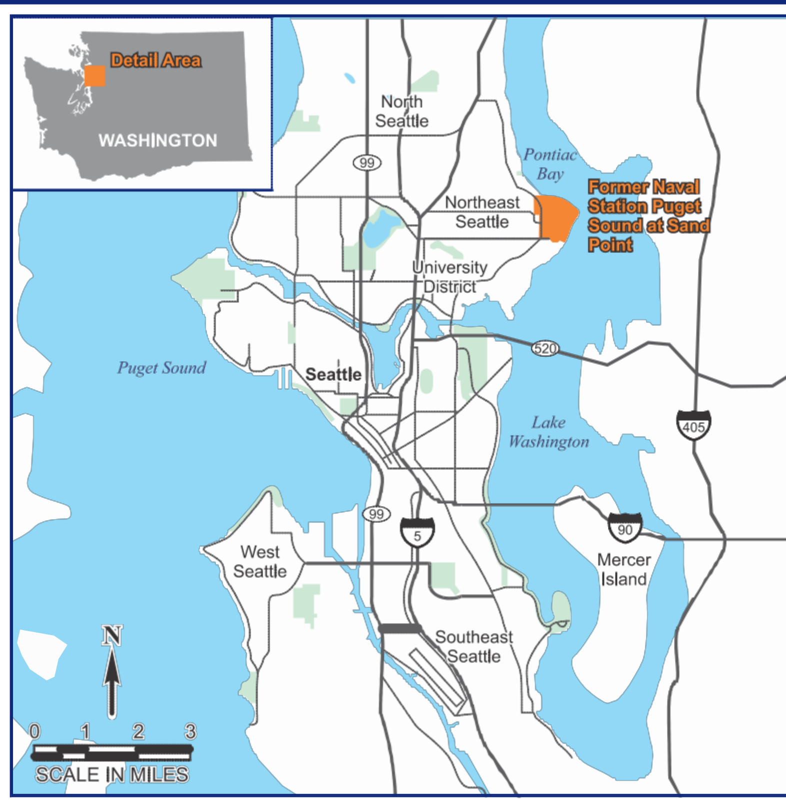

Figure 1: Former Naval Station Puget Sound at Sand Point Location Map

This TCRA is being conducted in accordance with the Department of Navy's Environmental Restoration Program using Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), with the Washington State Department of Ecology as the state regulatory agency. This TCRA will follow the requirements of CERCLA and the National Oil and Hazardous Pollution Contingency Plan (NCP) (40 Code of Federal Regulations [CFR] 300.5). The Navy will address the substantive requirements of the Washington State Model Toxics Control Act (MTCA, Washington Administrative Code 173-340-515). To accomplish cleanup, Department of Navy's environmental restoration team will work with various stakeholders, including state and federal regulators, and local communities. The Navy is conducting the cleanup under CERCLA in accordance with provisions included in the deed of transfer to the City of Seattle.

Figure 2: Photograph of Naval Air Station Seattle in the 1940s

Site History

Former NAVSTA PS was initially named Naval Air Station (NAS) Seattle. Portions of the facility were built in 1925 on land donated by King County. Many of the major buildings were constructed prior to World War II, including Building 2 (1929) and Building 27 (1937). Further building construction and remodeling took place in later years, including an addition of the South Shed to Building 27 in 1944. During World War II, NAS Seattle supported air transport and ship outfitting personnel for the Alaskan and Western Pacific theaters of operation (Figure 2).

Aviation activities officially ceased on June 30, 1970. Between 1970 and 1977, the Navy conveyed considerable portions of the former base that had supported air operations to the National Oceanographic and Atmospheric Administration (NOAA) and the City of Seattle**.** The remainder of the property was retained by the Navy until it was listed for closure under the Base Realignment and Closure Act in 1991, and formally closed in 1995.

The City of Seattle applied to receive additional property for recreational uses through the Department of Interior National Park Service. The Navy ultimately assigned the requested property to the National Park Service and by 2002 the City of Seattle was the owner of these additional lands that comprise the areas of Magnuson Park that are subject to this TCRA.

Radiological History

To support transfer to the National Park Service, the Navy conducted several environmental investigations and cleanup actions on portions of former NAVSTA PS (1988-1995). No radiological contamination was identified.

During planning of proposed renovations of Building 27 in 2009, the City of Seattle reviewed historical drawings and identified rooms labeled "Radium Room" and "Instrument Shop" in the South Shed of Building 27. Following this discovery, the City of Seattle reviewed drawings for Building 2 and identified a space labeled "Instrument Shop". From the late 1930s through the 1960s, airplane maintenance and storage activities included the use of radioluminescent (glow-in-the dark) paint for the maintenance and repair of radioluminescent aircraft dials, gauges, and compasses. Historical Navy records confirm that the former NAVSTA PS received routine shipments of Ra-226, which was used to make the radioluminescent paint. These operations were commonly conducted in aircraft hangars, optical and instrument shops, and radium paint facilities like those identified in Buildings 2 and 27.

The City completed a radiation survey in the Spring of 2009, after which the Navy took immediate action to investigate the extent of radiological contamination in and outside of Buildings 2 and 27. This investigation was conducted in 2010.

Radiological Remedial Investigation Results

The 2010 investigation identified radiological contamination above the project investigation criteria in and around the Instrument Shops in Building 2 and within the Building 27 South Shed. Radiological contamination was also found in piping in Buildings 2 and 27, in catch basins associated with Building 27, and in soil adjacent to these buildings and Building 12 (Figure 3).

TCRA Actions

The TCRA at the former NAVSTA PS will focus on the following tasks.

- Building 27 South Shed: Removal of radiological contamination in the South Shed, conduct radiological tests to ensure all contamination has been removed, and packaging of contaminated materials for disposal as Low-Level Radiological Waste (LLRW). Demolition of residual portions of the South Shed and restoration of the common wall between the hangar and the South Shed.
- Building 2: Removal of radiological contamination, conduct radiological tests to ensure all contamination has been removed, and packaging of contaminated materials for disposal as LLRW.
- Additional testing outside of Buildings 2, 12, and 27 to ensure all radiological contamination has been identified, removal of radiological contamination, conduct tests to ensure all contamination has been removed, and packaging of contamination materials for disposal as LLRW.
- Additional testing of storm and sanitary drain system components, removal and replacement of radiological contaminated storm drain system components associated with Buildings 2 and 27, conduct radiological tests to ensure all contamination has been addressed, and packaging of contaminated materials for disposal as LLRW.
- Transportation and disposal of non-LLRW in a permitted landfill and LLRW in a licensed LLRW waste disposal facility.

Project Schedule

The duration of the TCRA is expected to be less than six months. Field work is anticipated to begin in June 2013 and is expected to be completed by December 2013 with subsequent demolition of the Building 27 South Shed and restoration of the hangar south wall continuing into 2014.

Figure 3: Planned Removal Action Areas, Former Naval Station Puget Sound at Sand Point

INSIDE…

Navy Time Critical Removal Action Former Naval Station Puget Sound at Sand Point, Seattle, Washington

For More Information

The Action Memorandum and other relevant documents are available at the Navy and Washington Department of Ecology Web sites located at:

http://goo.gl/lSMVJ2

https://fortress.wa.gov/ecy/gsp/Sitepage.aspx?csid=1359

Documents can also be viewed in the Northeast Branch of the Seattle Public Library at 6801 35th Ave N.E,, in Seattle.

Ms. Cindy O'Hare
BRAC Environmental Coordinator
NAVFAC NW
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

The Navy encourages the public to comment on the proposed TCRA at the former NAVSTA PS at Sand Point described in this Fact Sheet. Written comments on the Action Memorandum may be submitted using the comment form below. The comment period is from May 27 through June 27, 2013. If additional space is needed, comments may be written neatly on plain white paper. The Navy also welcomes written comments submitted directly to our office.

The Action Memorandum and other relevant documents are available at the Navy and Washington Department of Ecology Web sites located at:

http://goo.gl/t4JKw

https://fortress.wa.gov/ecy/gsp/Sitepage.aspx?csid=1359

The Action Memorandum, which will be included in the administrative record for this site, is available at the following address:

Ms. Cindy O'Hare
BRAC Environmental Coordinator
NAVFAC NW
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101
cindy.ohare@navy.mil
(360) 396-0014

Documents can also be viewed in the Northeast Branch of the Seattle Public Library at 6801 35th Ave N.E, in Seattle.

Name: ____

Address: ____

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Telephone: __________________ **E-mail:** __________________________

Comments: ____

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G.10.2 Fact Sheet - Department of Ecology

DEPARTMENT OF ECOLOGY State of Washington http://www.ecy.wa.gov

Ecology home > Toxics Cleanup > Sites > US Navy Station Sand Point

US Navy Station Sand Point

Final reconstruction of the south wall of Arena Sports after south shed (annex) removed.

WHAT'S NEW AT THE US NAVY STATION SAND POINT?

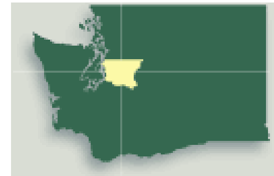
Contractors for the U.S. Navy have completed the cleanup of low-level radiation in contaminated building materials at Warren G. Magnusson Park (former US Naval Air station at Sand Point.) The Navy repainted aircraft cockpit dials with glow-in-the-dark radium paint in the 1940/s and 1950's. The Navy owned and operated an air station at what is now Magnuson Park, and was responsible for cleanup of all contamination left from its operations.

The contaminated building materials and soils were removed from the former aircraft hangers, Buildings 2 and 27 (Arena Sports.) The Navy will prepare a report of cleanup and confirmation sampling results. This report is expected August, 2015 and will be posted on this website.

The former aircraft labs were located in parts of Buildings 2 and 27, both former aircraft hangars. Building 2 now houses park maintenance shops and equipment. Building 27 houses Arena Sports, an indoor athletics facility. Repeated Navy and Health Department tests have confirmed that no radiation above background level present in the Arena Sports complex. The former lab at Building 27 was in an annex, referred to as the South Shed, separate from the sports facility. The annex was dismantled March-April, 2015 and contaminated materials were shipped to license facilities for disposal.

Seattle Parks and Recreation has contracted with Thomas Gray and Associates, Inc., a health physics consulting firm to do an independent radiation survey and sampling project in five areas of the park. The areas include: the "Solid Ground" housing area, the off-leash dog park, the children's play area, the amphitheater and "The Pea Patch" community vegetable gardens. For more information contact:

Cleanup work had been under way since June 2013. The Navy conducted the work under federal cleanup laws. Washington's departments of Ecology and Health provided additional oversight.



SITE INFORMATION

Facility Site ID:# 2214

Cleanup Site ID:1359

Location:
Seattle, King County

Status: No Further Action Required ?

View Electronic Documents

Site Summary Report

Contacts:
Ching-pi Wang
Site Manager
(425) 649-7134

Thea Levkovitz
Public Involvement Coordinator
(425) 649-7286

Document Repositories:

Northwest Regional Office
3190 160th Ave SE
Bellevue, 98008-5452
(425)649-7190

Seattle Public Library - Northeast Branch
6801 35th Ave NE
Seattle, 98115
(206)684-7539

Health is the state's radiation safety regulator. See FLIKR for more pictures of South Shed deconstruction.

October 2014 Update Fact Sheet

CONTAMINANTS OF CONCERN

Radium-226, Cesium-137 and Strontium-90

WHERE WERE THE CONTAMINANTS FOUND?

The contamination has been found in building materials, and in piping, catch basins and soil near Buildings 2 and 27.

Map of Sand Point Buildings

WHO IS RESPONSIBLE FOR THE CLEANUP?

Project Roles and Responsibilities

U.S. Navy

The U.S. Navy is responsible for the cleanup of the low-level radiological contamination at Sand Point. In accordance with the Department of Navy's Environmental Restoration Program, the U.S. Navy is required to follow the federal requirements of the:

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or "Superfund".
- Time critical removal action (TCRA), under CERCLA.
- National Oil and Hazardous Pollution Contingency Plan (NCP).

State of Washington

The Washington State Model Toxics Control Act (MTCA) and WAC 246 Radiation Protection are relevant state requirements. The state's role is to provide technical review by conducting:

- Technical review of investigation results and cleanup plans.
- On-site air monitoring
- On-site visual observations of cleanup actions.
- On-site and park-wide pre-cleanup radiation surveys.
- Conduct confirmation sampling and radiation surveys to verify cleanup completion.
- Community outreach, including public meetings.

The state departments of Ecology and Health, and the City of Seattle have worked closely with the U.S. Navy and their contractors to ensure a thorough cleanup of the low-level radiological contamination at Magnuson Park.

PREVIOUS CLEANUP WORK

In 2010 the Navy removed some radiological contaminated piping and cleaned up a catch basin.

SITE BACKGROUND

The former Naval Station Puget Sound at Sand Point (NS Puget Sound) was originally known as Naval Air Station (NAS) Sand Point and then later NAS Seattle. Acquired by the Navy in 1920, from King County, was developed slowly by the Navy as a reserve training command for Navy and Marine Corps aviators.

In 1998 and 2000, the Navy transferred portions of former NS Puget Sound to the Department of Interior for ultimate use by the City of Seattle for recreational purposes. The transfer of property included Buildings 2 and 27. The 1944 base map identified Building 2 as an Aircraft Assembly and Repair Shop and Building 27 as a Seaplane Hangar. Currently the City of Seattle Parks and Recreation Department manages use of the buildings. Building 2 was used as a recreation facility until recently. It is now used by Parks and Recreation Department personnel to store recreational equipment and materials.

The City has leased Building 27 to Arena Sports who has remodeled the main hangar bays of the building into a multi-sport recreation center providing both profit and non-profit recreational services for the local community. During the process of retrofitting the space for Arena Sports, the City recovered as-built drawings indicating the presence of a "Radium Room" in the south shed of Building 27 that is not used by Arena Sports and an "Instrument Shop" on the second floor of Building 2. The City of Seattle conducted screening in 2009 and notified the Navy of the confirmed presence of radiological materials. Upon being notified, the Navy quickly took action to characterize the type and extent of residual radiological materials in both buildings.

The radiological characterization surveys identified areas of radiological contamination in previously mentioned areas in buildings 2 and 27, and associated catch basins, drain lines and outdoor areas immediately outside of the buildings. The primary type of radiological contamination identified is radium-226 (Ra-226) with some small amounts of cesium-137 (Cs-137) and strontium-90 (Sr-90) also identified. Radium-226 was commonly used by military and commercial entities from the early 1930s through the 1970s in radioluminescent (glow-in-the dark) items. These items were used in dials, gauges and markers on ships, aircraft, tanks, and motor vehicles. To keep these items glowing, the Navy established "radium paint shops" or "instrument repair shops" where personnel removed the original radioluminescent paint, then repainted the radioluminescent item. The use of radioluminescent paint was not regulated by a government agency at the time of the former NS Puget Sound; however, there were Navy regulations on health and safety requirements. Today, use of radium is controlled by the Nuclear Regulatory Commission and state radiation health departments.

RELATED INFORMATION

- Radiological Remedial Investigation Report (May 2011)
- US Navy Station Sand Point Website
- Washington State Department of Health - Magnuson Park Cleanup Seattle
- Washington Department of Health - Radiation and Your Health Magnuson Park
- City of Seattle - Magnuson Park Website
- US Naval Station Sand Point Flicker

ADDITIONAL RESOURCES

- Acronyms used by the Toxics Cleanup Program
- Cleanup Process: Major Steps & Definitions
- Data Submittal Requirements for All Cleanup Sites
- Toxics Cleanup publications

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G.11 Department of Ecology No Further Action Letter, May 1996

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Northwest Regional Office, 3190 - 160th Ave S.E. • Bellevue, Washington 98008-5452 • (206) 649-7000

No further Action

May 16, 1996

Mr. Richard K. Stoll
Department of the Navy
Engineering Field Activity, Northwest
Naval Facilities Engineering Command
19917 7th Avenue
Poulsbo, WA 98370-7570

Dear Mr. Stoll:

Thank you for submitting the reports for the Naval Station Puget Sound (NAVSTA PS), Seattle (Sand Point), Fast-Track cleanup and remedial actions for Ecology's review.

The Washington State Department of Ecology's Toxics Cleanup Program has reviewed information regarding the Sand Point facility located at: 7500 Sand Point Way, Seattle, Washington.

Legal description is as follows:

Beginning at the City of Seattle Monument at the northwest corner of Section 11, Township 25 North, Range 4 East, Willamette Meridian; thence S88°30'02"E a distance of 1319.35 feet, along the north line of said section, to the City of Seattle Monument at the intersection of Sand Point Way Northwest and Northeast 65th Street; thence NO°15'43"E a distance of 45.22 feet; to the True Point of Beginning:

(1) Thence, NOO°14'20"E a distance of 2790.10 feet;

(2) Thence, along a curve to the left, with a radial bearing of N89°45'40"W, a radius of 613.36 feet, a delta angle of 27°43'00", and an arc length of 296.71 feet;

(3) Thence, N27°28'40" a distance of 170.84 feet;

(4) Thence, along a curve to the right, with a radial bearing of N62°31'20"E, a radius of 534.50 feet, a delta angle of 14°33'00", and an arc length of 135.73 feet;

ATTACHMENT (4)

Mr. Richard K. Stoll
Sandpoint NPA
May 16, 1996
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(5) Thence, N12°55'40" a distance of 999.42 feet;

(6) Thence along a curve to the left, with a radial bearing of S77°04'20"W, a radius of 2333.83 feet, a delta angle of 16°32'49", and an arc length of 674.01 feet;

(7) Thence, N29°28'29"W a distance of 357.94 feet;

(8) Thence, S88°23'09"E a distance of 25.71 feet;

(9) Thence, S88°23'09"E a distance of 363.85 feet;

(10) Thence, S49°14'29"E a distance of 1077.78 feet;

(11) Thence, S88°34'29"E a distance of 168.28 feet;

(12) Thence, S01°02'22"W a distance of 1699.68 feet;

(13) Thence, S88°53'11"E a distance of 690.52 feet;

(14) Thence, S01°07'01"W a distance of 1693.51 feet;

(15) Thence, S30°51'47"E a distance of 409.04 feet;

(16) Thence, S84°44"35"E a distance of 1076.83 feet;

(17) Thence, S01°02'07"W a distance of 772.81 feet;

(18) Thence, S89°36'59"W a distance of 448.62 feet;

(19) Thence, S63°11'22"W a distance of 205.91 feet;

(20) Thence, S01°01'48"W a distance of 147.06 feet;

(21) Thence, N88°30'32"W a distance of 506.04 feet;

(22) Thence, N00°25'44"E a distance of 279.00 feet;

(23) Thence, N88°43'26"W a distance of 25.00 feet;

(24) Thence, N88°36'49"W a distance of 177.40 feet;

Mr. Richard K. Stoll
Sandpoint NFA
May 16, 1996
Page 3

(25) Thence, S00°18'58"W a distance of 239.40 feet;

(26) Thence, N88°36'49"W a distance of 1112.33 feet:

(27) Thence, N00°20'51"E a distance of 121.31 feet;

(28) Thence, along a non tangent to the left, with a radial bearing of N70°21'05"W, a radius of 356.54, a delta angle of 19°20'50", and an arc length of 119.95 feet;

(29) Thence, N88°36'49"W a distance of 10.00 feet to the True Point of Beginning. Said area contains 151.74 acres; or **(Latitude 47°40'55", Longitude 122°15'24")**

A list of the remedial action reports and the dates they were submitted and a list of the additional documents and information reviewed accompanies this report.

Discussion

The site has been divided into six (6) parcels in order to expedite and speed up cleanup actions. These parcels are delineated on the map (See figure 1). In order to clarify the parcels, each has been given a name. They are:

1. South Base, Commissary and Auto Facilities
2. Residential Area
3. Ball Fields
4. Light Industry
5. North Shore
6. Off-Shore Bay and Sediments (Pontiac Bay)

All six (6) parcels are discussed in this letter. Based on the above referenced documents, Ecology has determined that the release of contaminants into the soil, and surface and ground water at the Sand Point facility no longer poses a threat to human health or the environment. Ecology has requested a Deed Restriction or Restrictive Covenant where there is a potential for release or the contaminated soils could not be removed.

Mr. Richard K. Stoll
Sandpoint NFA
May 16, 1996
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Ecology recommends that when any of the buildings on the site are demolished, soil samples be taken beneath the building to determine if any contamination is present. Monitoring wells will be left in place and available for sampling; removal or closure of a well will be only with Ecology's approval.

Care shall be taken to minimize contact with the sediments in the eastern half of Pontiac Bay. Although there are no known human health hazards present in the sediments, the area is environmentally sensitive and resuspension or disturbance of sediments shall be kept to a minimum.

SOUTH BASE, COMMISSARY AND AUTO FACILITIES -- PARCEL 1.

Property Included

The South Base portion of land is bordered by Magnuson Park on the east, Sand Point Way on the west, University of Washington housing on the south and by Parcels Two (2) and Three (3) on the north. The Magnuson Park Entrance, NE 65th Street, runs through the property.

Investigation, Cleanup Activities and Conclusions

Cleanup activities were conducted on two facilities in this parcel. Contaminated soils associated with the former oil/gas separator were removed adjacent to the Auto Hobby Shop (Building 310), and underground storage tanks adjacent to the Service Bay (Building 345) that contained gasoline and waste oils were removed.

The analytical data presented in the above reports states that the contamination in the adjacent areas was cleaned up but soils with petroleum contamination in evidence under Building 345 were not removed. Location: Beneath the north wall of the building. This is an acceptable action if removal of the soils would be a detriment to the integrity of the building structure. If, in the future, the building is removed from the site, additional sampling shall be conducted to assure that contamination under the building offers no threat to human health or the environment. If there is a threat to the environment or to human health, removal of the contaminated soil must be accomplished at that time.

Specific Required Actions

Soils under the Auto Maintenance Service Bay (Building 345, contamination location: SW corner Lat. 47°40'34.77654", Long. 122°15'26.52025" north to Lat. 47°40'36.20918, Long. 122°15'265283" east to Lat. 47°40'36.21011", Long. 122°15'25.6395" and south to Lat. 47°40'34.7748", Long. 122°15'25.6213") and the Auto Hobby Shop (Building 310, contamination location: SW corner Lat.47°40'33.13097, Long. 122°15'29.770" north to Lat. 47°40'33.27900, Long.

122° 15'29.7709 east to Lat. 47°40'33.27993", Long.122°15'29.6365" and south to Lat. 47° 40'33.11890", Long. 122°15'29.640") shall be sampled when the buildings are demolished. The Auto Hobby shop had traces of metal in sampling at the northwest corner.

When the Commissary (Building 193) is demolished, soil samples must be taken and evaluated. The Commissary was formerly an airplane hangar and materials used in the building could contribute to site contamination. If contamination above MTCA Level B Cleanup Level is found, remediation shall take place to minimize human and environmental impacts.

RESIDENTIAL AREA -- PARCEL 2

Property Included
In addition to the dormitories that abut Sand Point Way, the residential parcel of the base includes the old gas station (Building 41) and the Brig (Building 406). Boundaries include Parcel 1 and Parcel 3, to the south and south east; NOAA to the east-northeast; Parcel 4 to the north; and, Sand Point Way to the west.

Investigations, Cleanup Activities and Conclusions
Restricted use of Parcel 2 is not necessary. There were underground storage tanks for the old gas station and the Brig but they have been removed and there is no evidence that contamination still occurs in this parcel.
It should be noted that asbestos and leaded paint are found in most buildings on the site, but are not considered under the Model Toxics Control Act (MTCA) jurisdiction at this time.

Specific Required Actions - None
Therefore, Ecology is issuing this determination of **NO FURTHER ACTION** for this parcel under the Model Toxics Control Act (MTCA), Ch. 70.105D RCW. This determination is made only with respect to the releases identified in the remedial action reports listed above. This no further action determination applies only to the area of the property affected by any releases identified in the report. It does not apply to any other release or potential release to the property, any other areas on the property, nor any other properties owned or operated by the United States Navy. This **NO FURTHER ACTION** determination does not apply to remedial actions determined necessary as a result of confirmation monitoring.

BALL FIELDS -- PARCEL 3

Property Included

The Ball Fields at Sand Point are bordered by Parcel 1 (the Commissary/Auto Facilities) on the south, Magnuson Park on the east, and Parcel 2 (the Residential Area) on the north and west.

Investigations, Cleanup Activities and Conclusions

Based upon sampling done on site and the listed reports, Ecology as determined that, at this time, the release of PAHs and metals into the soil, surface water and ground water no longer poses a threat to human health or the environment.

This determination is made only with respect to the storm drain releases identified in the remedial action reports listed above. This **NO FURTHER ACTION** determination applies only to the area of the property affected by the releases identified in the reports. It does not apply to any other release or potential release at the property, any other areas on the property, nor any other properties owned or operated by the United States Navy. This no further action determination does not apply to remedial actions determined necessary as a result of confirmation monitoring.

Ecology does not assume any liability for any release, threatened release or other conditions at the site, or for any actions taken or omitted by any person or his\her agents or employees with regard to the release, threatened release, or other conditions at the site.

Specific Required Actions - None

Therefore, Ecology is issuing this determination that **NO FURTHER ACTION** is necessary at this parcel under the Model Toxics Control Act (MTCA), Ch. 70.105D RCW.

LIGHT INDUSTRY -- PARCEL 4

Property Included

Parcel 4 contains the hangars and buildings north of Parcel 2 and the Main Entrance and south of the road to NOAA. Building 406 or the Brig and the NOAA facilities are to the east and Sand Point Way NE is on the west.

Investigation, Cleanup Activities and Conclusions

Cleanup activities and decommissioning of the 100,000 gallon tank, a 2,000 gallon underground storage tank, and an 800 gallon underground storage tank took place on this parcel. Several underground storage tanks containing heating oil, gasoline, and waste oil were also removed and soil tested to determine if there was residual soil contamination. Contaminated soils were sent to an appropriate facility to be land farmed. AVGAS pipelines were cleaned and closed. There is no danger to human health or the environment so **NO FURTHER ACTION** is given on the petroleum storage facilities in Parcel 4.

Soil sampling for Buildings 2 and 30 revealed metals above cleanup levels inside Building 2 (under the floor) and in the grass strip between Building 30 and the adjacent parking lot on the north side of the building. Both sites had cadmium above cleanup levels. Cleanup of the two areas would be difficult; the buildings are part of the historical district on base and removal of the soil could affect the integrity of the structures of the buildings. Long term monitoring of the sites will take place to assure that the metals are not affecting the ground water. There are no immediate dangers to human health or the environment since both areas are inaccessible but there is a potential for impact if either building is demolished or the concrete is removed. A **NO FURTHER ACTION with deed restrictions** is given to the soils beneath Buildings 2 and 30.

Historically, Building 137 was a laundry/dry cleaning facility. The building has been removed but the foundation is being used as a parking lot. Sampling around the foundation did not reveal any contamination but Stoddard's Solution (a petroleum based cleaning fluid) was found at a depth of about 12 feet below the building when a sample was taken through the cement floor. The contaminant is not a risk to human health or the environment at this point. Logistics in removal of the contaminated soil appears to be difficult. The building is within five feet of a retaining wall, a utilities corridor, and a loading area for Building 5. In order to assure removal of the contamination, the wall would have to be breached and the utilities would be jeopardized. The monitoring wells in proximity to Building 137 indicate that Stoddard's Solution has not reached the ground water. There ia no immediate danger to human health or the environment since the area is inaccessible, but there is a potential for impact if the soil is removed, therefore a **NO FURTHER ACTION with deed restrictions** is given to the soils below the concrete/asphalt pad at Building 137.

Roofing materials were sampled on Buildings 2, 5, and 30. Polychlorinated biphenyls (PCBs) were detected at concentrations greater than MTCA levels for soils in two roof samples (Buildings 5 and 30). These materials are not accessible to humans and do not appear to be releasing to the surface water that strikes the roofing material. A

NO FURTHER ACTION determination has been made for the roofing material. If the roofs are replaced or receive repair activities on them, personnel working on the roofing materials must have removal expertise. They must be informed of the potential harmful effects and instructed in proper removal and disposal techniques.

Specific Required Actions
Long Term groundwater monitoring has been established for Parcel 4 to confirm cleanup.

Soils under Buildings 2 (contamination location: SW corner Lat. 47°41'09.74631", Long. 122°15'442.40163" north to Lat.47°41'10.22709", Long. 122°15'42.40323" east to Lat. 47°41'10.22905". Long. 122°15'42.27699" and south to Lat. 47°41'09.74615", Long. 122°15'42.2781")and 30 (contamination location: SW corner Lat. 47°40'59.87827", Long. 122°15'3.45559" north to Lat. 47°41'00.02271", Long. 122°15'34.44836" east to Lat. 47°41'00.01969", Long. 122°15'92701" and south to Lat. 47°40'59.87867", Long. 122°15'33.92948") need additional sampling when the buildings are demolished to determine the extent and magnitude of contamination. The soils under the buildings will then be remediated.

Further monitoring of the wells in proximity to Building 137 will assure that Stoddard's Solution is not contaminating the groundwater. If the site is to be modified, and the soils removed and/or recontoured, cleanup of the soils at Building 137 will proceed.(Location: SW corner 47°41'00.19524". Long. 122°15' 42.66099" north to 47°41'00.53943", Long. 122°15'42.65505" east to Lat. 47°41'00.54356", Long. 122°15'42.454" and south to 47°41'00.18635", Long. 122°15'42.4480".)

If roofs of Buildings 2, 5, and 30 are replaced or receive repair activities on them, personnel working on the roofing materials shall have PCB removal expertise. They shall be informed of the potential harmful effects and instructed in proper removal and disposal techniques.

NORTH SHORE -- PARCEL 5

Property Included

Parcel 5 is on the north edge of the property. It is bounded on the south by the entrance road to the NOAA facility, on the east by NOAA, on the north by Pontiac Bay and on the west by Sand Point Way NE.

Mr. Richard K. Stoll
Sandpoint NFA
May 16, 1996
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Investigation, Cleanup Activities and Conclusions

Petroleum cleanup was most extensive within this parcel. Approximately 4,500 cubic yards of contaminated soils were removed from the old tank farm and sent to the appropriate facility for land farming. The tank farm was then filled with recycled cement and soils, contoured and reseeded. Monitoring wells were installed for long term monitoring and the area was returned to its former use, that of a park. A **NO FURTHER ACTION** determination is given to the tank farm contingent on results of the long term monitoring. The plan for long term monitoring is given in the documents listed in Appendix I of this letter.

Pipelines that carried AVGAS throughout Parcel 5 were cleaned and closed. Soils were sampled adjacent to the pipelines and petroleum contamination above MTCA cleanup levels was found in one spot. It does not appear to be near the ground water and is not a risk to human health or to the environment. The contamination is beneath 18 - 24 inches of concrete and rebar, and it is in an area that is part of the former tarmac for the Naval Air Station and would be difficult to cleanup. Therefore, the contamination may remain in place until such time that the tarmac is removed and the underlying soils and fill are exposed. At that time the contamination must be addressed. The pipelines in Parcel 5 have a **NO FURTHER ACTION with deed restrictions** determination.

Specific Required Actions

If the tarmac in Parcel 5 is removed, the underlying soils and fill must be sampled and contamination remediated. (Location: SW Corner Lat. 47°41'15.85126", Long. 122°15'46.62587" north to Lat. 47°41'16.59035", Long. 122°15'46.62668" east to Lat. 47°41'16.59126", Long. 122°15'45.60140" and south to Lat. 47°41'15.87154", Long. 122°15'45.59824")

OFF-SHORE BAY AND SEDIMENTS -- PARCEL 6

Property Included

Parcel 6 is Lake Washington's Pontiac Bay on the northern edge of the property. It is bounded on the south by Parcel 5, the North Shore; on the west by the Sand Point Community and Sand Point Way; and on the east by NOAA and the Lake. The shoreline has been modified by fill and a bulkhead that has straightened the shoreline. There are two boat launches within the Sand Point property; one is adjacent to the

NOAA fence and the other is at the west end, adjacent to the fenceline along Sand Point Way. Dredging has taken place in the past, particularily in the off-shore property belonging to NOAA. The dredge spoils were deposited upland on the property.

Investigations and Conclusions

In 1993 samples of the sediments were analyzed. The results of the chemical analysis were published in the original Environmental Baseline Studies (EBS) but were inconclusive; they indicated there was no human risk associated with the sediments but there was a potential for environmental risks. Some of the compounds exceeded MTCA cleanup guidelines, particularily for PAHs and some of the metals. As a result the Navy and Ecology made the decision to perform bioassay sampling for the sediments. It was concluded that no areas in the western portion (about two-thirds) of Pontiac Bay (west of station 406) show effects at levels of concern. These areas may be transferred to the future owners without restrictions. A **NO FURTHER ACTION** determination is given to the western half of sediments in Pontiac Bay

The eastern portion (approximately one-third) of Pontiac Bay constitutes a freshwater sediment site according to Ecology regulations and standards. At least some of this contamination can be attributed to Navy activities, both associated with the base just before it was closed and possibly associated with the larger historic base. This portion of the site could potentially be divided into two areas, west and east of the NOAA Pier, due to past dredging and evidence that the remaining sediments north of the pier are not as contaminated. Additional chemical analyses should be run on stations exceeding SQS or CSL in accordance with the workplan. This need not hold up property transfer, but could be conducted concurrently with that process, or at a later date. The area west of the pier could be remediated separately, ahead of the eastern area, since the direction of sediment transport is to the east. It is also the area most directly attributable to Navy operations.The Navy may choose to either conduct a cleanup in this limited area, or transfer it with deed restrictions to a future owner, recognizing that the Federal government is will still responsible at a future date. The sediments in the eastern half of Pontiac Bay have a **NO FURTHER ACTION with deed restrictions** determination.

Specific Required Actions

The deed restriction shall notify the future owner that contamination that requires cleanup is present in the eastern half of Pontiac Bay, and that until cleanup is conducted, activities that disturb sediment (such as aquatic construction) must be limited to the extent practicable. Since a fence will separate NOAA's property from that belonging to the City, it is appropriate to post signs explaining that the area east of the fence is environmentally sensitive and should not be disturbed. If such a disturbance is necessary, Ecology shall be notified and provided an opportunity to review the plans to ensure that all appropriate measures are taken to prevent resuspension and exposure to humans and wildlife. New land uses shall not be allowed that involve continual resuspension or disturbance of sediment, such as public swimming, or wind surfing.

The area east of NOAA's pier needs to be studied further to determine the eastward and northern extent of contamination. This will be done when collective agency resources permit.

Specific Actions Required

The eastern portion of Pontiac Bay, that is east of a line expenting from Lat. 47°41'16.70556", Long. 122°15'38.15883" to Lat. 47°41'17.01490, Long. 122°15'42.89002", to Lat. 47°41'18,18340", Long. 122°15'44.28139" shall be used as a buffer zone between Magnuson Park and NOAA. It will be remediated at a future date when collective agency resources permit. Until that time, a sign shall be posted indicating the area is "Property of NOAA".

RESTRICTIVE COVENANTS

The property that is the subject of this Restrictive Covenant has been the subject of a Fast Track Cleanup Action under the Defense Base Closure and Realignment Act of 1990 (P.L. 101-510, 104 Stat. 1808) (BRAC 91,93,95) and is legally described on page 1 (one) of this letter. The remedial actions undertaken to clean up the property (hereafter the "Cleanup Actions") are described in the reports listed in Appendix I of this letter. These documents are on file at the Northwest Regional Office of the State of Washington Department of Ecology ("Ecology"), The Downtown Branch of the Seattle Public Library, and the Northeast Branch of the Seattle Public Library. These Restrictive Covenants are required by Ecology as defined in WAC 173-340-440 because the Cleanup Action resulted in residual concentrations of Petroleum (AVGAS, diesel fuel oil, and Stoddard's Solution) and heavy metals which exceed Model Toxics Control Act Method B cleanup levels for soil established under WAC 173-340-720(2).

The contamination that is the subject of these restrictive covenants are described in the referenced reports (Appendix I). The following declaration as to limitations, restrictions, and uses to which the Site may be put, and specification that such declarations shall constitute covenants to run with the land, as provided by law, and shall be binding on all parties and all persons claiming under them, including all current and future owners of any portion of/or interest in the Site.

1. Portions of the property contain petroleum contaminated soils (Building 345, Building 137, and the soil beneath the tarmac in front of Building 27). Other portions contain heavy metal contaminated soils located beneath buildings

(Buildings 2 and 30). Remediation or removal of the contaminated soils must be addressed before the owner or successor owner alters, modifies, or removes the existing building in any manner that exposes the contamination. Any plans for alteration, modification or removal which shall expose the contamination shall be submitted to and approved by Ecology or its successor agency prior to such actions.

2. The owner of the property must give written notice to Ecology, or to its successor agency, or the owner's intent to convey any interest in the property. No conveyance of title, easement, lease, or other interest in the property shall be consummated by the owner without adequate and complete provision for continued compliance with this restrictive covenant. Copies of this restrictive covenant shall be furnished to any transferee or such real property interest.

3. The owner or a successor owner shall allow authorized representatives of Ecology, or its successor agency , the right to enter the property at reasonable times for the purpose of carrying out its duties under Chapter 70.105D RCW, including the right to take samples, inspect remedial actions conducted at the property relating to the contamination identified in the above referenced reports, and to inspect records that are related to the Cleanup Action.

4. The Owner of the Site and any successor owners reserve the right under WAC 173-340-730 and WAC 173-340-440 to record an instrument which provides that this Restrictive Covenant shall no longer be of any further force or effect. However such an instrument may be recorded only with the consent of Ecology, or its successor agency. Ecology, or its successor agency, may consent to the recording of such an instrument only after appropriate public notice and comment.

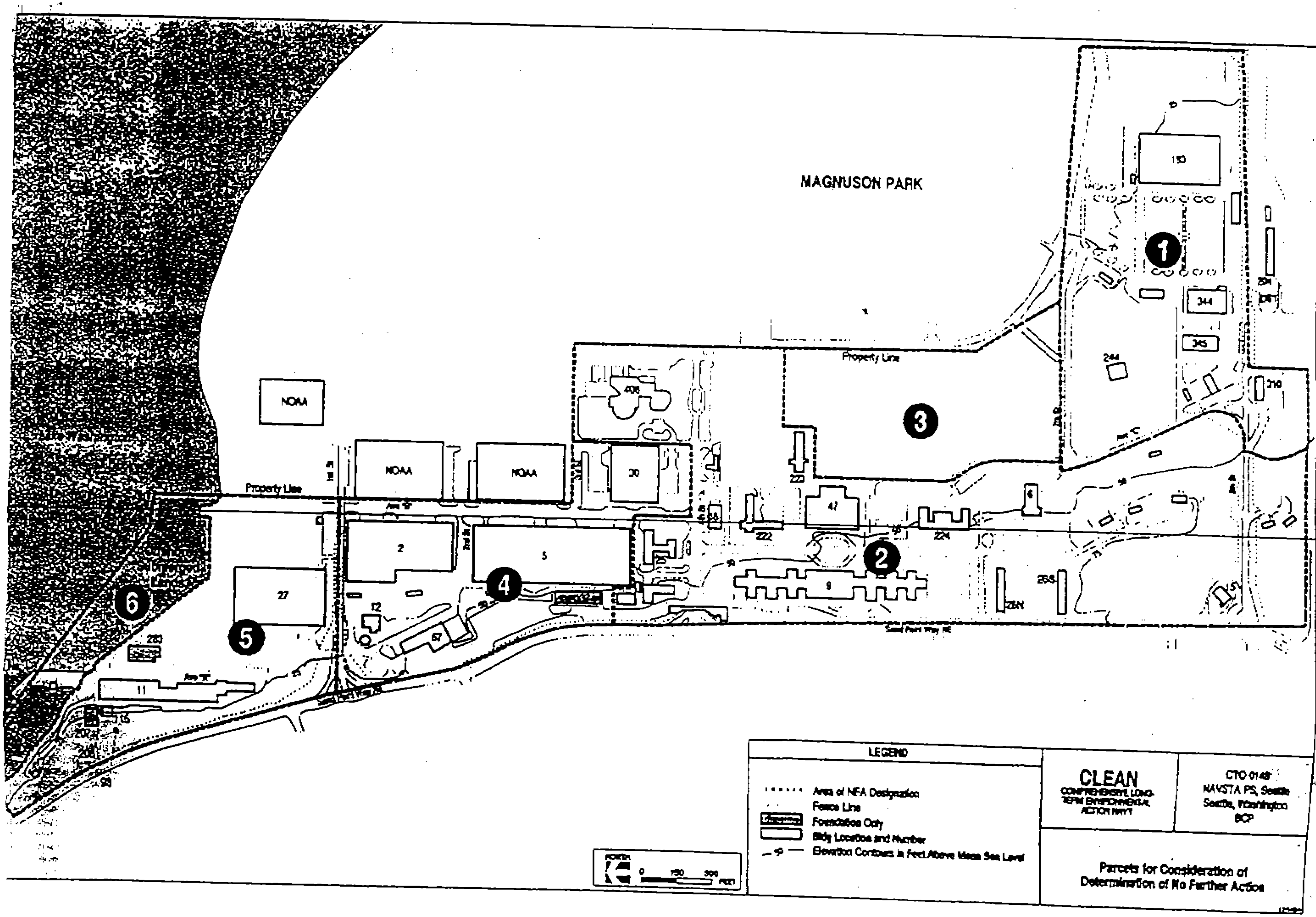
Ecology will update its database to reflect this <u>NO FURTHER ACTION</u> determination. Your site will not appear in future publications of the Confirmed & Suspected Contaminated Sites Report (previously known as the Affected Media and Contaminants Report.) and the LUST database. Ecology will also initiate the process to remove your site from the Hazardous Sites List. This process includes a 30 day public comment period, after which Ecology must evaluate the public's comments before making a final decision.

Should you have any questions, please call me at (206) 649-7135.

Sincerely,

Judith M. Aitken

Judith M. Aitken
Toxics Cleanup Program



Parcels for Consideration of Determination of No Further Action

APPENDIX I

ENVIRONMENTAL DOCUMENTS USED TO PREPARE THE DETERMINATION OF NO FURTHER ACTION

URS Consultants, Inc. (URS). 1991. Preliminary Assessment, PSNS-NAVSTA Puget Sound, Sand Point. Prepared for U.S. Navy CLEAN, N62474-89-D-9295. Seattle, Washington. October 1991.

_____ 1993a. Site Inspection Report, Naval Station Puget Sound Seattle, Washington. Vols. I and 2. October 1993.

_____ 1993b. Draft Environmental Baseline Survey for Naval Station Puget Sound (NAVSTA PS), Seattle, Washington. Prepared for U.S.Navy CLEAN, N62474-89-D-9295. Seattle, Washington, December 1993.

_____ 1994a. Technical Memorandum: Sampling Results for the Avgas Line and 100,000-Gallon Underground Storage Tank, Naval Station Puget Sound, Seattle, Washington. Prepared for U.S.Navy CLEAN, N62474-89-D-9295. Seattle, Washington. January 1994.

_____ 1994b. Factsheet: Environmental Cleanup Prior to Property Transfer, Sand Point Naval Base. Prepared of U.S. Navy CLEAN, N62474-89-D-9295. Seattle Washington. February 1994.

_____ 1994c. BRAC Cleanup Plan, NAVSTA PS, Seattle, Washington. Prepared for U.S. Navy CLEAN, N62474-89-D-9295. Seattle, Washington, March 1994.

_____ 1994d. Draft Technical Memorandum: Sampling Results for the Avgas Line and Auto Hobby Shop Excavation, Naval Station Puget Sound, Seattle, Washington. Prepared for U.S. Navy CLEAN, N62474-89-D-9295. Seattle, Washington. April 1994.

_____ 1994e. Draft Technical Memorandum: Conceptual Engineering Alternatives for Remediation of Soils in the Area of the Former Fuel Tank Farm, Naval Station Puget Sound, Seattle, Washington. Prepared for U.S. Navy CLEAN, N62474-89-D-9295. Seattle, Washington. April 1994.

_____ 1994f. Draft Community Relations Plan/Public Participation Plan (CRP/PPP) for Sand Point Naval Base. Prepared for U.S. Navy CLEAN, N62474-89-D-9295. Seattle, Washington. May 1994.

_____ 1994g. Factsheet: New Cleanup Documents available for Public Comment, Sand Point Naval Base. Prepared for U.S. Navy CLEAN, N62474-89-D-9295. Seattle, Washington. May 1994.

_____ 1994h. Draft Technical Memorandum: Summer 1994 Sampling Results: Building 2, Building 30, Building 137, Avgas Tank Farm, Asphalt Roofs, Ballfield, Naval Station Puget Sound, Seattle, Washington. Prepared for U.S. Navy CLEAN, N62474-89-D-9295. Seattle, Washington. October 1994.

_____ 1995a. Draft Technical Memorandum: Sampling Results for Groundwater and Soil Monitoring, Naval Station Puget Sound, Seattle, Washington CTO 170. Seattle, Washington. September 1995.

_____ 1995b. Technical Memorandum: Bioassay Sampling of Lake Washington Offshore Sediments, Naval Station Puget Sound, Seattle, Washington, CTO 199. Seattle, Washington. October 1995.

_____ 1996. Final BRAC Cleanup Plan, NAVSTA PS, Seattle, Seattle, Washington CTO 0149. Seattle, Washington. February 1996.

G.12 Environmental Bseline Survey Table 4-2: Summary of USTs

4.3.3 Underground Storage Tanks

All USTs at NAVSTA PS, Seattle, have been removed or closed in place (URS 1993c). Information concerning USTs is listed in Table 4-2 and their locations are shown in Figure 4-4.

Table 4-2
Summary of USTs at NAVSTA PS, Seattle

Tank No.	Size (gallons)	Product	Comments
2	200 (est.)	Gasoline	Removed in September 1994
12A	8,800	Fuel Oil	Removed in 1990 (buried railroad car)
12B	8,800	Fuel Oil	Removed in 1990 (buried railroad car)
12C	100,000	Fuel Oil	Closed in place in January 1995
12D	2,000	Gasoline	Closed in place in January 1995
29	300	Diesel	Removed in January 1994
143	3,000	Diesel	Removed in November 1988
144	2,500	Unleaded Gasoline	Removed in November 1988
145	2,500	Unleaded Gasoline	Removed in November 1988
206	1,000	Pesticides	Tank has not been used since 1980 and was closed in place; removed in February 1994
310A	500	Waste Oil	Removed in 1990
340A	15,000	Leaded Gas	Removed in September 1992
340B	15,000	Unleaded Gas	Removed in September 1992
340C	15,000	Unleaded Gas	Removed in September 1992
345	500	Waste Oil	Removed in January 1994
403	300	Diesel	Removed in February 1994
406	550	Diesel	Removed in August 1994

According to Navy files, four tanks (Tank Nos. 166, 167, 168, and 169) located at the old Navy Exchange Gas Station, Building 41, were removed in December 1986. At the time, regulations requiring site assessment and remediation following tank removal did not exist. Therefore, it is possible that petroleum from spills or leaks remains at the site.

During the SI addendum (URS 1993c), a monitoring well was installed in the area between the former tanks and Lake Washington. However, no petroleum products were detected.

Three tanks (Tank Nos. 143, 144, and 145) located south of Building 67 were removed in November 1988. Three soil samples were collected and analyzed with results from two of the samples at TPH concentrations of 730 ppm and 4,200 ppm. Navy records do not clearly indicate whether or not overexcavation was conducted.

4.3.4 100,000-Gallon UST (Tank 12C)

The 100,000-gallon UST was closed in place in January 1995. Oil-fired steam boilers located at Building 12, the Power Plant, historically supplied heat for NAVSTA PS, Seattle, buildings. The 100,000-gallon fuel tank supplying the boilers was refueled by railroad tanker cars and by barge/ship at Pier No. 1. A pipeline (now abandoned) connected the pier to the 100,000-gallon UST. The boiler plant has since been converted to use natural gas. However, during the winter when demand for natural gas was high, gas service to the boilers was cut off and fuel from the 100,000-gallon UST was used as a backup fuel supply. Following closure of the UST, four mobile aboveground tanks were installed to store backup fuel for the boiler.

As part of the SI addendum (URS 1993c), soils in the vicinity of the 100,000-gallon UST were sampled. Analytical results indicate that soils around the UST were not impacted by petroleum hydrocarbons. Prior to closing the tank, it was emptied of fuel and a hole was drilled through the bottom of the tank so that underlying soil and water could be sampled. No petroleum hydrocarbons were detected in either the soil or groundwater under the tank.

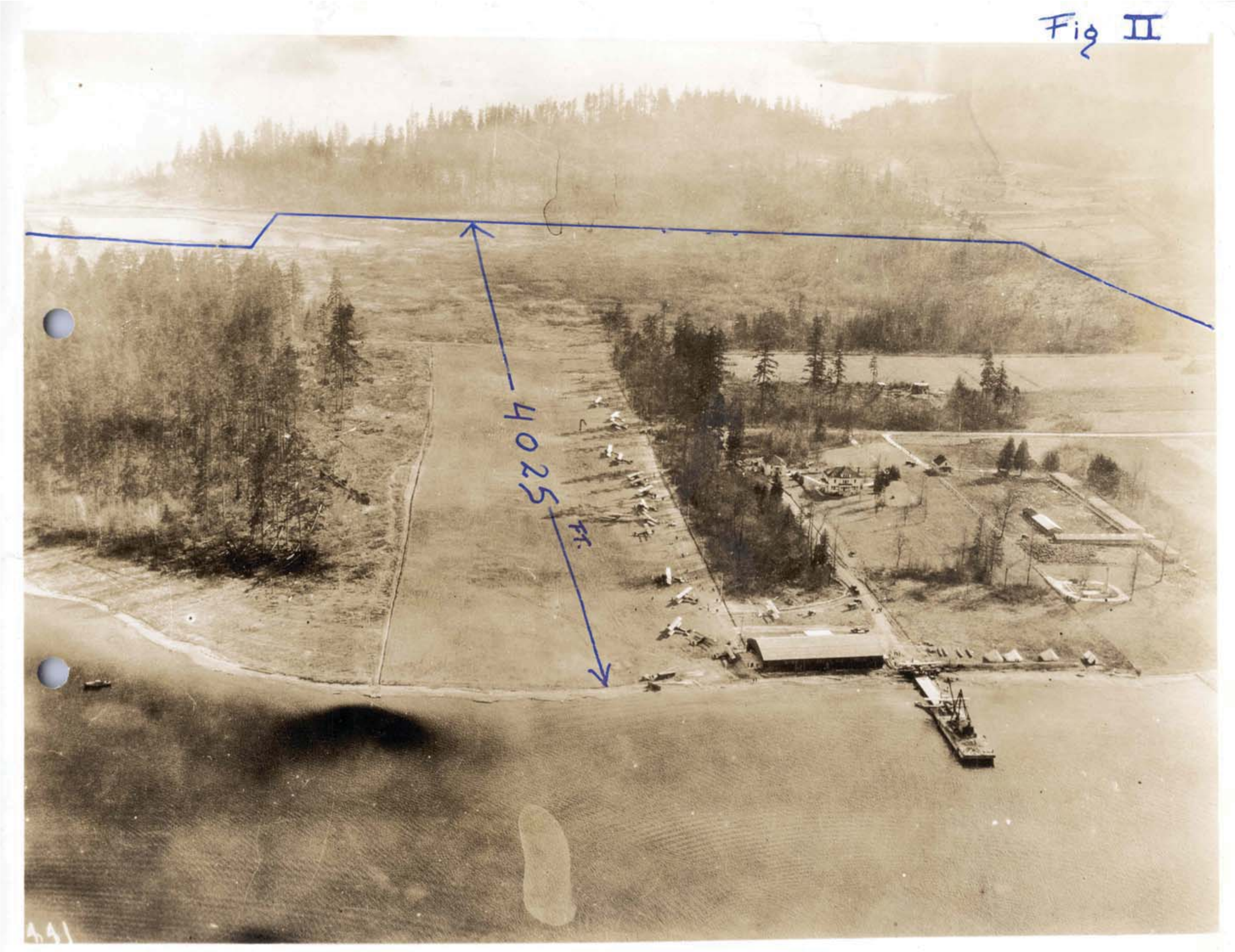
Appendix H

Still Photography References

G.1. Aerial View of the Aviation Field at Sand Point Naval Air Station - March 1928.

Source: http://digitalcollections.lib.washington.edu/cdm/singleitem/collecion/seattle/id/2775/rec/1

G.2 NAS Seattle - Late 1920s or Early 1930s

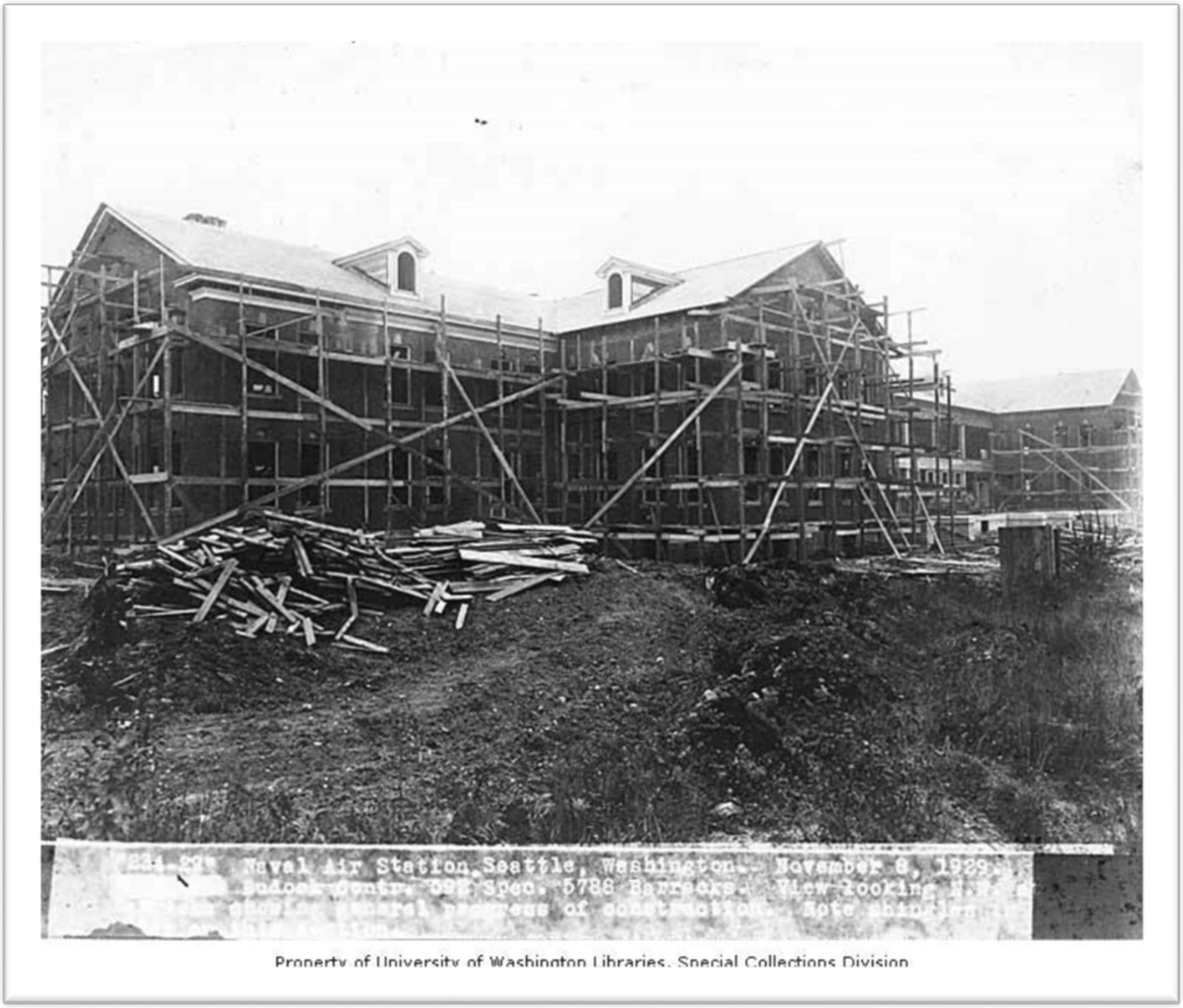


Source: http://www.seattle.gov/parks/magnuson/timeline/airfield.htm

G.3. Gravel Dredge Filling in Mud Lake – March 1928

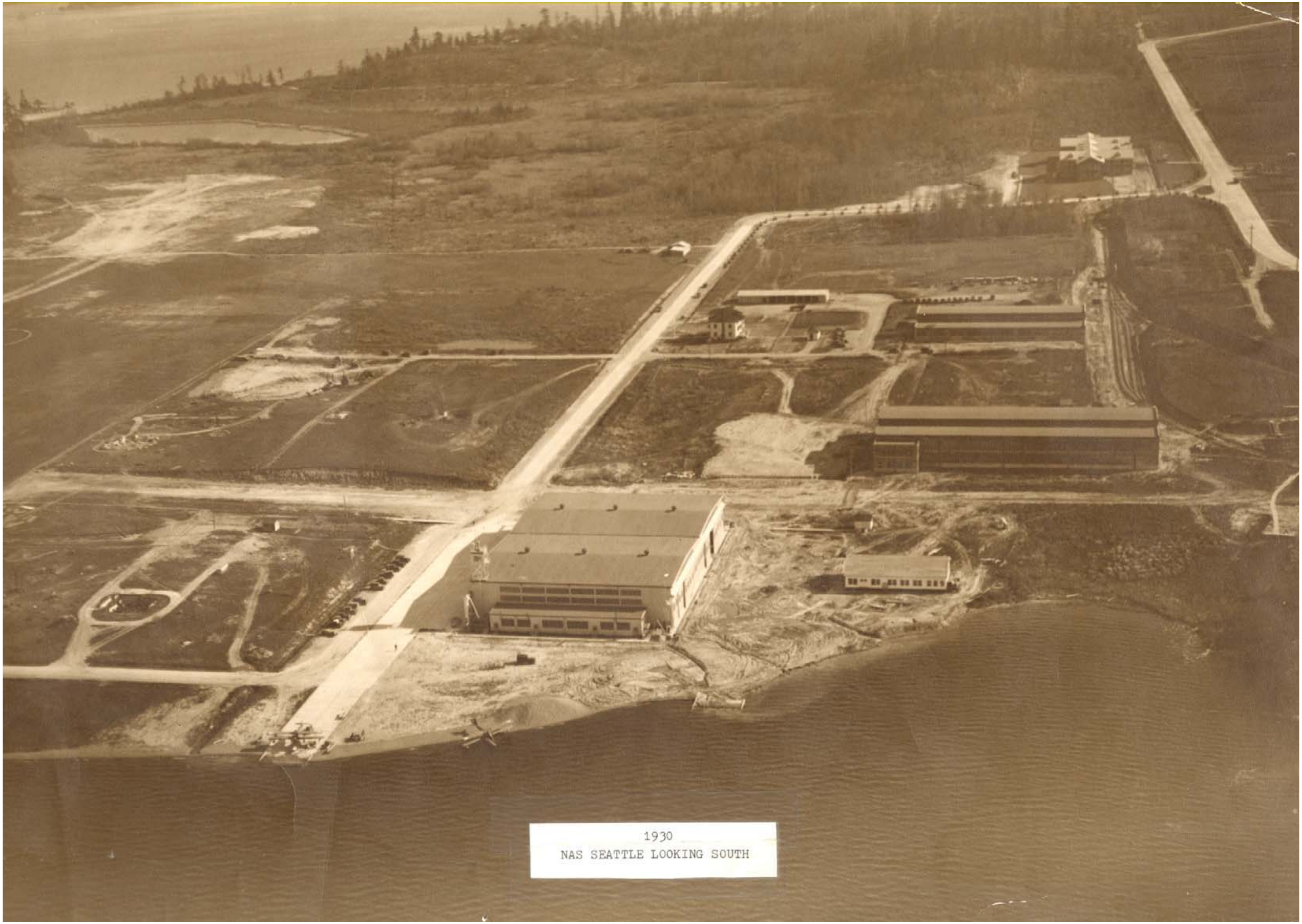
Source: http://digitalcollections.lib.washington.edu/cdm/singleitem/collecion/seattle/id/2776/rec/1

G.4. Barracks Under Construction – November 8, 1929



Source: http://digitalcollections.lib.washington.edu/cdm/singleitem/collecion/seattle/id/2777/rec/1

G.5. NAS Seattle - Aerial View Looking South - 1930



Source: http://www.seattle.gov/parks/magnuson/timeline/airfield.htm

G.6. Proposed Storehouse Site – January 16, 1930

Property of University of Washington Libraries, Special Collections Division

Source: http://digitalcollections.lib.washington.edu/cdm/singleitem/collecion/seattle/id/2775/rec/1

G.7. Brick Building Under Construction – March 15, 1938

Source: http://digitalcollections.lib.washington.edu/cdm/singleitem/collecion/seattle/id/2775/rec/1

G.8. Panoramic View of Under Construction Landing Field – February 28, 1939

Property of University of Washington Libraries, Special Collections Division

Notes: View looking east from Officers' Quarters showing fill being made for grading of landing field. W.P.A Project 709-2-16—PWA.

Source: http://digitalcollections.lib.washington.edu/cdm/singleitem/collecion/seattle/id/2781/rec/1

G.9. Hangar Under Construction (Building No. 32) – February 28, 1939

Property of University of Washington Libraries, Special Collections Division

Notes: View looking west showing south and east elevations of Building No. 32. W.P.A Project 709-2-16—P.W.A.

Source: http://digitalcollections.lib.washington.edu/cdm/singleitem/collecion/seattle/id/2784/rec/1

G.10. Hangar Under Construction – ca. 1939


Property of University of Washington Libraries, Special Collections Division

Source: http://digitalcollections.lib.washington.edu/cdm/singleitem/collection/seattle/id/2785/rec/1

G.11. Aerial of NAS Seattle, View to North - 1941

Source: http//www.seattle.gov/parks/Magnuson/timeline/WWII.htm

G.12. Cleaning of Aircraft Engine Parts – May 1944

Title: Naval Air Station, Seattle, Washington

Description: African-American personnel of A&R cleaning aircraft engine parts during engine overhauls, 19 May 1944. Official U.S. Navy Photograph, now in the collections of the National Archives.

Catalog #: 80-G-233290

G.13. Machine Gun Maintenance – May 1944

Title: Naval Air Station, Seattle, Washington

Description: Ordnance Department personnel working on machine gun parts, 19 May 1944. Guns appear to be Browning .50 caliber types. Official U.S. Navy Photograph, now in the collections of the National Archives. Catalog #: 80-G-233291

G.14. NAS Seattle, View Looking to West - 1953

Source: http://www.seattle.gov/parks/magnuson/timeline/post-war.htm

Seattle Historical Sites

New Search

Summary for 7777 62ND AVE / Parcel ID 0225049062 / Inv # 0

Historic Name: NAS Seattle Building 20 - Torpedo Shop
Style: Vernacular
Built By:
Common Name:
Neighborhood:
Year Built: 1937

Significance
Built in 1937, Building 20 housed a torpedo shop for the naval air station. It was originally constructed as a freestanding building, but by 1944, it was engulfed by Building 11, Shop & Office Building, Public Works.

Appearance
This single-story, utilitarian shop has a rectangular plan and is sited in the northwest corner of the district. A poured concrete foundation supports a poured concrete structure with brick cladding and a flat roof with a parapet. The only exterior entrance is in the east facade, which is symmetrical, apart from the concrete loading platform and ramp. Windows, doors, downspouts, cladding, and loading platform/ramp are original features. Steel sash, multi-lite windows with center pivot sections flank the double wood doors. Doors have wood panels beneath multi-lite glazing. Copper leader heads and downspouts direct water from scuppers at either end of the east facade. Ornament is limited to a brick soldier lintel over the doorway and a soldier course above the windows, stretching the length of the building. This former Torpedo Shop is surrounded on three sides by Building 11; only the east facade is entirely visible.

Detail for 7777 62ND AVE / Parcel ID 0225049062 / Inv # 0

Status:

Classication:	Building	**District Status:**	NR, NR, NR, NR, NR, NR, NR, NR, NR, NR, NR, NR, NR, NR
Cladding(s):	Brick	**Foundation(s):**	Concrete - Poured
Roof Type(s):	Flat with Parapet	**Roof Material(s):**	Unknown
Building Type:	Defense - Military facility	**Plan:**	Rectangular
Structural System:	Unknown	**No. of Stories:**	one
Unit Theme(s):	Architecture/Landscape Architecture, Military		

Integrity

Changes to Plan:	Intact
Changes to Windows:	Intact
Changes to Original Cladding:	Intact
Changes to Interior:	Unknown
Other:	Intact

Major Bibliographic References

Photo collection for 7777 62ND AVE / Parcel ID 0225049062 / Inv # 0


Photo taken May 07, 2009


Photo taken May 07, 2009


Photo taken May 07, 2009

G.14. Torpedo Shop (Bldg 20) - Current Appearance

Photo taken May 07, 2009

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App v2.0.1.0

Appendix I

Maps/Drawings References

Maps/Drawings References

The following maps, charts, and drawings were found during historical file reviews, library catalog queries, and online searches. Relevant information obtained from each document is summarized. Most are oversized and will be provided to USACE under separate cover.

Historical Maps obtained at National Archives and Records Administration (NARA), Pacific Alaska Region, in Seattle, Washington (contact: Kathleen Crosman, Public Records, 206-336-5121):

Map of Naval Air Station Seattle, Washington showing conditions on June 30, 1944. The map depicts buildings of the main station area with an inset showing the radio transmitter facility; it includes a list of structures corresponding to numbers indicated on the map. The southern extension and the properties northwest of the station are not included.

Map of Naval Air Station Seattle, Washington showing conditions on June 30, 1945. The map is similar to the 1944 map, although the names and numbers of the structures are not legible. It is possible to discern several buildings that were not present on the 1944 map.

Naval Air Station Seattle, Washington Property Map, South Extension NAS, Seattle, Washington, revised June 16, 1945 (base map March 16, 1945). The map depicts NAS properties located south of NE 65th Street, between Sand Point Way and the railroad right-of-way. No structures are shown.

Naval Air Station Seattle, Washington, Real Estate Summary Map, July 8, 1965. The map depicts NAS properties, including the main station, southern extension, transmitter facility, and the 15-acre area northwest of the station. Some acquisition and disposal information is included.

Naval Station Seattle, Washington, Real Estate Summary Map, November 22, 1994. The map depicts Naval Station properties; numbered buildings are indicated, but no list is included. The map includes tables showing acquisition information, encumbrances and outgrants, and a real estate acreage summary. All of the parcels shown on the map are ineligible for inclusion on the FUDS list because they were still under DOD control in 1994. The parcel now owned by the U.S. Geological Survey (USGS) and operated by the Western Fisheries Research Center is included on the map as a current holding; the table states that the 3.89-acre parcel is used by the Department of Fish and Wildlife under an agreement dated March 1, 1991.

Appendix J

Interviews

Interviews

This appendix contains summaries of research interviews conducted by phone.

Department of Parks and Recreation, Seattle, Washington (Marrell Livesay, 206-684-7133)

Mr. Livesay provided information regarding the removal action work that the Navy performed under the BRAC program, adjacent to the former hangar at the south end of the property.

NAVFAC NW, Silverdale, Washington (Mike Brady, 360-396-0908)

Mr. Brady provided information regarding property transfer history for the former NAS.

NOAA, Seattle, Washington (Tim Nesseth, Equipment Rigger, 206-526-6532)

Mr. Nesseth works for NOAA as an equipment rigger. He is also a recreational scuba diver, and a member of a local search and recovery team. He has dived around the shoreline of the former NAS many times. He said that there is very little debris near the NOAA shoreline, but there is much debris near the park shoreline. He has observed drums, reels, bottles, and empty cartridges. When asked about ordnance, he said he has seen shells from small arms, but nothing of significant size.

Appendix K

Abbreviated Site Safety and Health Plan

Abbreviated Site Safety and Health Plan

The property visit was conducted in accordance with the programmatic Health and Safety Plan (HASP) developed by Herrera Environmental Consultants, Inc. (dated October 7, 2002) for conducting site visits at FUDS. The HASP specifies procedures for avoidance and reporting of any suspected MEC.

Appendix L

Property Visit Report

Property Visit Report

Multiple property visits were conducted as part of the assessment. Julie Howe of Herrera conducted visits to the Magnuson Park property and the Burke-Gilman Playfield property on August 20, 2008, and to the NOAA property on October 15, 2008. Additional photographs of the Magnuson Park property were taken by Ms. Howe on October 19, 2008. Photographic documentation is provided in Appendix M.

Magnuson Park

Ms. Howe met with Kevin Stoops to examine the contaminated shoreline area previously discussed (see Section 2.0). Mr. Stoops pointed out the area where the concrete slabs had been removed in 2004 and areas that seemed to show signs of vegetative stress. These areas seem to have less grass growing on them, which Mr. Stoops said might be attributed to soil contamination.

After leaving Magnuson Park, Ms. Howe examined the location of the former transmitter station, now occupied by a play structure at the Burke-Gilman Playfield. This property is also managed by Seattle Parks and Recreation. Historical NAS plans identify a fuel storage tank adjacent to the former station building, but no indication of a fuel storage tank was visible during the inspection.

NOAA

Ms. Howe met with NOAA employees Jesse Hurtado, Dave Petre, and David Winandy on October 15, 2008. After examining some historical photographs of the NAS, Mr. Winandy, an environmental engineer, accompanied Ms. Howe on a tour of the grounds. The only NAS structures remaining on the NOAA grounds are Buildings 32 and 33, (former aircraft hangars), which are now used by NOAA primarily for storage. Mr. Winandy indicated that an area at the northeast corner of Building 32, currently beneath the floor tiles, was used as an old grease pit.

No indications of the former skeet or trap ranges along the shoreline were visible. The only remaining structures consist of an unlabeled row of vertical concrete slabs that appear on the 1944 map. The location of a former ordnance storage building was examined; the area is now vegetated with tall grasses and brush and no sign of the former building. In addition, an area that formerly contained oil and gasoline storage tanks, a gasoline control pit, and a motor test building, is now within the footprint of the easternmost NOAA building. No problems associated with these former features were found during the investigation.

Appendix M

Property Visit Photographs

Property Visit Photographs
NAS Seattle
Site Visits conducted August 20, October 15, and 19, 2008

Photo Number	Photo Description
1	Building 32 (former hangar now owned by NOAA), looking northwest.
2	Stored materials inside Building 32.
3	Wind tunnel inside Building 32.
4	Building 33 (former hangar now owned by NOAA), looking southwest.
5	Net-making inside Building 33.
6	Looking north-northwest at the location of former Building 1 (former hangar owned by NOAA), now occupied by parking lot and lawn.
7	One of 13 concrete blocks denoted on the 1944 map of the NAS. There is no remaining indication of Buildings 122 (Inert Storage Building) or 203 (Ordnance Material Storage) shown just north of these features on the map (NOAA property).
8	Approximate location of former Building 122, with NOAA building in background, looking south.
9	Earth moving work occurring as part of a wetland renovation project being conducted in the southeastern portion of the park.
10	Magazine 55, located in the eastern portion of the park, looking southeast.
11	Sparsely vegetated area within the park along the shoreline in the vicinity of the former trash burning pits.
12	Debris visible along the park shoreline.
13	Building 312 (former Pyrotechnic Magazine), located on park property close to shoreline, looking west.
14	Magazine 19, located on park property close to shoreline, looking southwest.
15	Debris visible along the park shoreline.
16	Debris visible along the park shoreline.
17	Exposed fill material beneath shoreline vegetation on park property.
18	Play structure at Burke-Gilman Park.


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Appendix N

Munitions Response Site Prioritization Protocol Tables

Table A
MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from DoD databases, such as RMIS. If the MRS is located on a FUDS property, the suitable FUDS property information should be substituted. In the MRS summary, briefly describe the UXO, DMM, or MC that are known or suspected to be present, the exposure setting (the MRS's physical environment), any other incidental non-munitions related contaminants found at the MRS (e.g., benzene, trichloroethylene), and any potentially exposed human and ecological receptors. Include a map of the MRS, if one is available.

Munitions Response Site Name: Small Arms Ranges MRS
Component: **U.S. Army Corps of Engineers, Formerly Used Defense Sites (FUDS)**
Location (City, County, State): Seattle, King, Washington
Site Name (RMIS ID)/Project Name (Project No.): Sand Pt NAS-Magnuson Pk, F10WA0031

Date Information Entered/Updated:
Point of Contact (Name/Phone): **PUBLIC AFFAIRS – (xxx-xxx-xxxx)**
Project Phase (check only one):

☒ PA	☐ SI	☐ RI	☐ FS	☐ RD
☐ RA-C	☐ RIP	☐ RA-O	☐ RC	☐ LTM

Media Evaluated (check all that apply):

☐ Groundwater	☐ Sediment (human receptor)
☐ Surface Soil	☐ Surface Water (ecological receptor)
☐ Sediment (ecological receptor)	☐ Surface Water (human receptor)

MRS Summary: MRS Description: Describe the munitions-related activities that occurred at the installation, the dates of operation, and the UXO, DMM (by type of munition, if known) or munitions constituents (by type, if known) known or suspected to be present):

The former Sand Point NAS – Magnuson Park property is located in Seattle, Washington, along the western shoreline of Lake Washington. The former NAS comprised approximately 536.8 acres. Activities conducted at NAS included: aircraft repair/overhauls; aircraft engine overhauls; fueling; torpedo maintenance/modification/repair; bomb sight maintenance; outfitting of escort carriers; armed aircraft training missions (ceased in 1941); and, munitions storage. Between 1959 and 1975, a total of approximately 339.9 acres were disposed. Approximately 196.9 additional acres were either disposed of after 17 October 1986 or were declared excess but not conveyed from GSA making the acreage FUDS ineligible. (PA Report, Section 4.2.1 and CENWK-PM-ES Memorandum, 18 June 2015, FRMD: F10WA0031--_01.08_0501_a)

The Small Arms Ranges MRS consists of adjacent small arms range and machine gun range with a combined acreage of approximately 2.95 acres. The MRS is located in the south central portion of the FUDS. The machine gun range appears to have been a known distance range with fixed firing points and fixed targets. The small arms range is situated to the west of the machine gun range and is surmised to be the firing stations for the outdoor small arms range. Although the weapons and caliber used at the these ranges were not specifically identified, an historic photograph depicts what appears to be Browning 0.50 caliber machine guns being worked upon. It is presumed that the weapon depicted in the referenced photograph would have been fired at the machine gun range. Otherwise, the caliber of round fired would have likely been either .30, .45, or .50. Both ranges used a berm as a downrange impact area and backstop that could contain contamination. (PA Report, Sections 4.2.1 and 5.2).

The EHE module was assigned the alternative rating of **No Known or Suspected Explosive Hazard**. Only small arms ammunition was used at the MRS. No MEC has been reported at the MRS. (PA Report, Sections 4.2.1, 5.1, 9.1, and 9.2.2). Army policy is expended small arms ammunitions does not pose an explosive hazard.

The CHE module was assigned the alternative rating of **No Known or Suspected CWM Hazard**. Historical records indicate a "gas training building" was located in the northwestern part of the property. This area is away from the MRS and on a portion of the former NAS that is not FUDS eligible. There is no evidence CWM was present or used on the MRS. (PA Report, Sections 4.2.2 and 5.3)

The HHE module was assigned the alternative rating of **Evaluation Pending**. Small arms was used at the MRS. Historic drawings depict a berm and "dike" behind the target shelter that appears to have been present in order to 'catch' errant small arms fire. Bullet fragments contained in the berm constitute a potential health and environmental hazard. It is not known to what extent (if any) the berm or dike may have been regraded and incorporated into the recontoured landscape. It is also not known what became of the expended bullets fired into the target shelter. (PA Report, Section 5.2) No sampling has been conducted. (PA Report, Sections 8.3.2 and 9.2.1)

Reference to the PA Report refers to the Preliminary Assessment Report, NAS Seattle (Sand Point), King County, Washington, DERP FUDS No. F10WA0031, dated September 2016.

Description of Pathways for Human and Ecological Receptors:
The groundwater and surface water MC exposure pathways are considered incomplete. (PA Report, Section 8.1.2, 8.2.2). The surface soil exposure pathway may be complete on the MRS from MC in the impact berm. The MEC exposure pathway is considered incomplete since the MRS was only used for small arms and no MEC has been reported (PA Report, section 5.1).

Description of Receptors (Human and Ecological):
Potential MC receptors include the resident population, recreational users of Magnuson Park, and workers who could be exposed to surface and/or near surface soils potentially containing elevated lead concentrations in the areas of the former machine gun and small arms ranges (PA Report, Executive Summary and Section 8.3). There are no potential MEC receptors since the MRS was only used for small arms and no MEC has been reported (PA Report, section 5.1).

Table 1

EHE Module: Munitions Type Data Element Table

DIRECTIONS: Below are 11 classifications of munitions and their descriptions. Circle the score(s) that correspond with **all** munitions types known or suspected to be present at the MRS.

Note: The terms *practice munitions, small arms, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
Sensitive	♦ All UXO that are considered likely to function upon any interaction with exposed persons [e.g., submunitions, 40mm high-explosive (HE) grenades, white phosphorus (WP) munitions, high-explosive antitank (HEAT) munitions, and practice munitions with sensitive fuzes, but excluding all other practice munitions]. ♦ All hand grenades containing energetic filler. ♦ Bulk primary explosives, or mixtures of these with environmental media, such that the mixture poses an explosive hazard.	30
High explosive (used or damaged)	♦ All UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered “sensitive.” ♦ All DMM containing a high-explosive filler that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	25
Pyrotechnic (used or damaged)	♦ All UXO containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades). ♦ All DMM containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades) that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	20
High explosive (unused)	♦ All DMM containing a high explosive filler that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	15
Propellant	♦ All UXO containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ♦ All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor) that are: ▪ Damaged by burning or detonation ▪ Deteriorated to the point of instability.	15
Bulk secondary high explosives, pyrotechnics, or propellant	♦ All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor), that are deteriorated. ♦ Bulk secondary high explosives, pyrotechnic compositions, or propellant (not contained in a munition), or mixtures of these with environmental media such that the mixture poses an explosive hazard.	10
Pyrotechnic (not used or damaged)	♦ All DMM containing a pyrotechnic fillers (i.e., red phosphorous), other than white phosphorous filler, that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	10
Practice	♦ All UXO that are practice munitions that are not associated with a sensitive fuze. ♦ All DMM that are practice munitions that are not associated with a sensitive fuze and that have not: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point o instability	5
Riot control	♦ All UXO or DMM containing a riot control agent filler (e.g., tear gas).	3
Small arms	♦ All used munitions or DMM that are categorized as small arms ammunition [Physical evidence or historical evidence that no other types of munitions (e.g., grenades, subcaliber training rockets, demolition charges) were used or are present on the MRS is required for selection of this category.].	2
Evidence of no munitions	♦ Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0
MUNITIONS TYPE	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	**2**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Munitions Type*** classifications in the space provided.

The MRS consists of a small arms range and a machine gun range where small arms of .30, .45, or .50 caliber were used. (PA Report, Sections 4.2.1 and 5.2) The property has been significantly redeveloped and no MEC has been reported at the site. (PA Report, Sections 5.1, 9.1, and 9.2.2)

Table 2

EHE Module: Source of Hazard Data Element Table

DIRECTIONS: Below are 11 classifications describing sources of explosive hazards. Circle the score(s) that correspond with **all** sources of explosive hazards known or suspected to be present at the MRS.

Note: The terms *former range, practice munitions, small arms, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
Former range	♦ The MRS is a former military range where munitions (including practice munitions with sensitive fuzes) have been used. Such areas include: impact or target areas, associated buffer and safety zones, firing points, and live-fire maneuver areas.	**10**
Former munitions treatment (i.e., OB/OD) unit	♦ The MRS is a location where UXO or DMM (e.g., munitions, bulk explosives, bulk pyrotechnic, or bulk propellants) were burned or detonated for the purpose of treatment prior to disposal.	**8**
Former practice munitions range	♦ The MRS is a former military range on which only practice munitions without sensitive fuzes were used.	6
Former maneuver area	♦ The MRS is a former maneuver area where no munitions other than flares, simulators, smokes, and blanks were used. There must be evidence that no other munitions were used at the location to place an MRS into this category.	5
Former burial pit or other disposal area	♦ The MRS is a location where DMM were buried or disposed of (e.g., disposed of into a water body) without prior thermal treatment.	5
Former industrial operating facilities	♦ The MRS is a location that is a former munitions maintenance, manufacturing, or demilitarization facility.	4
Former firing points	♦ The MRS is a firing point, where the firing point is delineated as an MRS separate from the rest of a former military range.	4
Former missile or air defense artillery emplacements	♦ The MRS is a former missile defense or air defense artillery (ADA) emplacement not associated with a military range.	2
Former storage or transfer points	♦ The MRS is a location where munitions were stored or handled for transfer between different modes of transportation (e.g., rail to truck, truck to weapon system).	2
Former small arms range	♦ The MRS is a former military range where only small arms ammunition was used [There must be evidence that no other types of munitions (e.g., grenades) were used or are present to place an MRS into this category.].	1
Evidence of no munitions	♦ Following investigation of the MRS, there is physical evidence that no UXO or DMM are present, or there is historical evidence indicating that no UXO or DMM are present.	0
SOURCE OF HAZARD	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).	**1**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Source of Hazard*** classifications in the space provided.

The MRS consists of a small arms range and a machine gun range where small arms of .30, .45, or .50 caliber were used. (PA Report, Sections 4.2.1 and 5.2) The property has been significantly redeveloped and no MEC has been reported at the site. (PA Report, Sections 5.1, 9.1, and 9.2.2)

Table 3

EHE Module: Location of Munitions Data Element Table

DIRECTIONS: Below are eight classifications of munitions locations and their descriptions. Circle the score(s) that correspond with **all** locations where munitions are located or suspected of being found at the MRS.

Note: The terms *surface, subsurface, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
Confirmed surface	♦ Physical evidence indicates that there are UXO or DMM on the surface of the MRS ☐ ♦ Historical evidence (e.g., a confirmed incident report or accident report) indicates there are UXO or DMM on the surface of the MRS.	25
Confirmed subsurface, active	♦ Physical evidence indicates the presence of UXO or DMM in the subsurface of the MRS, and the geological conditions at the MRS are likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost, heat heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM. ♦ Historical evidence indicates that UXO or DMM are located in the subsurface of the MRS and the geological conditions at the MRS are likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost, heat heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM.	20
Confirmed subsurface, stable	♦ Physical evidence indicates the presence of UXO or DMM in the subsurface of the MRS and the geological conditions at the MRS are not likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause UXO or DMM to be exposed. ♦ Historical evidence indicates that UXO or DMM are located in the subsurface of the MRS and the geological conditions at the MRS are not likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause UXO or DMM to be exposed.	15
Suspected (physical evidence)	♦ There is physical evidence (e.g., munitions debris, such fragments, penetrators, projectiles, shell casings, links, fins), other than the documented presence of UXO or DMM, indicating that UXO or DMM may be present at the MRS.	10
Suspected (historical evidence)	♦ There is historical evidence indicating that UXO or DMM may be present at the MRS.	5
Subsurface, physical constraint	♦ There is physical or historical evidence indicating that UXO or DMM may be present in the subsurface, but there is a physical constraint (e.g., pavement, water depth over 120 feet) preventing direct access to the UXO or DMM.	2
Small arms (regardless of location)	♦ The presence of small arms ammunition is confirmed or suspected, regardless of other factors such as geological stability [There must be evidence that no other types of munitions (e.g., grenades) were used or are present at the MRS to place an MRS into this category.].	1
Evidence of no munitions	♦ Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0
LOCATION OF MUNITIONS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 25).	**1**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Location of Munitions*** classifications in the space provided.

The MRS consists of a small arms range and a machine gun range where small arms of .30, .45, or .50 caliber were used. (PA Report, Sections 4.2.1 and 5.2) The property has been significantly redeveloped and no MEC has been reported at the site. (PA Report, Sections 5.1, 9.1, and 9.2.2)

Table 4

EHE Module: Ease of Access Data Element Table

DIRECTIONS: Below are four classifications of barrier types that can surround an MRS and their descriptions. The barrier type is directly related to the ease of public access to any explosive materiel. Circle the score that corresponds with the ease of access to the MRS.

Note: The term *barrier* is defined in Appendix C of the Primer.

Classification	Description	Score
No barrier	♦ There is no barrier preventing access to any part of the MRS (i.e., all parts of the MRS are accessible).	10
Barrier to MRS access is incomplete	♦ There is a barrier preventing access to parts of the MRS, but not the entire MRS.	8
Barrier to MRS access is complete but not monitored	♦ There is a barrier preventing access to all parts of the MRS, but there is no surveillance (e.g., by a guard) to ensure that the barrier is effectively preventing access to all parts of the MRS.	5
Barrier to MRS access is complete and monitored	♦ There is a barrier preventing access to all parts of the MRS, and there is active, continual surveillance (e.g., by a guard, video monitoring) to ensure that the barrier is effectively preventing access to all parts of the MRS.	0
EASE OF ACCESS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).	**10**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ease of Access*** classification in the space provided.

There is no evidence of barriers that restrict access to the MRS (PA Report, Section 3.3 and FUDS GIS: http://maps.crrel.usace.army.mil:7778/apex/fuds.fudscm2.map?map=&p_MapExt=-122.259525,47.673144,-122.253656,47.675932&p_layers=fudspoly&p_basemap=GES)

Table 5

EHE Module: Status of Property Data Element Table

DIRECTIONS: Below are three classifications of the status of a property within the Department of Defense (DoD) and their descriptions. Circle the score that corresponds with the status of property at the MRS.

Classification	Description	Score
Non-DoD control	♦ The MRS is at a location that is no longer owned by, leased to, or otherwise possessed or used by DoD. Examples are privately owned land or water bodies; land or water bodies owned or controlled by state, tribal, or local governments; and land or water bodies managed by other federal agencies.	5
Scheduled for transfer from DoD control	♦ The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD, and DoD plans to transfer that land or water body to the control of another entity (e.g., a state, tribal, or local government; a private party; another federal agency) within 3 years from the date the rule is applied.	3
DoD control	♦ The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD. With respect to property that is leased or otherwise possessed, DoD must control access to the MRS 24 hours per day, every day of the calendar year.	0
STATUS OF PROPERTY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Status of Property*** classification in the space provided.

The MRS is on a Formerly Used Defense Site no longer under DoD jurisdiction (PA Report, Section 3.2). This meets the definition of Non DoD Control.

Table 6

EHE Module: Population Density Data Element Table

DIRECTIONS: Below are three classifications of population density and their descriptions. Determine the population density per square mile in the vicinity of the MRS and circle the score that corresponds with the associated population density.

Note: If an MRS is located in more than one county, use the largest population density value among the counties. If the MRS is within or borders a city or town, use the population density for the city or town, rather than that of the county.

Classification	Description	Score
> 500 persons per square mile	♦ There are more than 500 persons per square mile in the county in which the MRS is located, based on U.S. Census Bureau data.	5
100–500 persons per square mile	♦ There are 100 to 500 persons per square mile in the county in which the MRS is located, based on U.S. Census Bureau data.	3
< 100 persons per square mile	♦ There are fewer than 100 persons per square mile in the county in which the MRS is located, based on U.S. Census Bureau data.	1
POPULATION DENSITY	**DIRECTIONS:** Record **<u>the single highest score</u>** from above in the box to the right (maximum score = 5).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Density*** classification in the space provided.

The population density of King County, Washington, is 912.9 people per square mile (U.S. Census Quickfacts)

Table 7

EHE Module: Population Near Hazard Data Element Table

DIRECTIONS: Below are six classifications describing the number of inhabited structures near the MRS. The number of inhabited buildings relates to the population near the hazard. Determine the number of inhabited structures within two miles of the MRS boundary and circle the score that corresponds with the associated population near the known or suspected hazard.

Note: The term *inhabited structures* is defined in Appendix C of the Primer.

Classification	Description	Score
26 or more inhabited structures	♦ There are 26 or more inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	5
16 to 25 inhabited structures	♦ There are 16 to 25 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	4
11 to 15 inhabited structures	♦ There are 11 to 15 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	3
6 to 10 inhabited structures	♦ There are 6 to 10 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	2
1 to 5 inhabited structures	♦ There are 1 to 5 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	1
0 inhabited structures	♦ There are no inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	0
POPULATION NEAR HAZARD	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Near Hazard*** classification in the space provided.

There are more than 26 inhabited structures within a two-mile radius of the MRS. Reference PA Report, sections 3.3 and 3.4 and FUDS GIS: http://maps.crrel.usace.army.mil:7778/apex/fuds.fudscm2.map?map=&p_MapExt=-122.284564,47.667519,-122.237614,47.688555&p_layers=fudspoly&p_basemap=GES

Table 8

EHE Module: Types of Activities/Structures Data Element Table

DIRECTIONS: Below are five classifications of activities and/or inhabited structures near the hazard and their descriptions. Review the types of activities that occur and/or structures that are present within two miles of the MRS and circle the score(s) that correspond with **all** the activities/structure classifications at the MRS.

Note: The term *inhabited structure* is defined in Appendix C of the Primer.

Classification	Description	Score
Residential, educational, commercial, or subsistence	♦ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with any of the following purposes: residential, educational, child care, critical assets (e.g., hospitals, fire and rescue, police stations, dams), hotels, commercial, shopping centers, playgrounds, community gathering areas, religious sites, or sites used for subsistence hunting, fishing, and gathering.	5
Parks and recreational areas	♦ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with parks, nature preserves, or other recreational uses.	4
Agricultural, forestry	♦ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with agriculture or forestry.	3
Industrial or warehousing	♦ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with industrial activities or warehousing.	2
No known or recurring activities	♦ There are no known or recurring activities occurring up to two miles from the MRS's boundary or within the MRS's boundary.	1
TYPES OF ACTIVITIES/STRUCTURES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Types of Activities/Structures*** classifications in the space provided.

The MRS is currently part of Magnuson Park and borders a residential area (PA Report, Section 9.2.1). A number of child day care facilities and schools are located within an approximate 2 mile radius of the property (and MRS). Future land use of both the former NAS Seattle property and adjacent properties appear to be stable. The city of Seattle has made a long term investment in Magnuson Park. There is no indication that adjacent land use is likely to change from being residential (PA Report, Sections 3.3 and 3.4).

Table 9

EHE Module: Ecological and/or Cultural Resources Data Element Table

DIRECTIONS: Below are four classifications of ecological and/or cultural resources and their descriptions. Review the types of resources present and circle the score that corresponds with the ecological and/or cultural resource classifications at the MRS.

Note: The terms *ecological resources* and *cultural resources* are defined in Appendix C of the Primer.

Classification	Description	Score
Ecological and cultural resources present	♦ There are both ecological and cultural resources present on the MRS.	5
Ecological resources present	♦ There are ecological resources present on the MRS.	3
Cultural resources present	♦ There are cultural resources present on the MRS.	3
No ecological or cultural resources present	♦ There are no ecological resources or cultural resources present on the MRS.	0
ECOLOGICAL AND/OR CULTURAL RESOURCES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**0**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ecological and/or Cultural Resources*** classification in the space provided.

There is no evidence of ecological or cultural resources being present on the MRS (PA Report, Section 3.0).

Table 10
Determining the EHE Module Rating

DIRECTIONS:

1. From Tables 1–9, record the data element scores in the **Score** boxes to the right.
2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.
3. Add the three **Value** boxes and record this number in the **EHE Module Total** box below.
4. Circle the appropriate range for the **EHE Module Total** below.
5. Circle the **EHE Module Rating** that corresponds to the range selected and record this value in the **EHE Module Rating** box found at the bottom of the table.

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

	Source	Score	Value
Explosive Hazard Factor Data Elements			
Munitions Type	Table 1	2	3
Source of Hazard	Table 2	1	
Accessibility Factor Data Elements			
Location of Munitions	Table 3	1	16
Ease of Access	Table 4	10	
Status of Property	Table 5	5	
Receptor Factor Data Elements			
Population Density	Table 6	5	15
Population Near Hazard	Table 7	5	
Types of Activities/Structures	Table 8	5	
Ecological and /or Cultural Resources	Table 9	0	
EHE MODULE TOTAL			**34**

EHE Module Total	EHE Module Rating
92 to 100	A
82 to 91	B
71 to 81	C
60 to 70	D
48 to 59	E
38 to 47	F
less than 38	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected Explosive Hazard
EHE MODULE RATING	**NKSH**

Table 11
CHE Module: CWM Configuration Data Element Table

DIRECTIONS: Below are seven classifications of CWM configuration and their descriptions. Circle the score(s) that correspond to **all** CWM configurations known or suspected to be present at the MRS.

Note: The terms *CWM/UXO, CWM/DMM, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
CWM, explosive configuration either UXO or damaged DMM	The CWM known or suspected of being present at the MRS is: ♦ Explosively configured CWM that are UXO (i.e., CWM/UXO). ♦ Explosively configured CWM that are DMM (i.e., CWM/DMM) that have been damaged.	30
CWM mixed with UXO	♦ The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged, or nonexplosively configured CWM/DMM, or CWM not configured as a munition, that are commingled with conventional munitions that are UXO.	25
CWM, explosive configuration that are undamaged DMM	♦ The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged.	20
CWM, not explosively configured or CWM, bulk container	The CWM known or suspected of being present at the MRS is: ♦ Nonexplosively configured CWM/DMM. ♦ Bulk CWM/DMM (e.g., ton container).	15
CAIS K941 and CAIS K942	♦ The CWM/DMM known or suspected of being present at the MRS is CAIS K941-toxic gas set M-1 or CAIS K942-toxic gas set M-2/E11.	12
CAIS (chemical agent identification sets)	♦ Only CAIS, other than CAIS K941 and K942, are known or suspected of being present at the MRS.	10
Evidence of no CWM	♦ Following investigation, the physical evidence indicates that CWM are not present at the MRS, or the historical evidence indicates that CWM are not present at the MRS.	0
CWM CONFIGURATION	**DIRECTIONS:** Record **<u>the single highest score</u>** from above in the box to the right (maximum score = 30).	**0**

DIRECTIONS: Document any MRS-specific data used in selecting the ***CWM Configuration*** classifications in the space provided.

Historical records indicate a “gas training building” was located in the northwestern part of the property. This area is away from the MRS and on a portion of the former NAS that is not FUDS eligible. There is no evidence CWM was present or used on the MRS. (PA Report, Sections 4.2.2 and 5.3) Tables 12 through 19 intentionally omitted accordance to Army Guidance

Tables 12 through 19 intentionally omitted accordance to Army Guidance

Table 20

Determining the CHE Module Rating

DIRECTIONS:

1. From Tables 11–19, record the data element scores in the **Score** boxes to the right.

2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.

3. Add the three **Value** boxes and record this number in the **CHE Module Total** box below.

4. Circle the appropriate range for the **CHE Module Total** below.

5. Circle the **CHE Module Rating** that corresponds to the range selected and record this value in the **CHE Module Rating** box found at the bottom of the table.

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

	Source	Score	Value
CWM Hazard Factor Data Elements			
CWM Configuration	Table 11	0	0
Sources of CWM	Table 12		
Accessibility Factor Data Elements			
Location of CWM	Table 13		
Ease of Access	Table 14		
Status of Property	Table 15		
Receptor Factor Data Elements			
Population Density	Table 16		
Population Near Hazard	Table 17		
Types of Activities/Structures	Table 18		
Ecological and /or Cultural Resources	Table 19		
CHE MODULE TOTAL			**0**

CHE Module Total	CHE Module Rating
92 to 100	A
82 to 91	B
71 to 81	C
60 to 70	D
48 to 59	E
38 to 47	F
less than 38	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected CWM Hazard
CHE MODULE RATING	**NKSH**

Table 21
HHE Module: Groundwater Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's groundwater and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value.** Determine the **CHF** by adding the contaminant **ratios** together, including any additional groundwater contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record **CHF Value**. If there is no known or suspected MC hazard present in the groundwater, select the box at the bottom of the table.

Contaminant	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios
CHF Scale	**CHF Value**	**Sum the Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$\text{CHF} = \sum \frac{[\text{Maximum Concentration of Contaminant}]}{[\text{Comparison Value for Contaminant}]}$$

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the groundwater is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in groundwater has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the groundwater to a potential point of exposure (possibly due to the presence of geological structures or physical controls.)	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater receptors at the MRS.

Classification	Description	Value
Identified	There is a threatened water supply well downgradient of the source and the groundwater is a current source of drinking water or source of water for other beneficial uses such as irrigation/agriculture (equivalent to Class I or IIA aquifer).	H
Potential	There is no threatened water supply well downgradient of the source and the ground water is currently or potentially usable for drinking water, irrigation, or agriculture (equivalent to Class I, IIA, or IIB aquifer).	M
Limited	There is no potentially threatened water supply well downgradient of the source and the groundwater is not considered a potential source of drinking water and is of limited beneficial use (equivalent to Class IIIA or IIIB aquifer, or where perched aquifer exists only).	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Groundwater MC Hazard ☐

Table 21 Comments: Ground water was not sampled. (PA Report, Sections 8.3.2 and 9.2.1)

Table 22
HHE Module: Surface Water – Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's surface water and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value.** Determine the **CHF** by adding the contaminant **ratios** together, including any additional surface water contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record **CHF Value**. If there is no known or suspected MC hazard with human endpoints present in the surface water, select the box at the bottom of the table.

Contaminant	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios
CHF Scale	**CHF Value**	**Sum the Ratios**	
CHF > 100	**H (High)**	$CHF = \sum \frac{[\text{Maximum Concentration of Contaminant}]}{[\text{Comparison Value for Contaminant}]}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to the presence of geological structures or physical controls.)	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Surface Water (Human Endpoint) MC Hazard ☐

Table 22 Comments: Surface water was not sampled. (PA Report, Sections 8.3.2 and 9.2.1)

Table 23

HHE Module: Sediment – Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's sediment and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value.** Determine the **CHF** by adding the contaminant **ratios** together, including any additional sediment contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record **CHF Value**. If there is no known or suspected MC hazard with human endpoints present in the sediment, select the box at the bottom of the table.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
CHF Scale	**CHF Value**	**Sum the Ratios**	
CHF > 100	**H (High)**	$\text{CHF} = \sum \frac{[\text{Maximum Concentration of Contaminant}]}{[\text{Comparison Value for Contaminant}]}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to the presence of geological structures or physical controls.)	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Sediment (Human Endpoint) MC Hazard ☐

Table 23 Comments: Sediment was not sampled. (PA Report, Sections 8.3.2 and 9.2.1)

Table 24

HHE Module: Surface Water – Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's surface water and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value.** Determine the **CHF** by adding the contaminant **ratios** together, including any additional surface water contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record **CHF Value**. If there is no known or suspected MC hazard with ecological endpoints present in the surface water, select the box at the bottom of the table.

Contaminant	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios
CHF Scale	**CHF Value**	**Sum the Ratios**	
CHF > 100	**H (High)**	$$CHF = \sum \frac{[\text{Maximum Concentration of Contaminant}]}{[\text{Comparison Value for Contaminant}]}$$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to the presence of geological structures or physical controls.)	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Surface Water (Ecological Endpoint) MC Hazard ☐

Table 24 Comments: Surface water was not sampled. (PA Report, Sections 8.3.2 and 9.2.1)

Table 25

HHE Module: Sediment – Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's sediment and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value.** Determine the **CHF** by adding the contaminant **ratios** together, including any additional sediment contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record **CHF Value**. If there is no known or suspected MC hazard with ecological endpoints present in the sediment, select the box at the bottom of the table.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
CHF Scale	**CHF Value**	**Sum the Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$\text{CHF} = \sum \frac{[\text{Maximum Concentration of Contaminant}]}{[\text{Comparison Value for Contaminant}]}$$

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to the presence of geological structures or physical controls.)	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Sediment (Ecological Endpoint) MC Hazard ☐

Table 25 Comments: Sediment was not sampled. (PA Report, Sections 8.3.2 and 9.2.1)

Table 26
HHE Module: Surface Soil Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's surface soil and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value.** Determine the **CHF** by adding the contaminant **ratios** together, including any additional surface soil contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record **CHF Value**. If there is no known or suspected MC hazard with present in the surface soil, select the box at the bottom of the table.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
CHF Scale	**CHF Value**	**Sum the Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		

$$CHF = \sum \frac{[\text{Maximum Concentration of Contaminant}]}{[\text{Comparison Value for Contaminant}]}$$

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface soil migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface soil is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface soil has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface soil to a potential point of exposure (possibly due to the presence of geological structures or physical controls.)	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface soil receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface soil to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface soil to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface soil to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Surface Soil MC Hazard ☐

Table 26 Comments: Surface soil was not sampled. (PA Report, Sections 8.3.2 and 9.2.1)

Table 27
HHE Module: Supplemental Contaminant Hazard Factor Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Only use this table if there are more than five contaminants in any given medium present at the MRS. This is a supplemental table designed to hold information about contaminants that do not fit in the previous tables. Indicate the **media** in which these contaminants are present. Then record all **contaminants**, their **maximum concentrations** and their **comparison values** (from Appendix B of the Primer) in the table below. Calculate and record the **ratio** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** for each medium on the appropriate media-specific tables.

Note: Do not add ratios from different media.

Media	Contaminant	Maximum Concentration	Comparison Value	Ratio

Table 28

Determining the HHE Module Rating

DIRECTIONS:

1. Record the letter values (H, M, L) for the **Contaminant Hazard, Migration Pathway,** and **Receptor Factors** for the media (from Tables 21-26) in the corresponding boxes below.
2. Record the media's three-letter combinations in the **Three-Letter Combination** boxes below (three-letter combinations are arranged from Hs to Ms to Ls).
3. Using the **HHE Ratings** provided below, determine each media's rating (A-G) and record the letter in the corresponding **Media Rating** box below.

Media (Source)	Contaminant Hazard Factor Value	Migratory Pathway Factor Value	Receptor Factor Value	Three-Letter Combination (Hs-Ms-Ls)	Media Rating (A-G)
Groundwater (Table 21)					
Surface Water/Human Endpoint (Table 22)					
Sediment/ Human Endpoint (Table 23)					
Surface Water/Ecological Endpoint (Table 24)					
Sediment/Ecological Endpoint (Table 25)					
Surface Soil (Table 26)					

DIRECTIONS (cont.):

4. Select the single highest Media Rating (A is the highest; G is the lowest) and enter the letter in the **HHE Module Rating** box.

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more media, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

HHE MODULE RATING	

HHE Ratings (for reference only)

Combination	Rating
HHH	A
HHM	B
HHL	C
HMM	C
HML	D
MMM	D
HLL	E
MML	E
MLL	F
LLL	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected MC Hazard

Table 29

MRS Priority

DIRECTIONS: In the chart below, circle the letter **rating** for each module recorded in Table 10 (EHE), Table 20 (CHE), and Table 28 (HHE). Circle the corresponding numerical **priority** for each module. If information to determine the module rating is not available, choose the appropriate alternative module rating. The MRS priority is the single highest priority; record this number in the **MRS or Alternative Priority** box at the bottom of the table.

Note: An MRS assigned Priority 1 has the highest relative priority; an MRS assigned Priority 8 has the lowest relative priority. Only an MRS with CWM known or suspected to be present can be assigned Priority 1; an MRS that has CWM known or suspected to be present cannot be assigned Priority 8.

EHE Rating	Priority	CHE Rating	Priority	HHE Rating	Priority
		A	1		
A	2	B	2	A	2
B	3	C	3	B	3
C	4	D	4	C	4
D	5	E	5	D	5
E	6	F	6	E	6
F	7	G	7	F	7
G	8			G	8
Evaluation Pending		Evaluation Pending		Evaluation Pending	
No Longer Required		No Longer Required		No Longer Required	
No Known or Suspected Explosive Hazard		No Known or Suspected CWM Hazard		No Known or Suspected MC Hazard	
MRS or ALTERNATIVE PRIORITY				**Evaluation Pending**	

Appendix O

TAG Review Fact Sheet

Appendix P

Response to Comments

Appendix Q

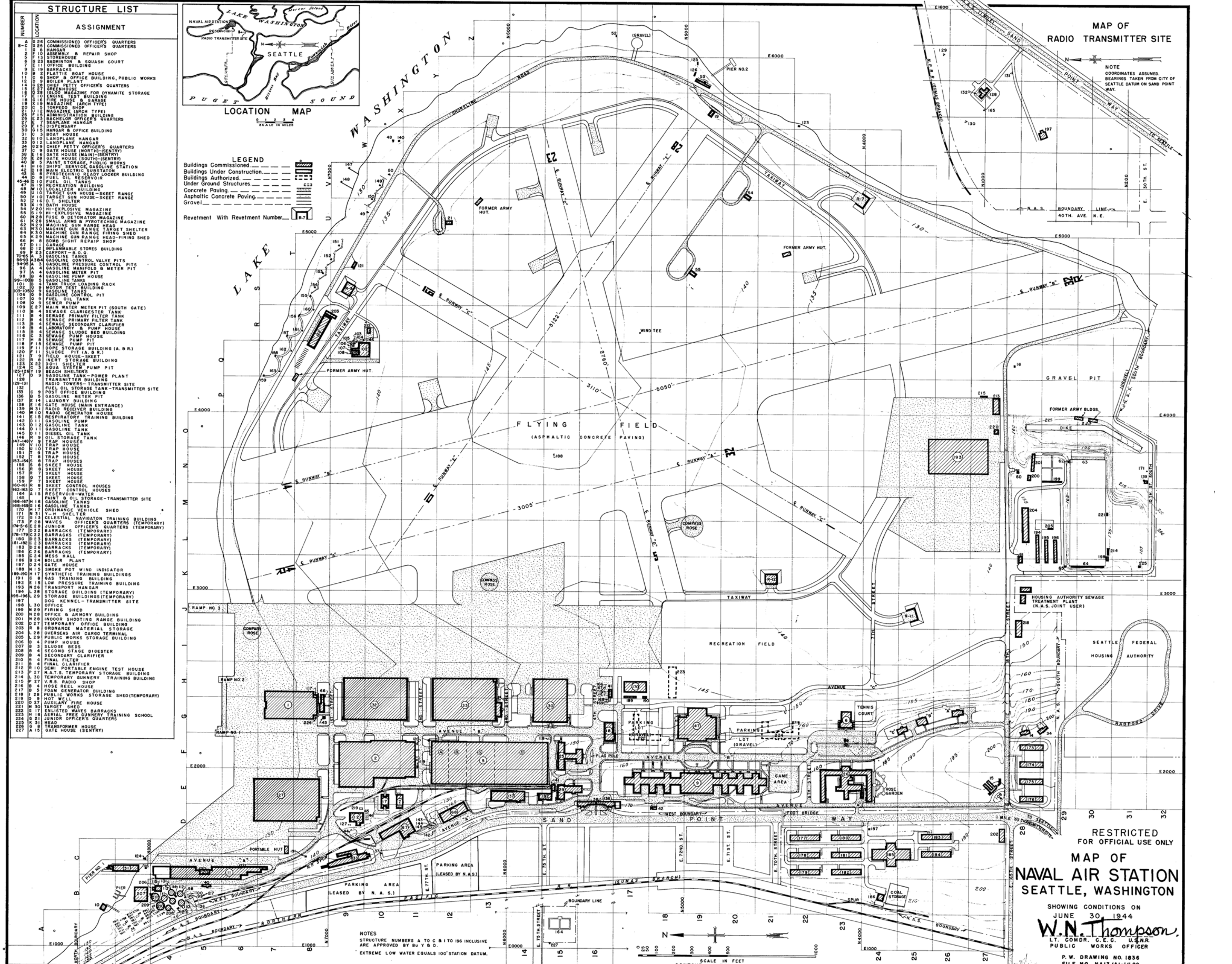
Report Distribution

Appendix R

Report Plates

STRUCTURE LIST

NUMBER	LOCATION	ASSIGNMENT
A	G 26	COMMISSIONED OFFICER'S QUARTERS
B-C	G 25	COMMISSIONED OFFICER'S QUARTERS
1	G 8	HANGAR
2	F 10	ASSEMBLY & REPAIR SHOP
5	F 13	STOREHOUSE
6	G 23	BADMINTON & SQUASH COURT
7	E 11	OFFICE BUILDING
9	E 19	BARRACKS
10	B 2	FLATTIE BOAT HOUSE
11	C 6	SHOP & OFFICE BUILDING, PUBLIC WORKS
12	D 9	BOILER PLANT
14	G 28	CHIEF PETTY OFFICER'S QUARTERS
15	E 27	GREENHOUSE
16	O 28	IGLOO MAGAZINE FOR DYNAMITE STORAGE
17	E 10	ENGINE TEST BUILDING
18	G 16	FIRE HOUSE & GARAGE
19	X 19	MAGAZINE (ARCH TYPE)
20	C 5	TORPEDO SHOP
21	U 12	MAGAZINE (ARCH TYPE)
25	F 15	ADMINISTRATION BUILDING
26	E 23	BACHELOR OFFICER'S QUARTERS
27	E 7	SEAPLANE HANGAR
29	E 15	DISPENSARY
30	G 15	HANGAR & OFFICE BUILDING
31	C 3	BOAT HOUSE
32	G 10	LANDPLANE HANGAR
33	G 12	LANDPLANE HANGAR
34	G 29	CHIEF PETTY OFFICER'S QUARTERS
37	C 9	GATE HOUSE (NORTH)-(SENTRY)
38	E 16	GATE HOUSE (MAIN)-(SENTRY)
39	E 28	GATE HOUSE (SOUTH)-(SENTRY)
40	B 5	PAINT, STORAGE, PUBLIC WORKS
41	H 16	SHIPS' SERVICE, GASOLINE STATION
42	D 18	MAIN ELECTRIC SUBSTATON
43	G 8	PYROTECHNIC READY LOCKER BUILDING
44	D 9	FUEL OIL RESERVOIR
45-46	D 10	FUEL OIL TANKS
47	G 19	RECREATION BUILDING
48	W 10	LOCALIZER BUILDING
49	U 10	TARGET GUN HOUSE—SKEET RANGE
50	V 10	TARGET GUN HOUSE—SKEET RANGE
52	Z 16	D. T. SHELTER
53	X 19	BATH HOUSE
54	V 20	HI-EXPLOSIVE MAGAZINE
55	S 19	HI-EXPLOSIVE MAGAZINE
60	N 28	FUSE & DETONATOR MAGAZINE
61	K 28	SMALL ARMS & PYROTECHNIC MAGAZINE
62	N 29	MACHINE GUN RANGE HEAD
63	N 30	MACHINE GUN RANGE TARGET SHELTER
64	K 30	MACHINE GUN RANGE FIRING SHED
65	K 29	MACHINE GUN RANGE HEAD-FIRING SHED
66	H 8	BOMB SIGHT REPAIP SHOP
67	D 11	GARAGE
68	D 12	INFLAMMABLE STORES BUILDING
69	F 23	CARPORT—B. O. Q.
70-85	A 3	GASOLINE TANKS
86-93	A 3&4	GASOLINE CONTROL VALVE PITS
94-95	A 3	GASOLINE PRESSURE CONTROL PITS
96	A 4	GASOLINE MANIFOLD & METER PIT
97	A 4	GASOLINE METER PIT
98	B 4	GASOLINE PUMP HOUSE
99-100	B 5	GASOLINE TANKS
101	B 4	TANK TRUCK LOADING RACK
102	Q 9	MOTOR TEST BUILDING
103-105	Q 9	GASOLINE TANKS
106	Q 9	GASOLINE CONTROL PIT
107	Q 9	FUEL OIL TANK
108	Q 9	SEWER PUMP
109	E 27	MAIN WATER METER PIT (SOUTH GATE)
110	B 4	SEWAGE CLARIGESTER TANK
111	B 4	SEWAGE PRIMARY FILTER TANK
112	B 4	SEWAGE PRIMARY FILTER TANK
113	B 4	SEWAGE SECONDARY CLARIFIER
114	B 4	LABORATORY & PUMP HOUSE
115	B 4	SEWAGE SLUDGE BED BUILDING
116	C 3	SEWAGE PUMP HOUSE
117	H 8	SEWAGE PUMP PIT
118	F 15	SEWAGE PUMP PIT
119	F 11	DOPE STORAGE BUILDING (A. & R.)
120	F 11	SLUDGE PIT (A. & R.)
121	T 9	FIELD HOUSE-SKEET
122	R 8	INERT STORAGE BUILDING
123	X 22	DO-1 SHELTER
124	C 3	AQUA SYSTEM PUMP PIT
125-126	Y 19	BEACH SHELTER'S
127	D 9	GASOLINE TANK—POWER PLANT
128		TRANSMITTER BUILDING
129-131		RADIO TOWERS— TRANSMITTER SITE
132		FUEL OIL STORAGE TANK-TRANSMITTER SITE
133	C 9	POST OFFICE BUILDING
136	B 5	GASOLINE METER PIT
137	E 14	LAUNDRY BUILDING
138	E 16	GATE HOUSE (MAIN ENTRANCE)
139	N 31	RADIO RECEIVER BUILDING
140	W 10	RADIO GENERATOR HOUSE
141	E 15	RESPIRATORY TRAINING BUILDING
142	D 11	GASOLINE PUMP
143	D 12	GASOLINE TANK
144	D 11	GASOLINE TANK
145	D 11	DIESEL OIL TANK
146	R 9	OIL STORAGE TANK
147-148	V 9	TRAP HOUSES
149	V 10	TRAP HOUSE
150	U 10	TRAP HOUSE
151	T 9	TRAP HOUSE
152	T 8	TRAP HOUSE
153-154	S 8	TRAP HOUSES
155	S 8	SKEET HOUSE
156	R 8	SKEET HOUSE
157	R 7	SKEET HOUSE
158	Q 7	SKEET HOUSE
159	P 7	SKEET HOUSE
160-161	R 8	SKEET CONTROL HOUSES
162-163	Q 7	SKEET CONTROL HOUSES
164	A 15	RESERVOIR-WATER
165		PAINT & OIL STORAGE-TRANSMITTER SITE
166-167	H 16	GASOLINE TANKS
168-169	G 16	GASOLINE TANKS
170	H 17	ORDINANCE VEHICLE SHED
171	N 31	Y-H SHELTER
172	G 13	CELESTIAL NAVIGATON TRAINING BUILDING
173	F 28	WAVES OFFICER'S QUARTERS (TEMPORARY)
174-5-6	E 28	JUNIOR OFFICER'S QUARTERS (TEMPORARY)
177	D 22	BARRACKS (TEMPORARY)
178-179	C 22	BARRACKS (TEMPORARY)
180	D 23	BARRACKS (TEMPORARY)
181-182	C 23	BARRACKS (TEMPORARY)
183	D 26	BARRACKS (TEMPORARY)
184	C 26	BARRACKS (TEMPORARY)
185	C 24	MESS HALL
186	B 24	BOILER PLANT
187	D 24	GATE HOUSE
188	N 15	SMOKE POT WIND INDICATOR
189-190	H 17	SYNTHETIC TRAINING BUILDINGS
191	C 8	GAS TRAINING BUILDING
192	E 15	LOW PRESSURE TRAINING BUILDING
193	N 26	TRANSPORT HANGAR
194	L 28	STORAGE BUILDING (TEMPORARY)
195-196	L 29	STORAGE BUILDINGS (TEMPORARY)
197		DOG KENNEL—TRANSMITTER SITE
198	L 30	OFFICE
199	N 29	FIRING SHED
200	N 28	OFFICE & ARMORY BUILDING
201	N 28	INDOOR SHOOTING RANGE BUILDING
202	D 27	TEMPORARY OFFICE BUILDING
203	R 8	ORDNANCE MATERIAL STORAGE
204	L 28	OVERSEAS AIR CARGO TERMINAL
205	L 29	PUBLIC WORKS STORAGE BUILDING
206	B 4	PUMP HOUSE
207	B 3	SLUDGE BEDS
208	B 4	SECOND STAGE DIGESTER
209	B 4	SECONDARY CLARIFIER
210	B 4	FINAL FILTER
211	B 4	FINAL CLARIFIER
212	R 10	SEMI PORTABLE ENGINE TEST HOUSE
213	P 27	N.A.T.S. TEMPORARY STORAGE BUILDING
214	L 30	TEMPORARY GUNNERY TRAINING BUILDING
215	P 27	V. R.S. RADIO SHOP
216	B 4	HOSE REEL HOUSE
217	B 5	FOAM GENERATOR BUILDING
218	I 28	PUBLIC WORKS STORAGE SHED (TEMPORARY)
219	D 9	HOT WELL
220	O 27	AUXILARY FIRE HOUSE
221	M 30	TARGET SHED
222	G 17	ENLISTED WAVES BARRACKS
223	H 18	AERIAL FREE GUNNERY TRAINING SCHOOL
224	G 21	JUNIOR OFFICER'S QUARTERS
225	K 31	HEAD
226	G 8	TRANSFORMER HOUSE
227	A 15	GATE HOUSE (SENTRY)



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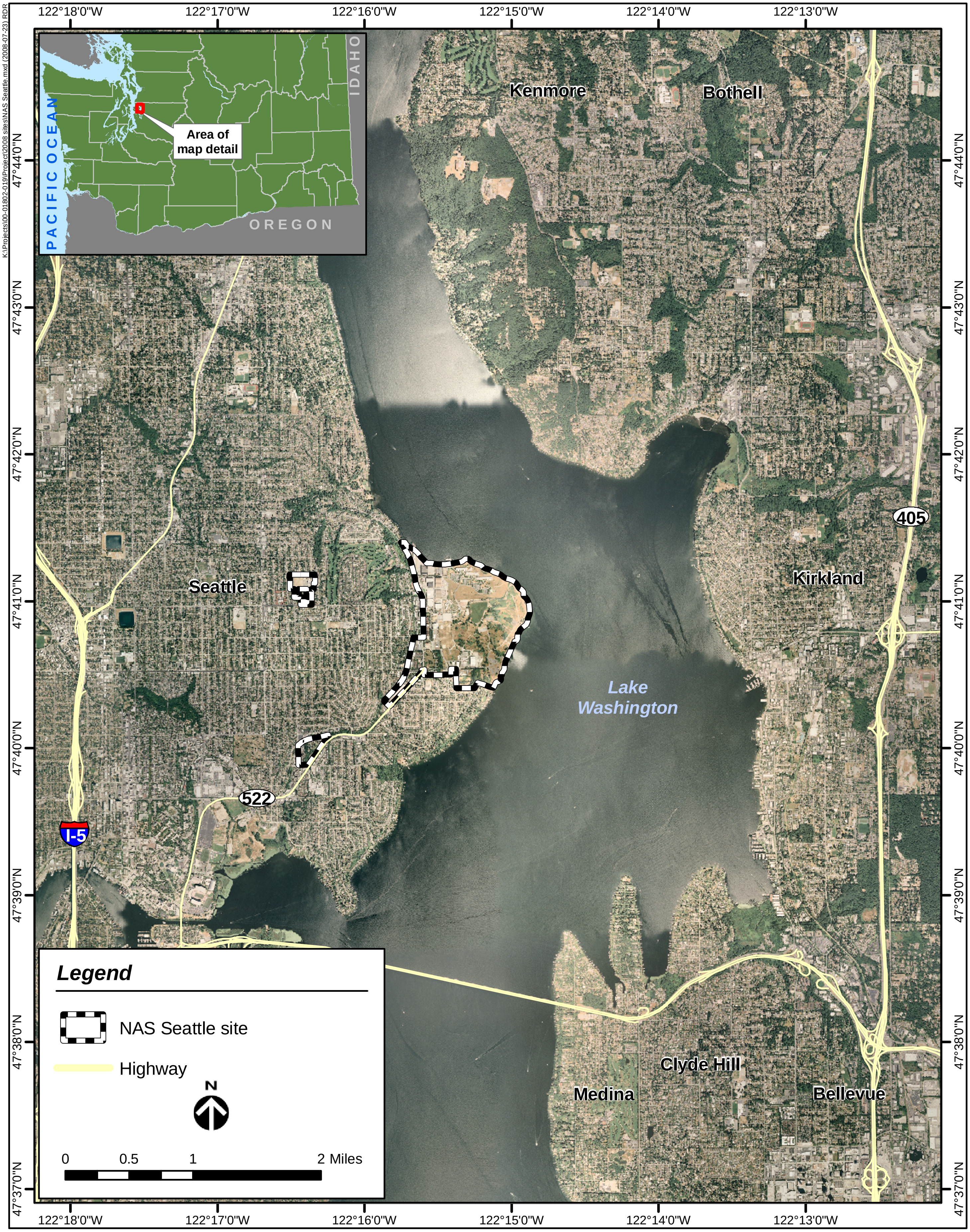
633693 51½% SEATTLE, WASH. 13-31

FIGURES

Figure 3-1. Vicinity Map of NAS Seattle



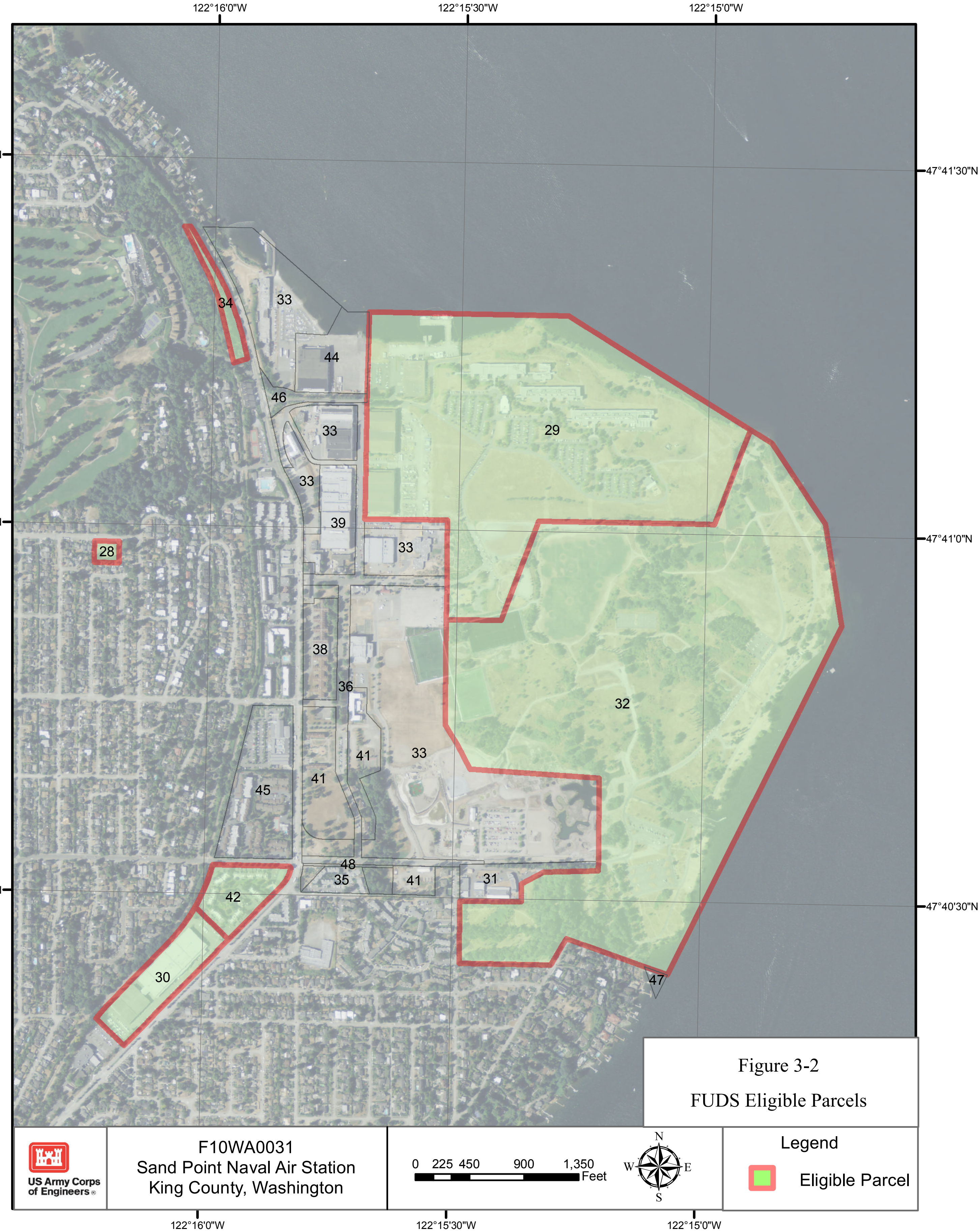


Figure 3-2

FUDS Eligible Parcels

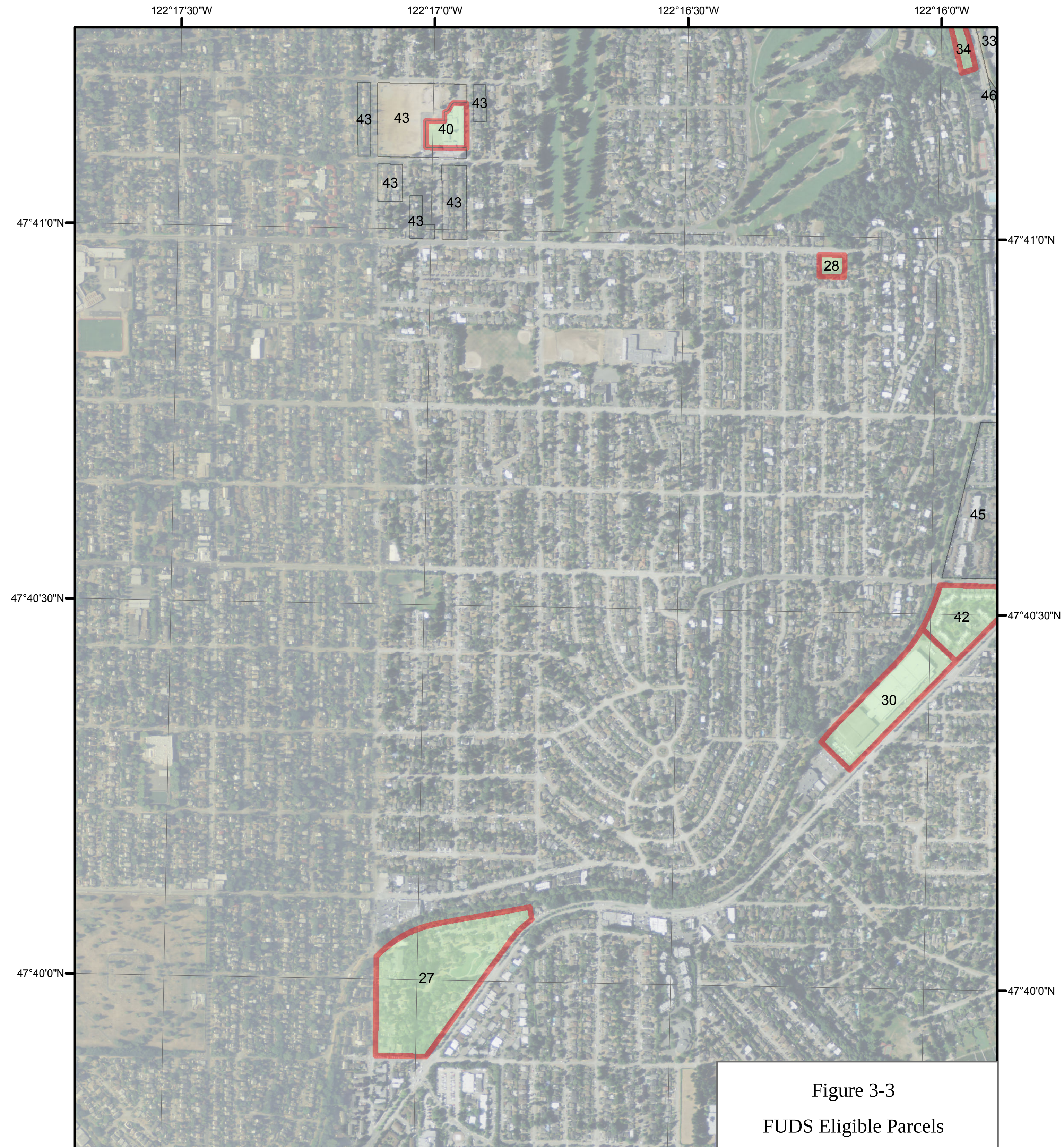


Figure 3-3

FUDS Eligible Parcels

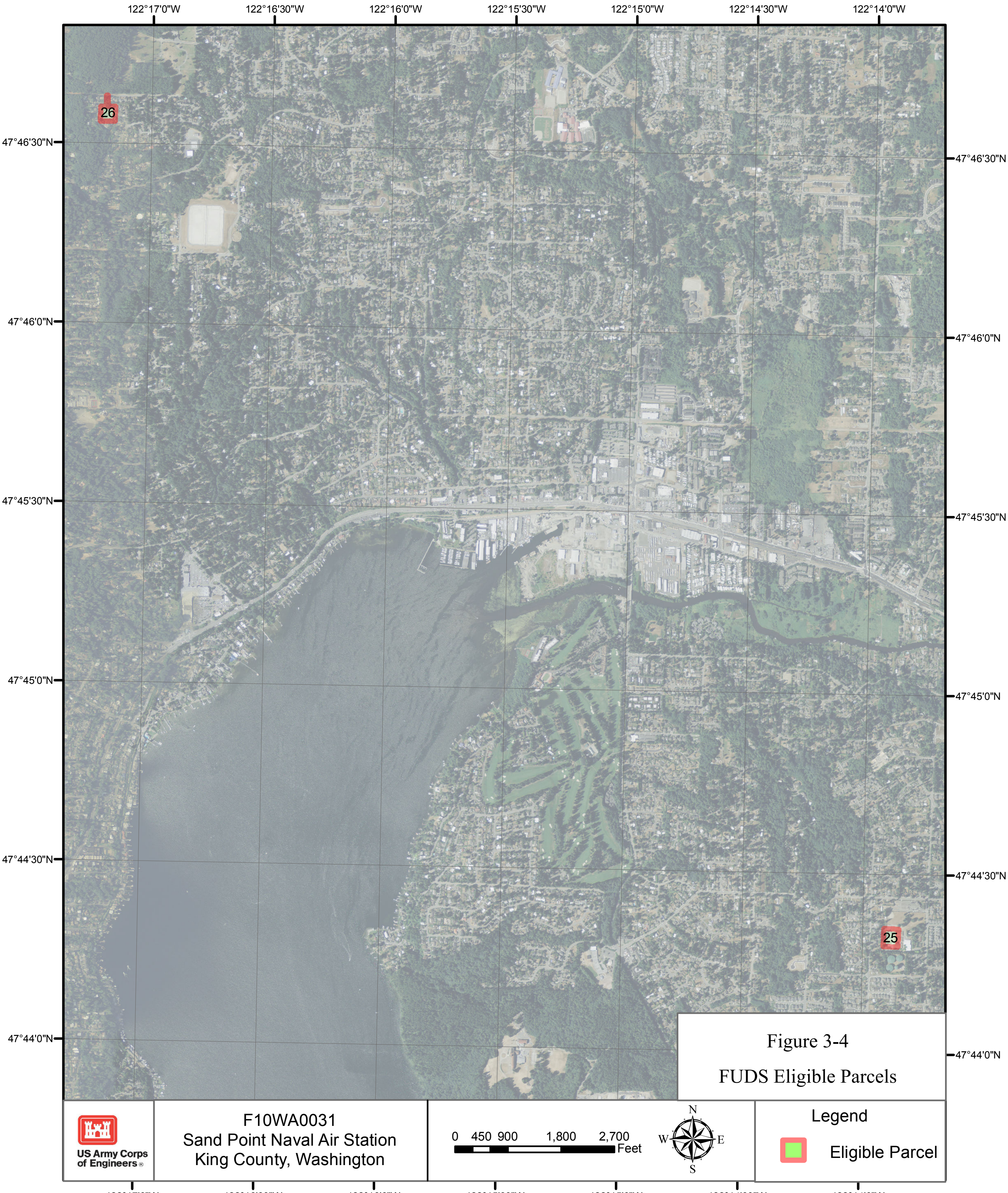
US Army Corps of Engineers

F10WA0031
Sand Point Naval Air Station
King County, Washington

0 225 450 900 1,350 Feet

Legend

Eligible Parcel


122°17'0"W
122°16'30"W
122°16'0"W
122°15'30"W
122°15'0"W
122°14'30"W
122°14'0"W
47°46'30"N
47°46'0"N
47°45'30"N
47°45'0"N
47°44'30"N
47°44'0"N
26
25
Figure 3-4
FUDS Eligible Parcels
US Army Corps of Engineers®
F10WA0031
Sand Point Naval Air Station
King County, Washington
0 450 900 1,800 2,700
Feet
N
W
E
S
Legend
Eligible Parcel

Enclosure

Figure 3-5. Navy Owned Property - 1978

STRUCTURE LIST

NO.	LOC.	ASSIGNMENT
2	F10	Hanger (Coast Guard & Marines)
5	F13	Warehouse (Supply)
6	G23	Bowling Alley
9	E19	EM Barracks; COM Admin.
11	C6	Public Works
12	D9	Heating Plant
15	E27	Hobby Shop - Ceramics
17	E10	Rehabilitation Shop
18	G16	Fire Station
20	C5	P.W. Storage
25	F15	C.O.M. Admin.
26	E23	BOQ
27	E7	Reserve Activities
29	E15	Dispensary Dental
30	G15	Admin, Training, Personnel & Fin.
31	C3	Boat House
38	E16	Main Entrance Sentry House
40	B5	P.W. Shop
41	H16	Navy Exchange Maintenance Shop
42	D18	Main Substation
47	G19	Recreation Bldg; Special Svcs.
60	N28	Vacant
61	K28	Disaster Control Storage
67	D11	Transportation
68	D12	Flamable Warehouse
69	F23	BOQ Carport
98	B5	Gas Pump House
99	B5	Vechicle Fuel Tank
100	B5	Vechicle Fuel Tank
101	B4	Tank Truck Fill Stand
114	B4	P.W. Maintenance Shop
115	B4	P.W. Maintenance Shop
116	C3	Sewage-Plumbing Station
119	F11	Flammable Storage (Vacant)
124	C3	Aqua Pumping Station
137	E14	N X Laundry & Dry Clean
138	E16	Gatehouse
141	E15	Navy Wives Club
142	D11	Filling Station
143	D12	Vechicle Fuel Tank
144	D11	" " "
145	D11	" " "
192	E15	Consolidated Mess Coordinator - Admin.
193	N26	Exchange & Commissary
194	N26	Chick - Inn
198	N25	Thrift Store
204	L28	Fish & Wildlife Lab.
206	B4	Sewage Pumping Station
222	G17	SUPSHIPS
223	H18	"X" Division Qtrs.
224	F21	CPO, Waves, Enlisted Mens Qtrs.
44	D9	Fuel Oil Storage Tank
228	M27	NX Small Shops
229	M27	NX Package Store Whse.
244	J25	Navy Exch. Storage
248	C10	Vechicle Storage Shelter
275	A2	Boat Dock Shelter & Shop
283	C5	P.W. Vehicle Storage.
301	K27	Country Store Exch.
303	C10	Gatehouse
307	M29	F.&W.F. Lab Storage
308	K26	NX Pacakage Store
310	J28	Auto Hobby Shop - Spec. Svcs.
109	E27	Main Water Pit (South)
320	F16	Flagpole
321	C2	Small Craft Pier
324	B2	Recreational Boat Dock
327	G18	Playing Court
328	G24	" "
330	G26	Quarters "A"
331	G25	Quarters "B"
332	G25	Quarters "C"
333	G28	Quarters "D"
334	G28	Quarters "E"
337	E12	Pedestrian Bridge
385	P27	Regulator Vault
389	B1	Mooring Dolphin
391	D11	Truck Scale
402	B2	Floating Boat House
403	E15	Stand-By Generator Plant
344	K27	NX Farm Store
340	J27	NX Pump Station
341	I26	NX Courtesy Island
342	J27	NX Service Station Office
343	J26	NX Auto Service Bay
396	D16	World Flight Monument
281	C10	Main Water Pit (North)
394	F19	Totem Pole
395	F19	Bell Monument
399	C3	Small Craft Fueling Station
		Sanitary Sewer Lift Station
401	I27	South Gate House

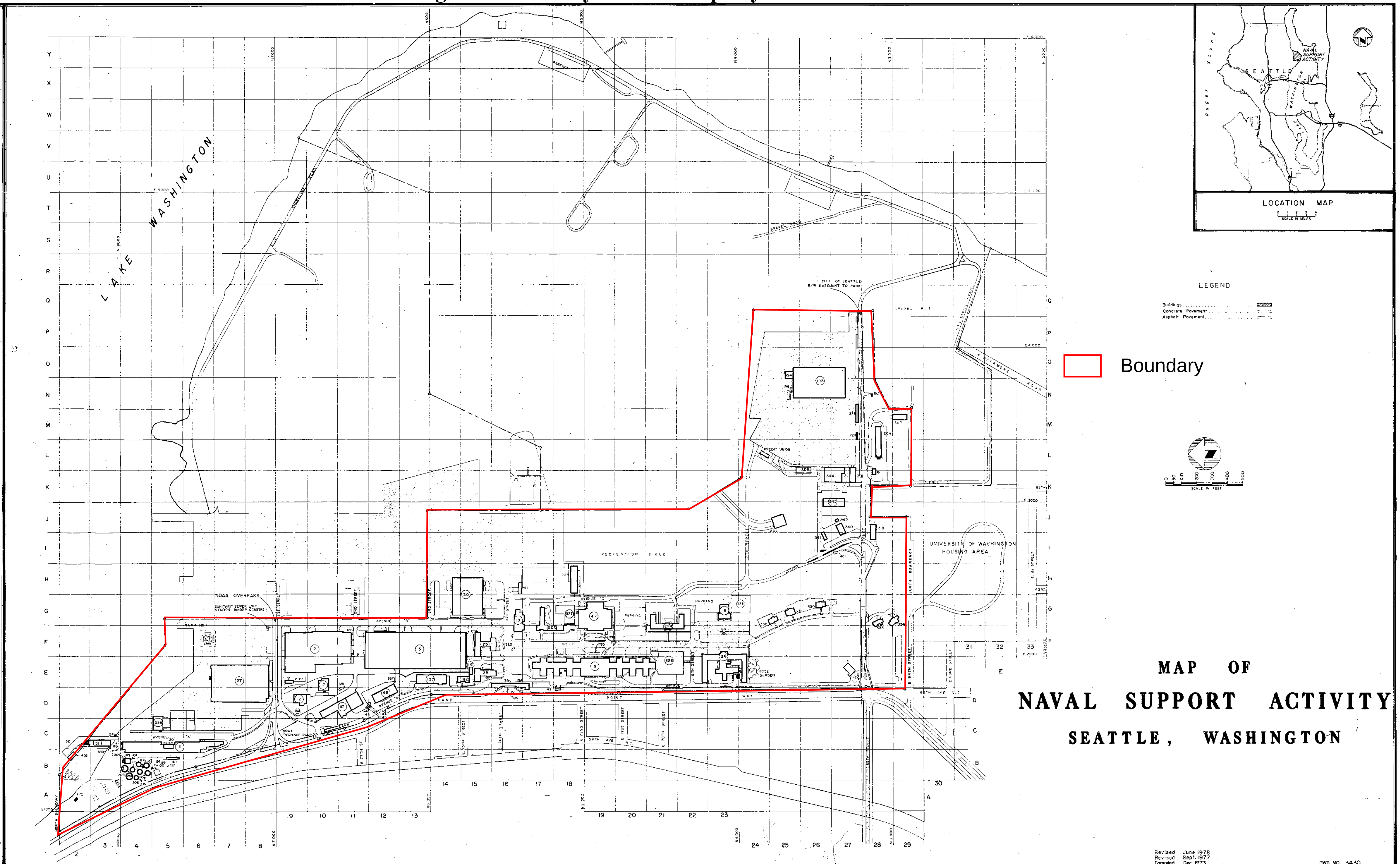


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Figure 3-6. NAS Seattle (northwest portion) - 1926

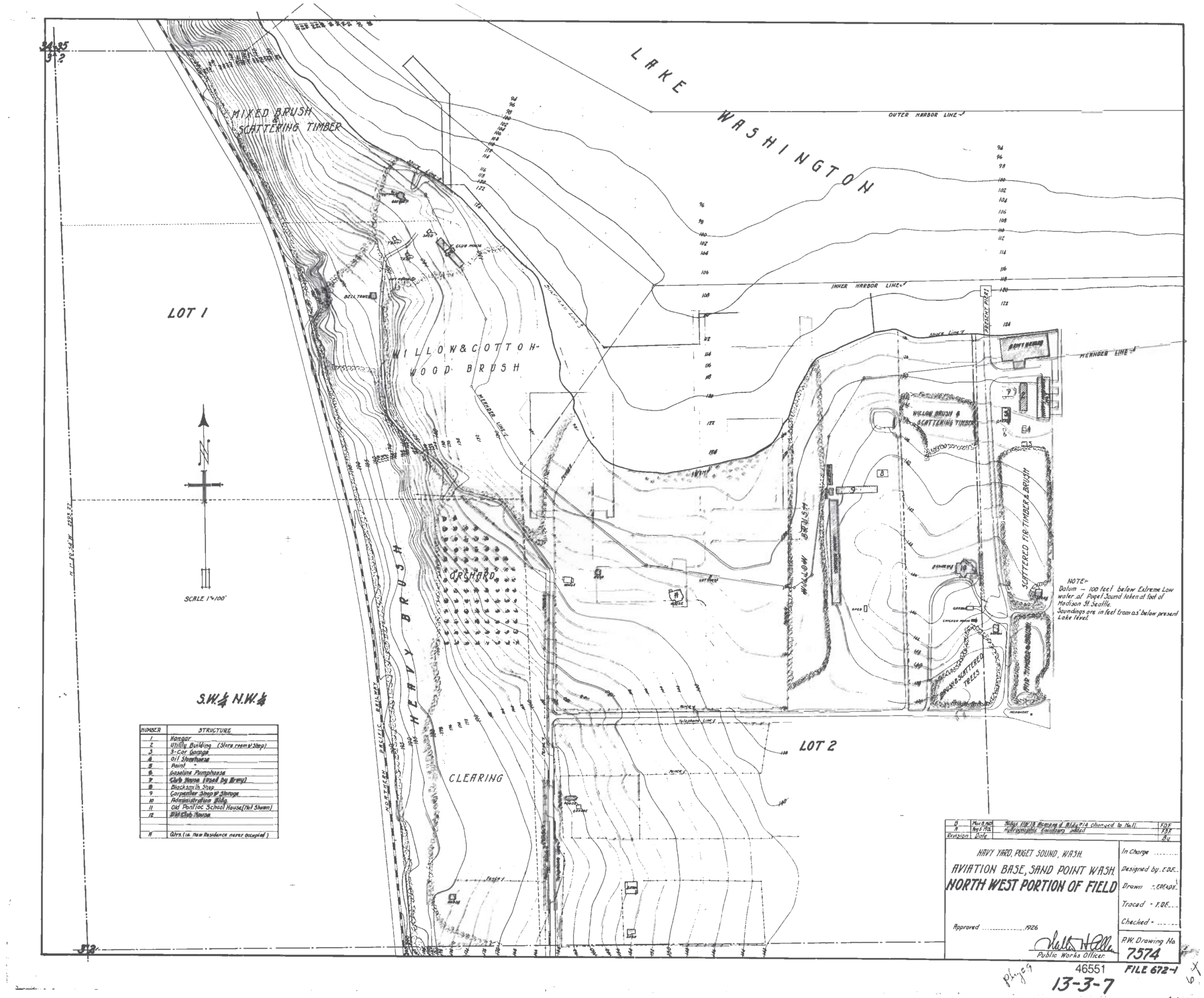
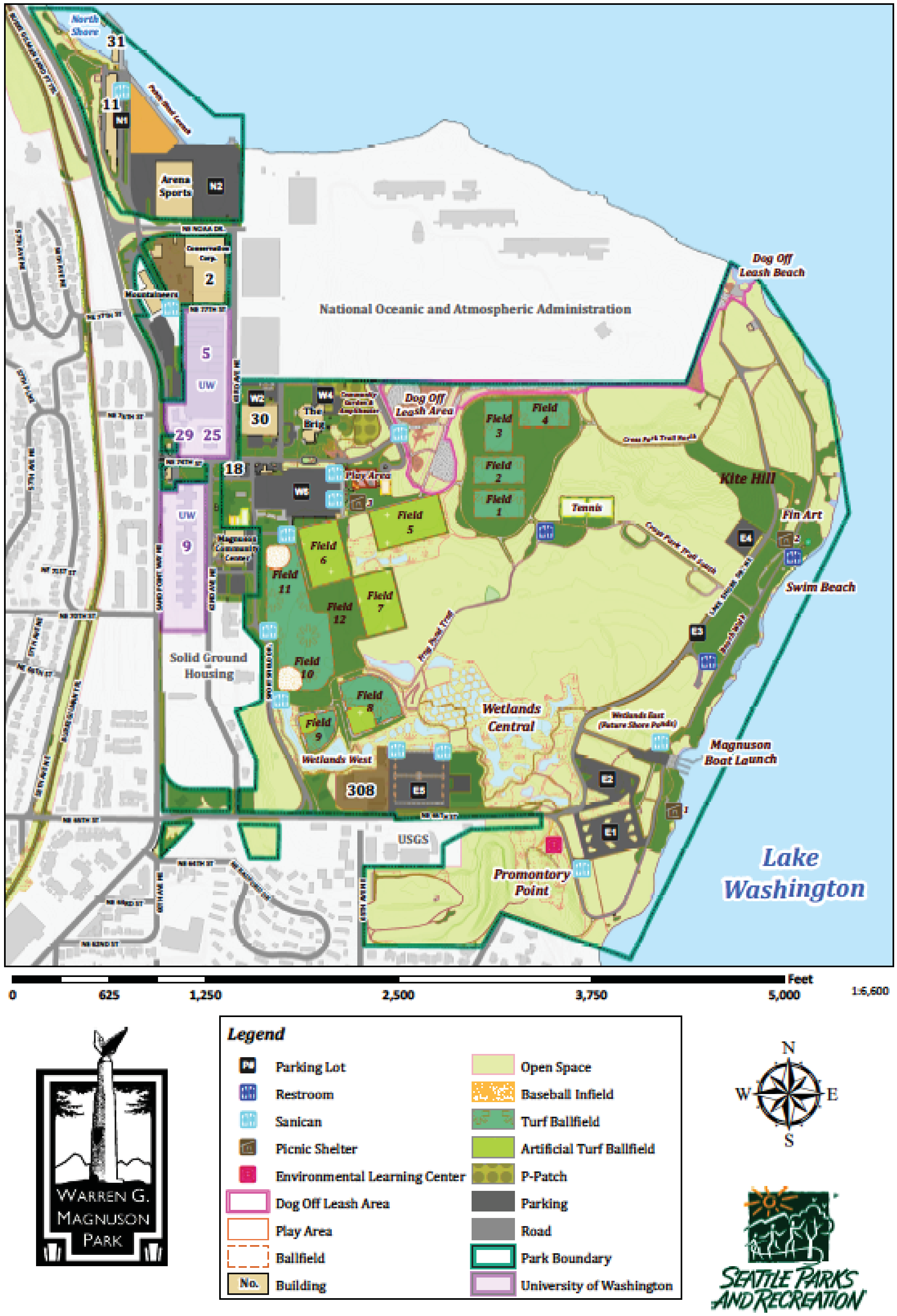
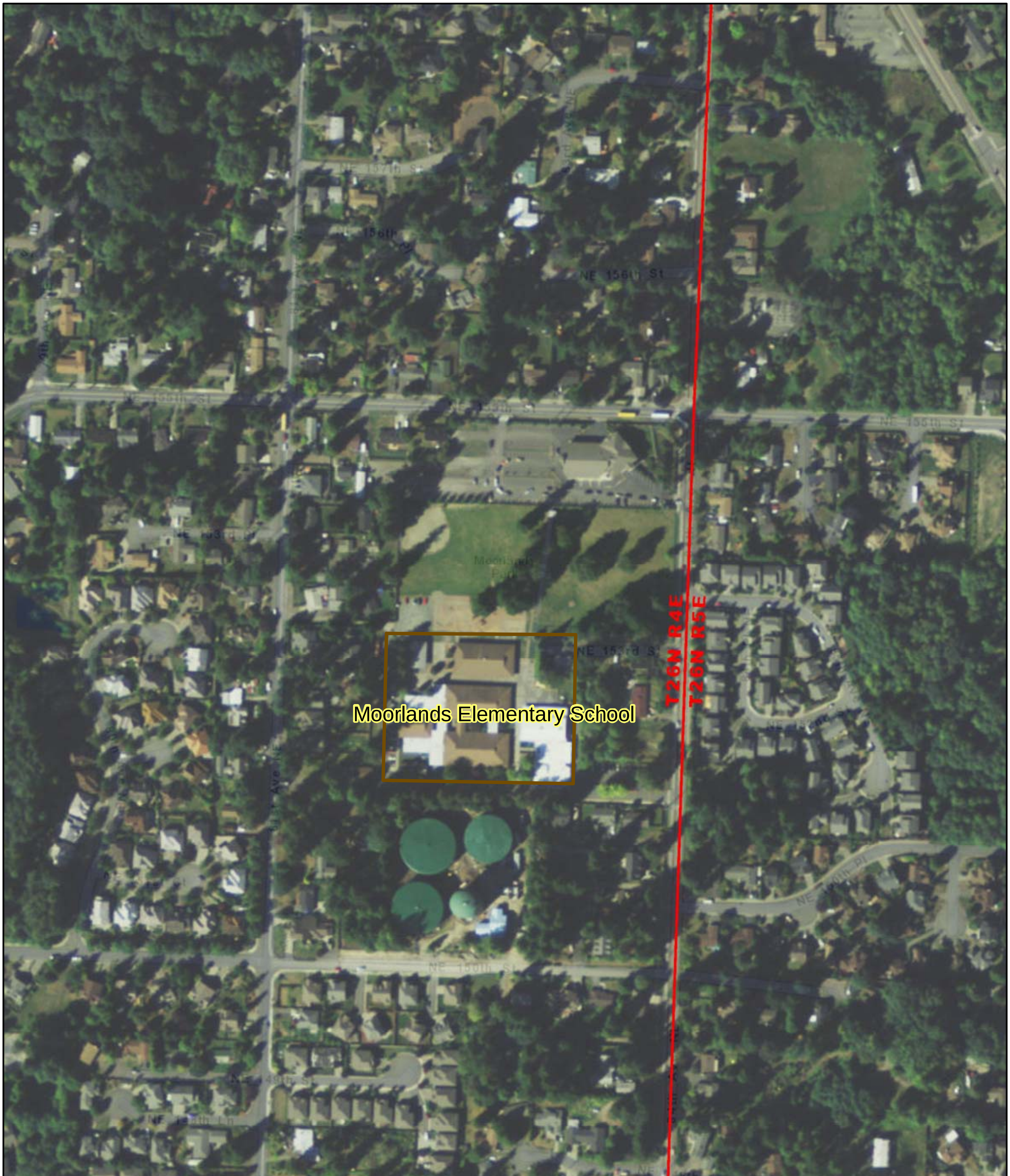


Figure 3-7. Land Usage - 2012



Source: "Warren G. Magnuson Park Strategic Development Plan - Sep 2012", Seattle Parks & Recreation



Notes: The former RACON site is now occupied by the Moorlands Elementary School

Property Boundary approximate and for illustration purposes only

0 150 300 600 Feet

N W E S

US Army Corps of Engineers ®

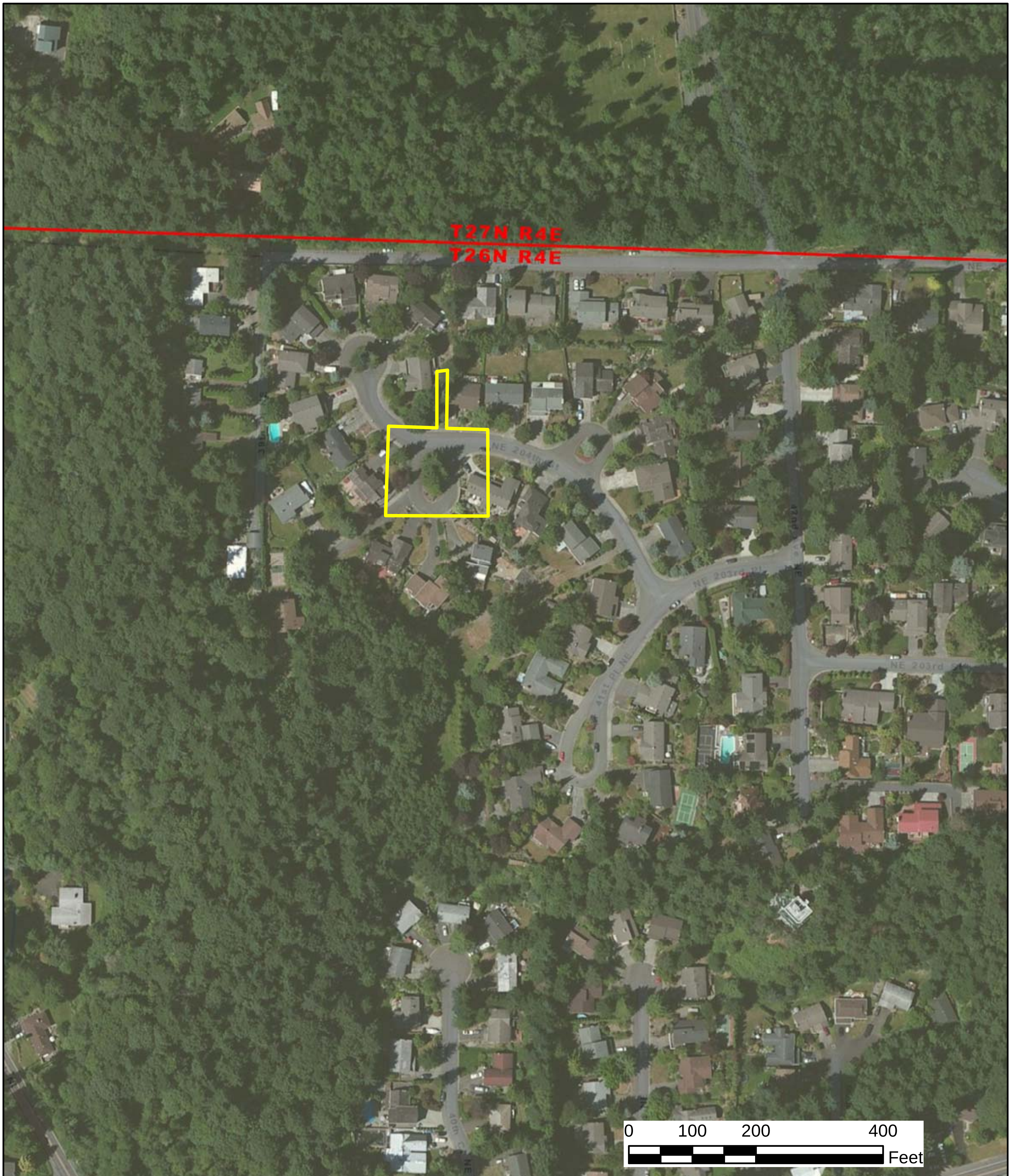
Figure 3-8

FORMER RACON SITE

PRELIMINARY ASSESSMENT REPORT

NAS SEATTLE
SEATTLE, WASHINGTON

Path: K:\MissionProjects\htw\NDAI_properties\Properties\PA INPR NWS\F10WA0031 Sand Point (Seattle NAS)\FDE\Figures\Figure3-8_RACON.mxd



Notes: The former site of the Low Frequency Navigational Aid is outlined in yellow. The property is now a residential area. Access to the former site was via an access road off of NE 205th Street.

Property Boundary approximate and for illustration purposes only

N
W E
S

US Army Corps of Engineers ®

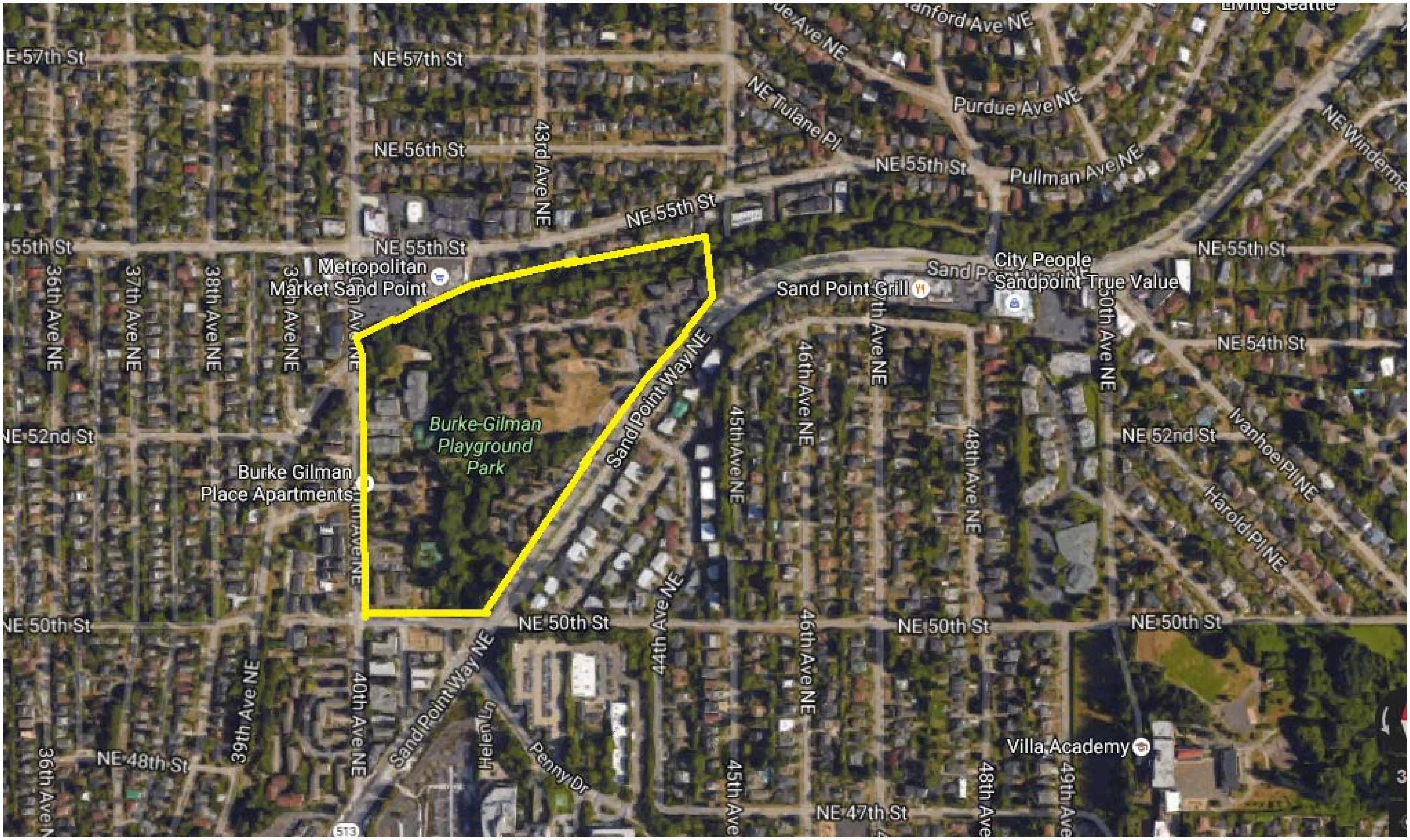
Figure 3-9

Site Location of Former Low Frequency Navigational Aid

PRELIMINARY ASSESSMENT REPORT

NAS SEATTLE
SEATTLE, WASHINGTON

Path: K:\MissionProjects\htw\NDAI_properties\Properties\PA INPR NWS\F10WA0031 Sand Point (Seattle NAS)\FDE\Figures\Figure3-9_LFNA.mxd



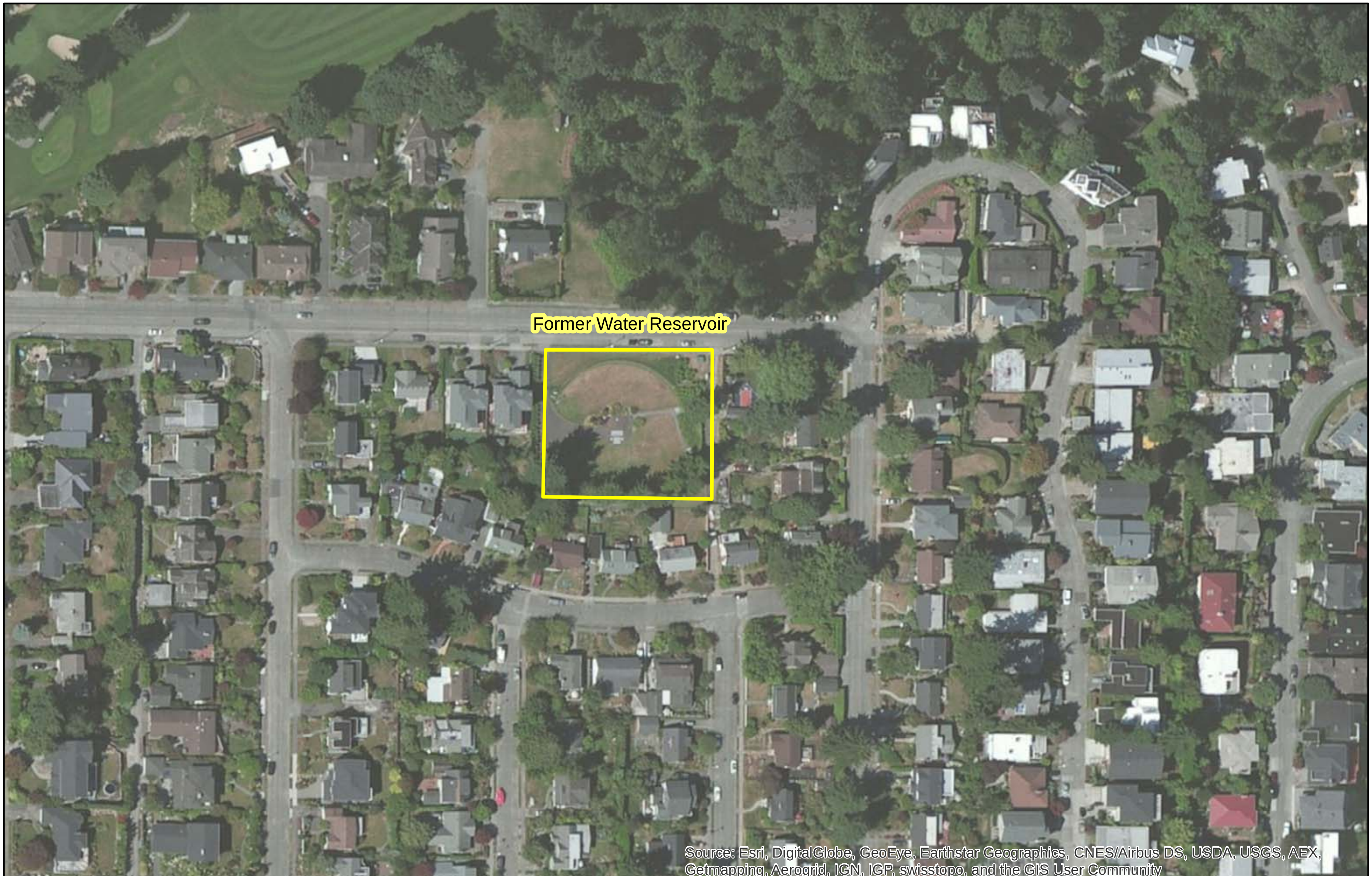
Note: Site of the former transmitter is outlined in yellow. The area is now occupied by a 7-acre neighborhood park. A Ronald McDonald House is located adjacent the park, proximate to the park's northwest corner. Residential land use surrounds the location. (Google Maps). Property boundary is approximate and for illustration purposes only.

US Army Corps of Engineers ®

Figure 3-10

Former Transmitter Site Location

NAS SEATTLE
SEATTLE, WASHINGTON



Notes: Site of former water reservoir (tower) is highlighted in yellow. The area appears vacant and is located in a residential neighborhood.

Property Boundary approximate and for illustration purposes only

N W E S

0 75 150 300 Feet

US Army Corps of Engineers ®

Figure 3-11

Site of Former Water Reservoir (Tower)

PRELIMINARY ASSESSMENT REPORT

NAS SEATTLE
SEATTLE, WASHINGTON

Path: K:\MissionProjects\htw\NDAI_properties\Properties\PA INPR NWS\F10WA0031 Sand Point (Seattle NAS)\FDE\Figures\Figure3-11_WaterReservoir.mxd

Notes:
Location of former NAS Seattle warehouse is depicted above.
The property is now owned by National Archives and Records Administration.

Former NAS Seattle property which had been associated with warehouse also shown.
Surrounding area is residential.

Property Boundary approximate and for illustration purposes only

N W E S

0 200 400 800 Feet

US Army Corps of Engineers

Figure 3-12

Site of Former Warehouse and Adjacent Property

PRELIMINARY ASSESSMENT REPORT

NAS SEATTLE
SEATTLE, WASHINGTON

Path: K:\MissionProjects\htw\NDAI_properties\Properties\PA INPR NWS\F10WA0031 Sand Point (Seattle NAS)\FDE\Figures\Figure3-12_FormerWarehouse.mxd

Notes: The yellow highlighted areas depict the former Shearwater Housing tracts. The DERP-FUDS eligible portion is the cross-hatched area which is now occupied by the Thornton Creek School. Surrounding area is residential.

Property Boundary approximate and for illustration purposes only

0 200 400 800 Feet

N W E S

US Army Corps of Engineers ®

Figure 3-13

Former Shearwater Housing Tracts

PRELIMINARY ASSESSMENT REPORT

NAS SEATTLE
SEATTLE, WASHINGTON

Path: K:\MissionProjects\htw\NDAI_properties\Properties\PA INPR NWS\F10WA0031 Sand Point (Seattle NAS)\FDE\Figures\Figure3-13_FormerShearwaterHousingTracts.mxd

Figure 3-14. Census Radius Map and HRS Qualified Wetlands

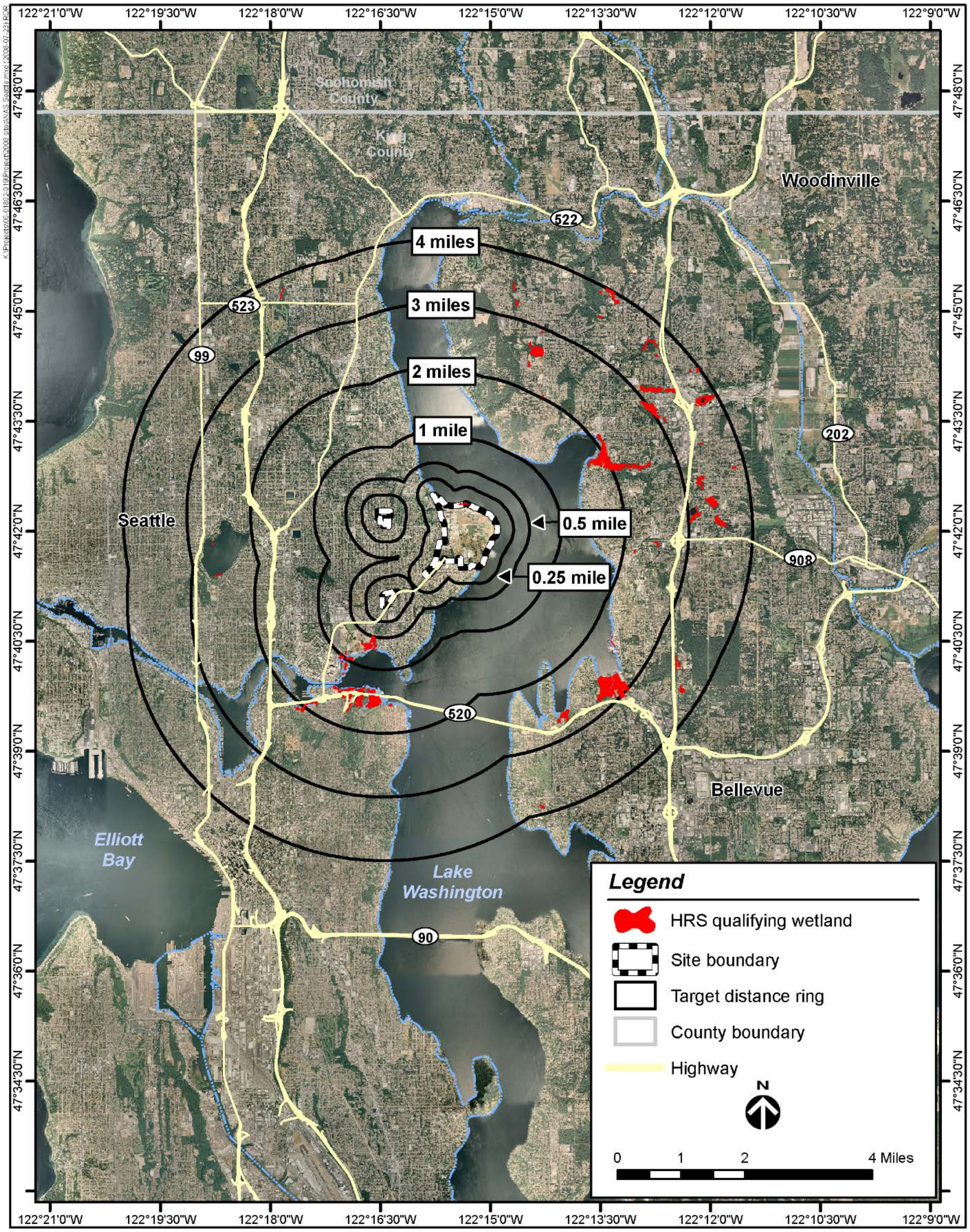


Figure 3-15. Proposed Layout of NAS Seattle - 1927

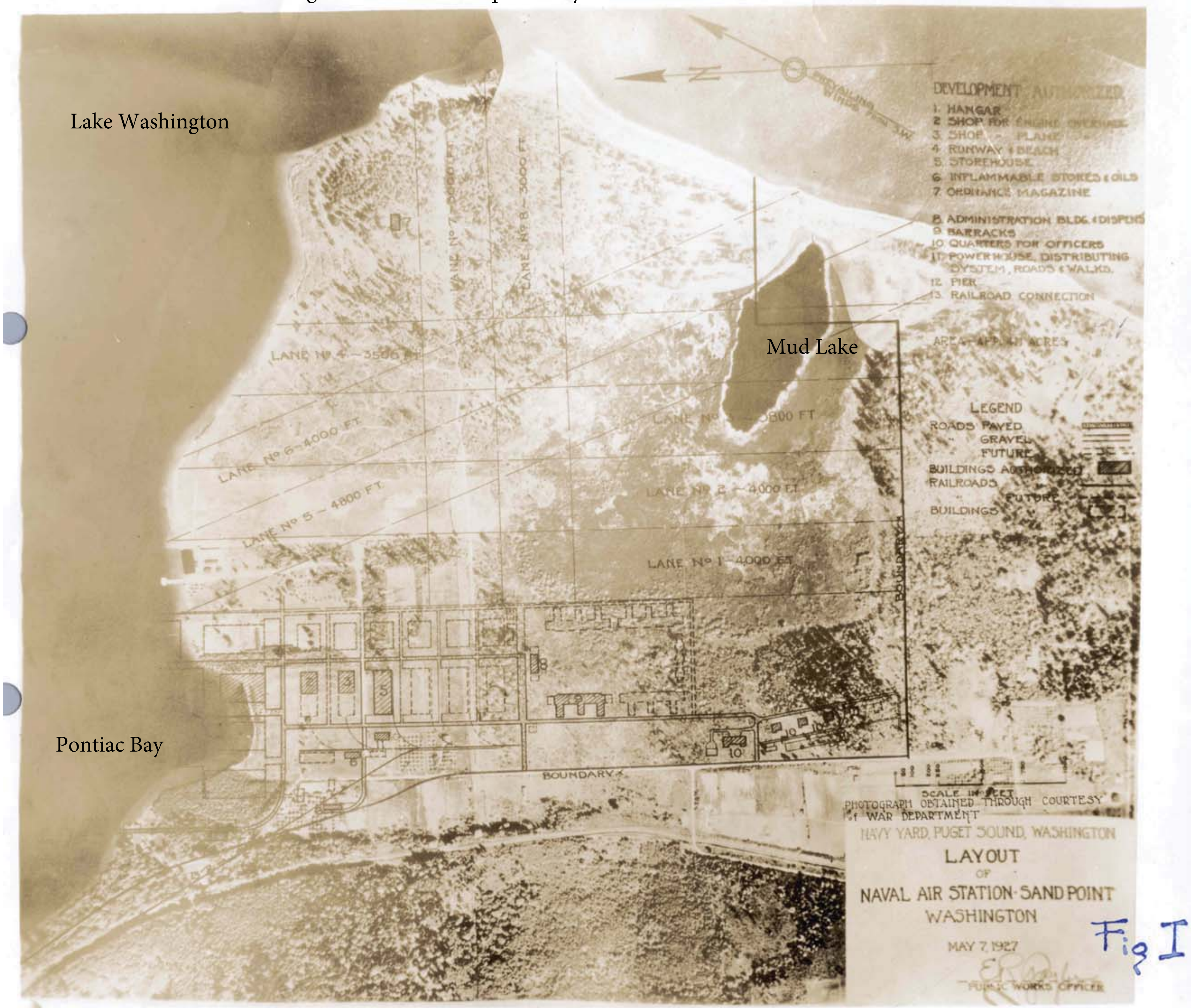


Figure 3-16. Climate Data for Seattle, Washington

Temperature - Precipitation - Sunshine - Snowfall

US Climate Data on

Home United States Washington Enter a location

Monthly | Geo & Map | Weather Forecast

You are here: United States > Washington > Seattle

Climate Seattle - Washington °C | °F

	Jan	Feb	Mar	Apr	May	Jun
Average high in °F:	45	48	52	58	64	69
Average low in °F:	36	37	39	43	47	52
Av. precipitation in inch:	5.2	3.9	3.31	1.97	1.57	1.42
Days with precipitation:	19	15	16	13	11	9
Hours of sunshine:	74	99	154	201	247	234

	Jul	Aug	Sep	Oct	Nov	Dec
Average high in °F:	72	73	67	59	51	47
Average low in °F:	54	55	52	47	41	38
Av. precipitation in inch:	0.63	0.75	1.65	3.27	5	5.43
Days with precipitation:	5	6	8	14	17	19
Hours of sunshine:	304	248	197	122	77	62

Climate data for Seattle, WA - 98164 - 1961-1990 normals - weather

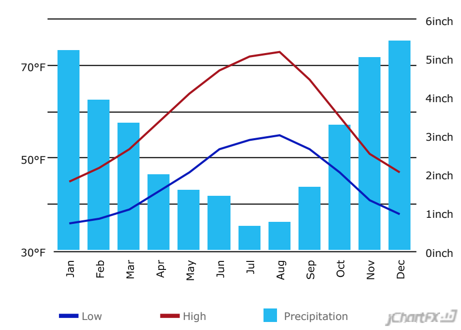
Jan: January, Feb: February, Mar: March, Apr: April, May: May, Jun: June, Jul: July, Aug: August, Sep: September, Oct: October, Nov: November, Dec: December

Seattle weather averages

Annual high temperature:	58.8°F
Annual low temperature:	45.1°F
Average temperature:	51.95°F
Average annual precipitation - rainfall:	34.1 inch
Days per year with precipitation - rainfall:	152 days
Annual hours of sunshine:	2019 hours
Av. annual snowfall:	-

g+1 42

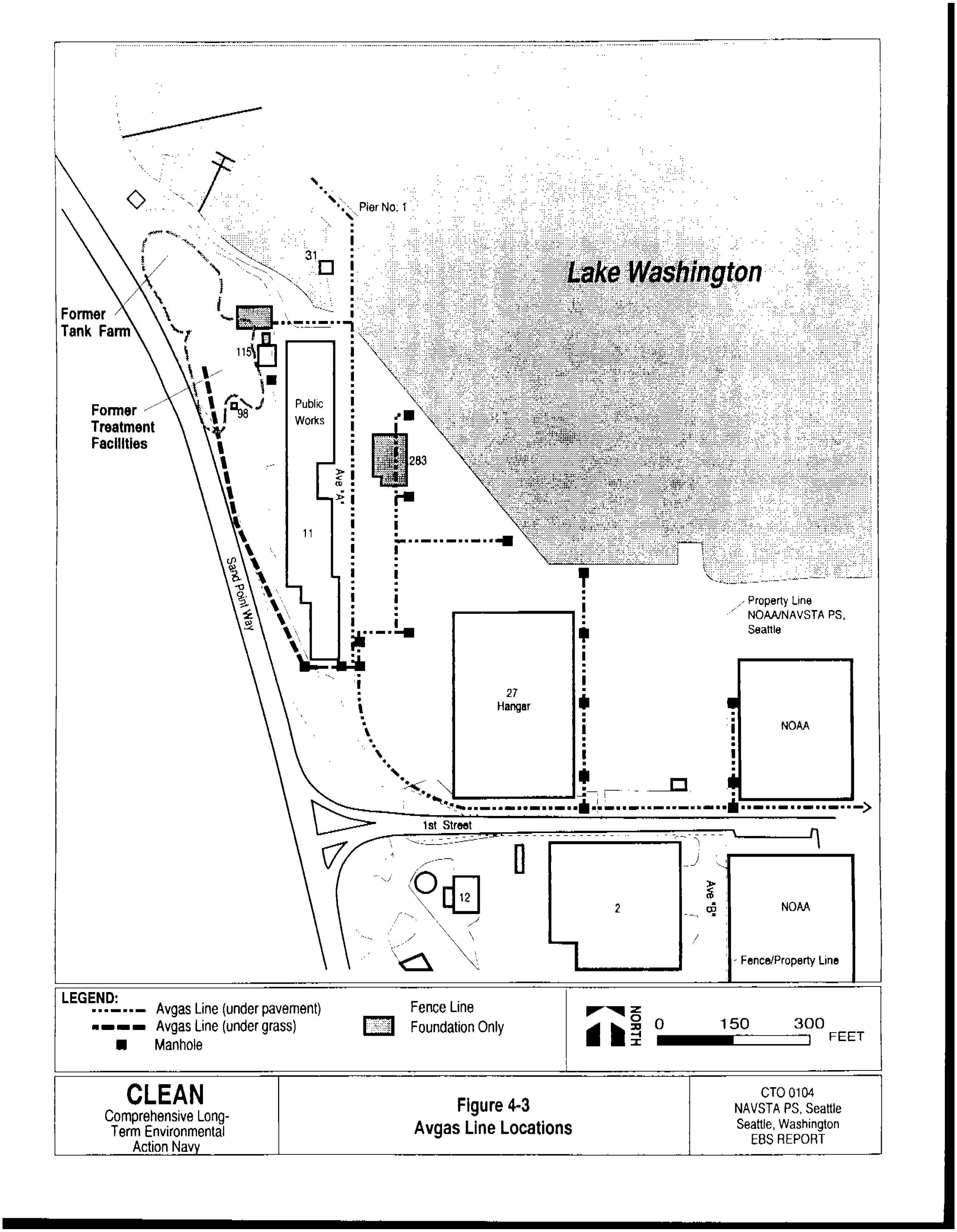
Seattle Climate Graph - Washington Climate Chart



Climograph of Seattle on your website

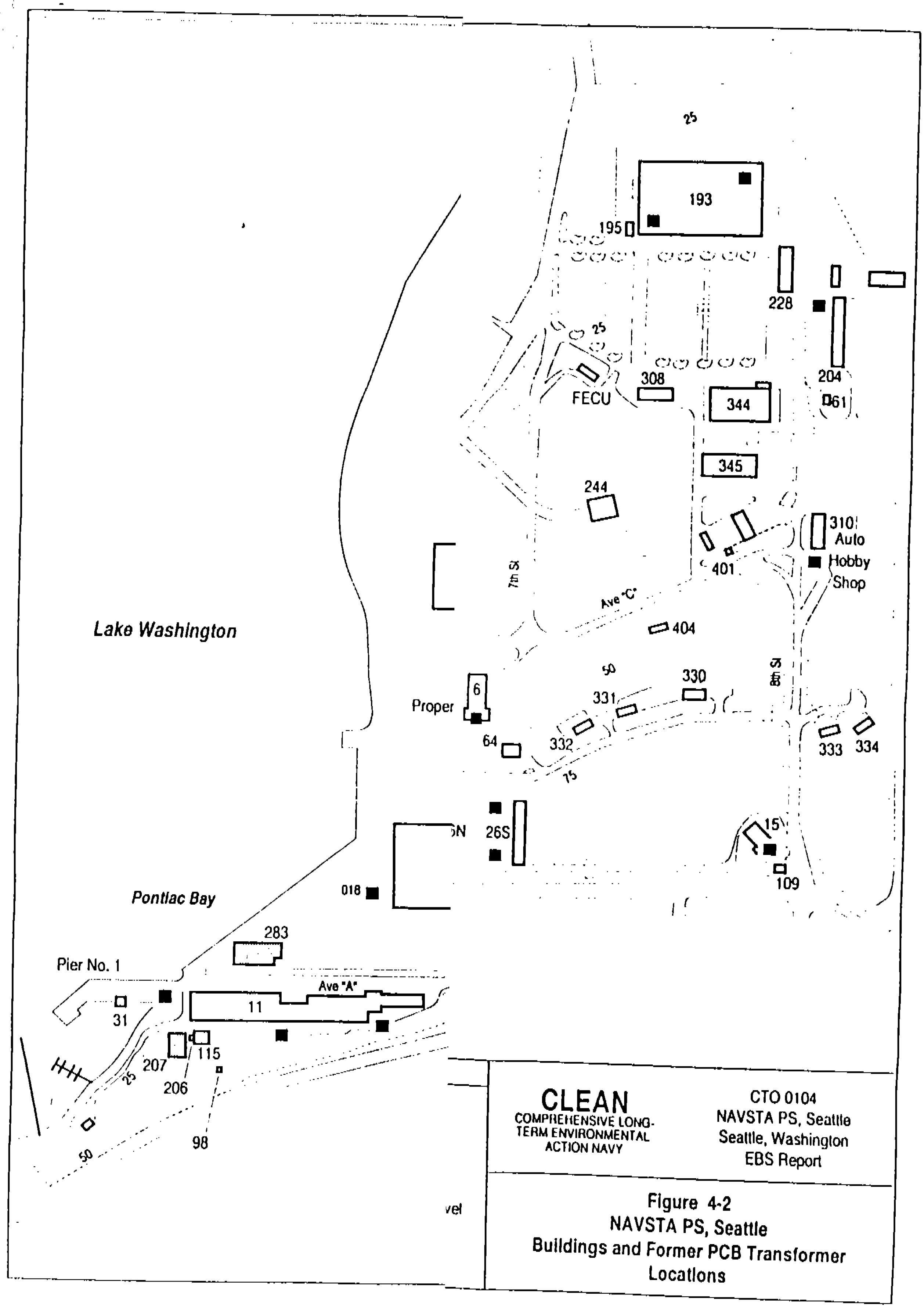
© 2015 US Climate Data | version 2.2 beta | Programming & Design by Your Weather Service | World Climate | Weernetwerk About us | Disclain

Figure 4-1. Partial Depiction of Avgas Distribution Lines



Source: "Final Environmental Baseline Study." Navy, 1996.

Figure 4-2. Former PCB Transformer Locations



Source: "Final Environmental Baseline Study." Navy, 1996.

Note: Former location of Machine Gun, Small Arms, and Indoor Ranges. Source of image is Google Maps. Property boundary is approximate and for illustration only.

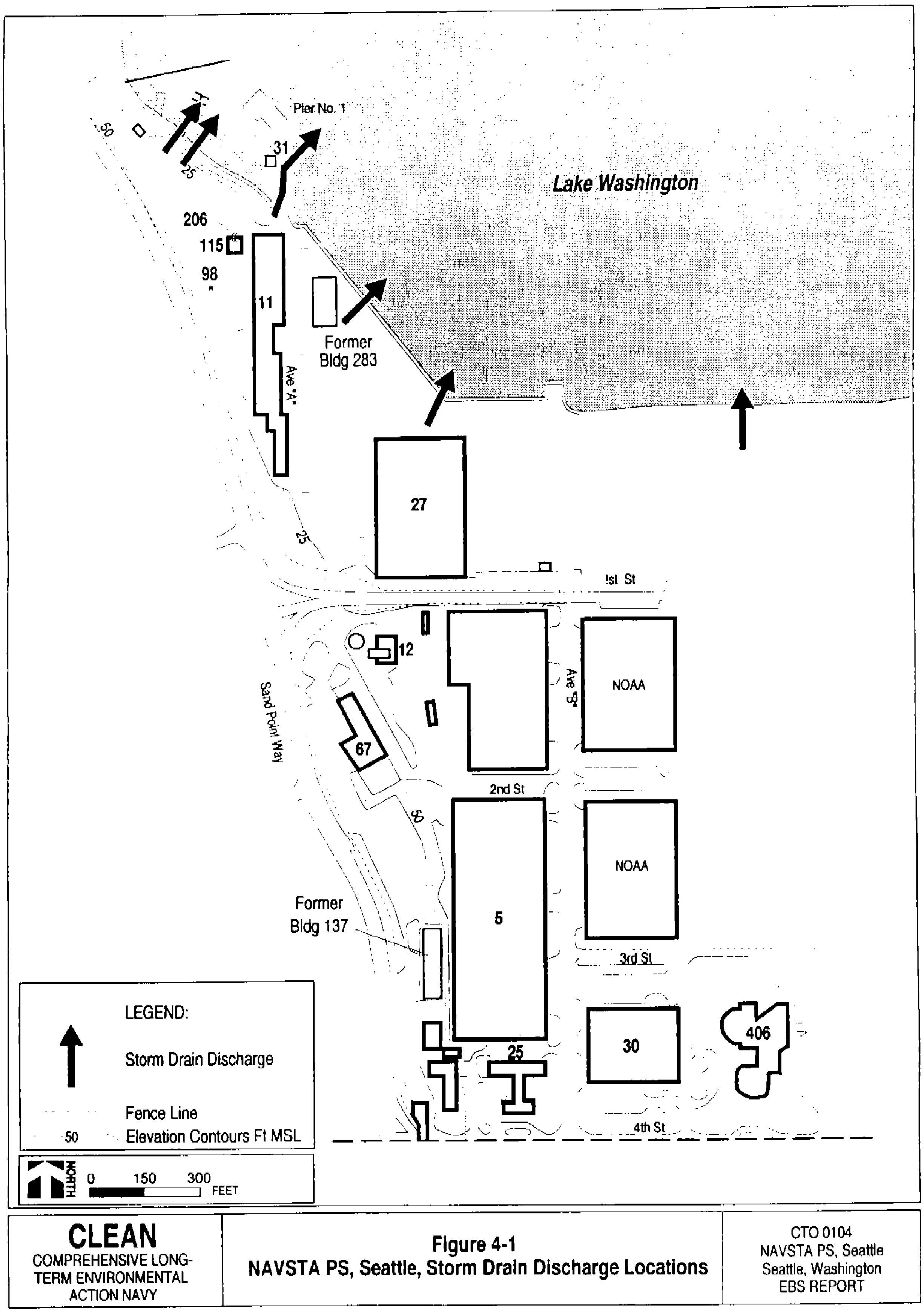
US Army Corps of Engineers ®

Figure 5-1

Former Locations of Machine Gun, Small Arms and Indoor Ranges

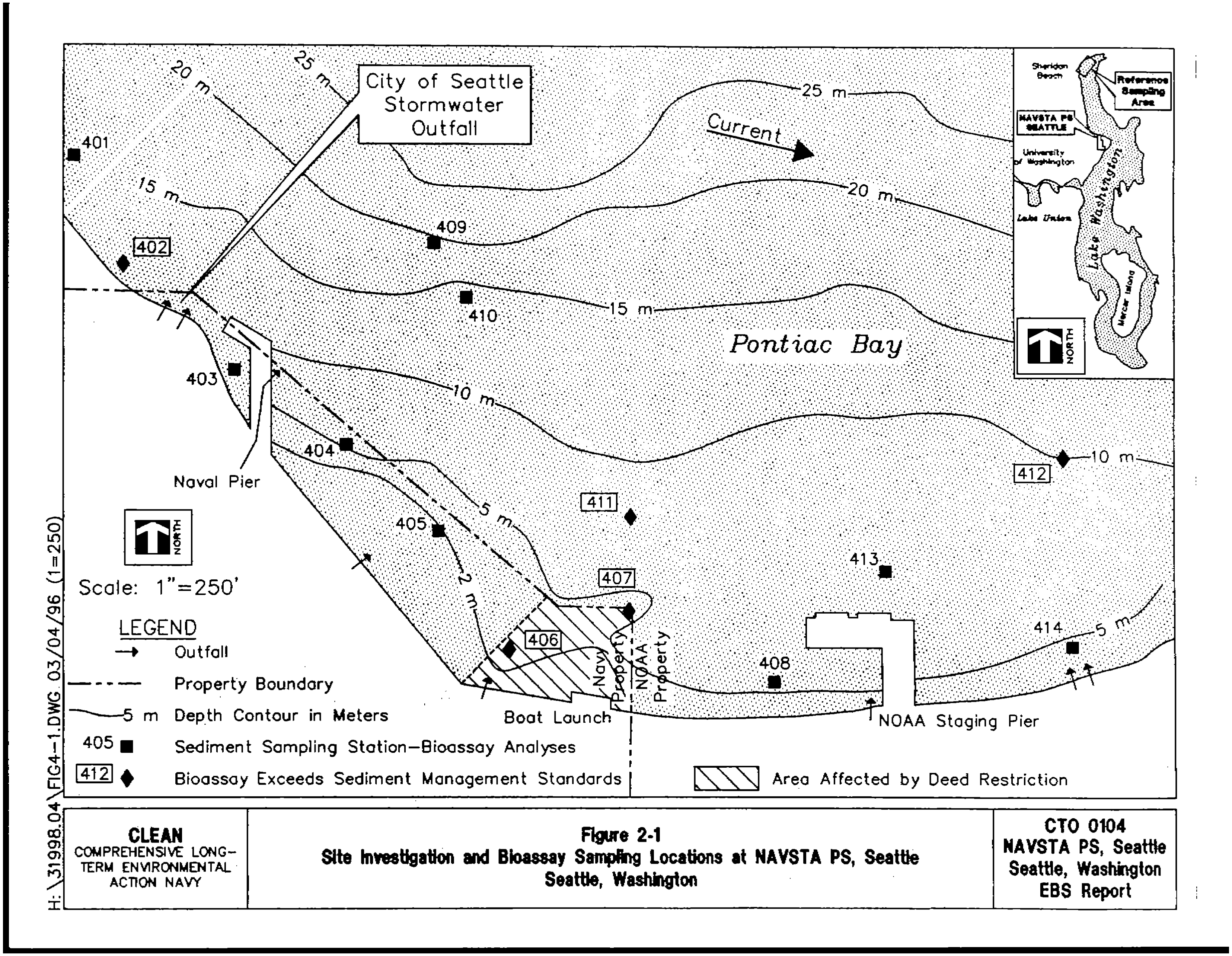
NAS SEATTLE

Figure 6-1. NAVSTA PS, Seattle, Storm Drain Discharge Locations



Source: "Final Environmental Baseline Study." Navy, 1996.

Figure 6-2. Site Investigation and Bioassay Sampling Locations



Source: "Final Environmental Baseline Study." Navy, 1996.

Source: King County Water and Land Services Groundwater Protection Program "Groundwater Well Viewer" (http://green2.kingcounty.gov/groundwater/map.aspx).

US Army Corps of Engineers ®

Figure 8-1

Groundwater Wells Nearest Magnuson Park

NAS SEATTLE
SEATTLE, WASHINGTON

Figure 8-2. Fifteen-mile target distance limit, NAS Seattle (Sand Point) site, King County, WA.

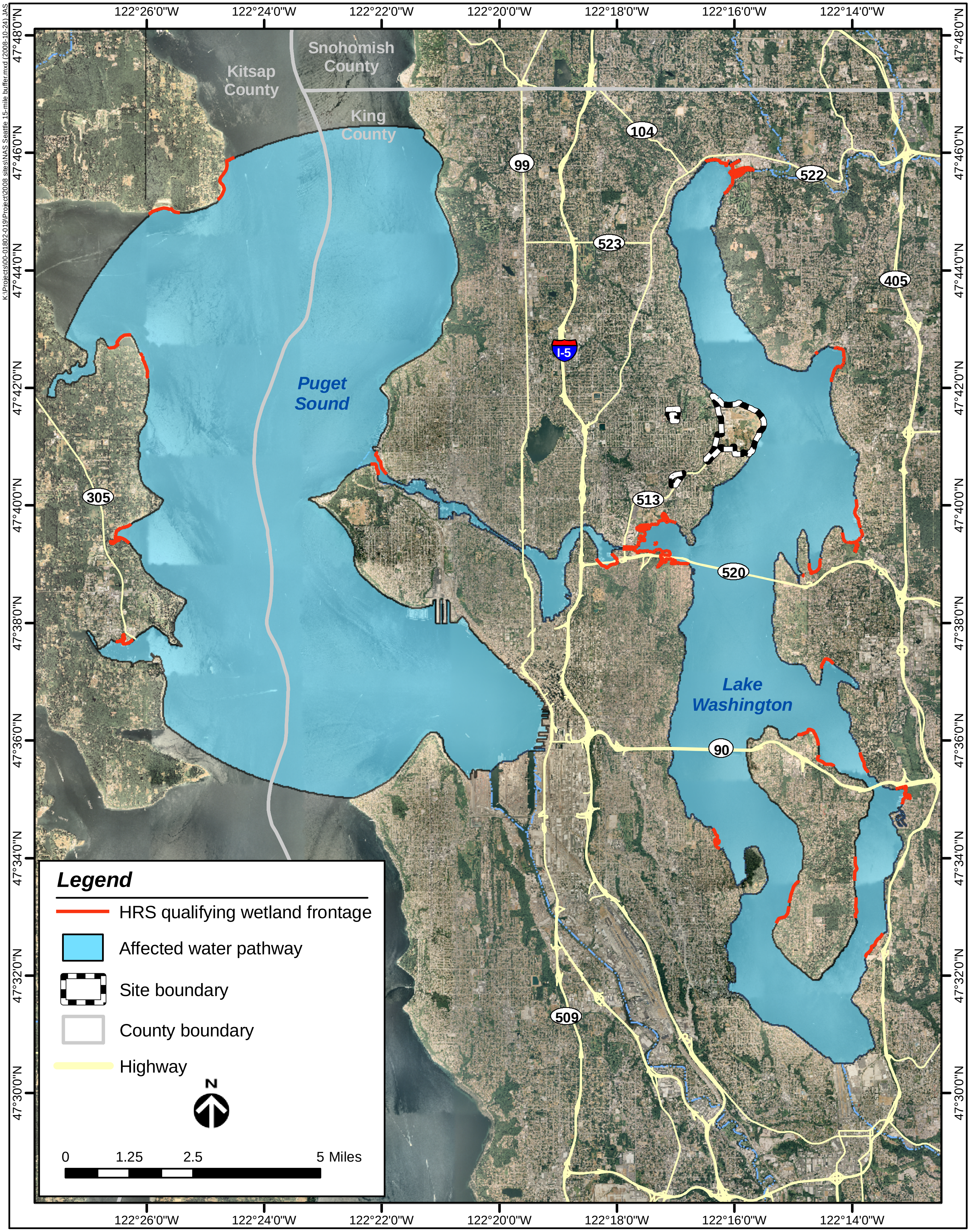
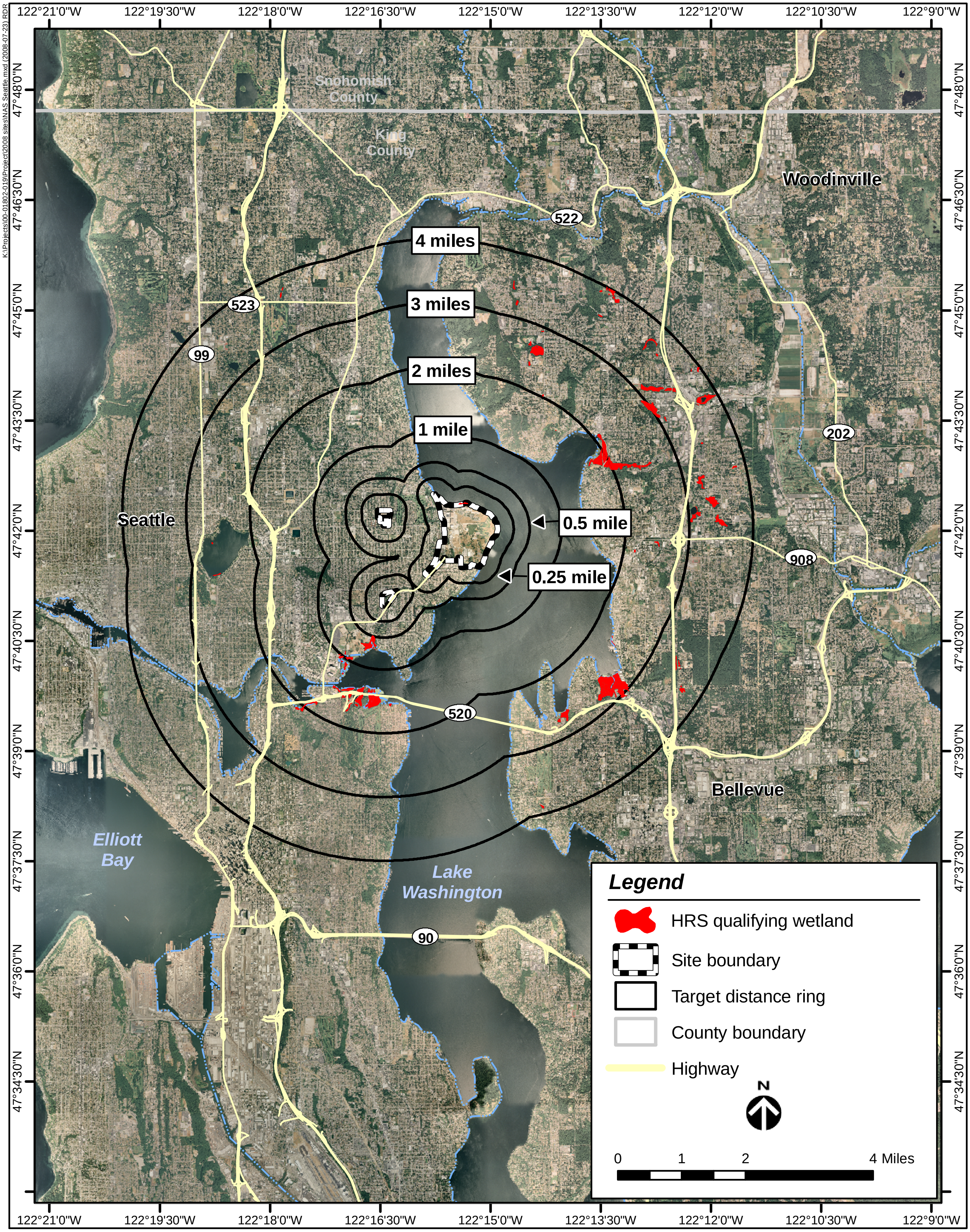
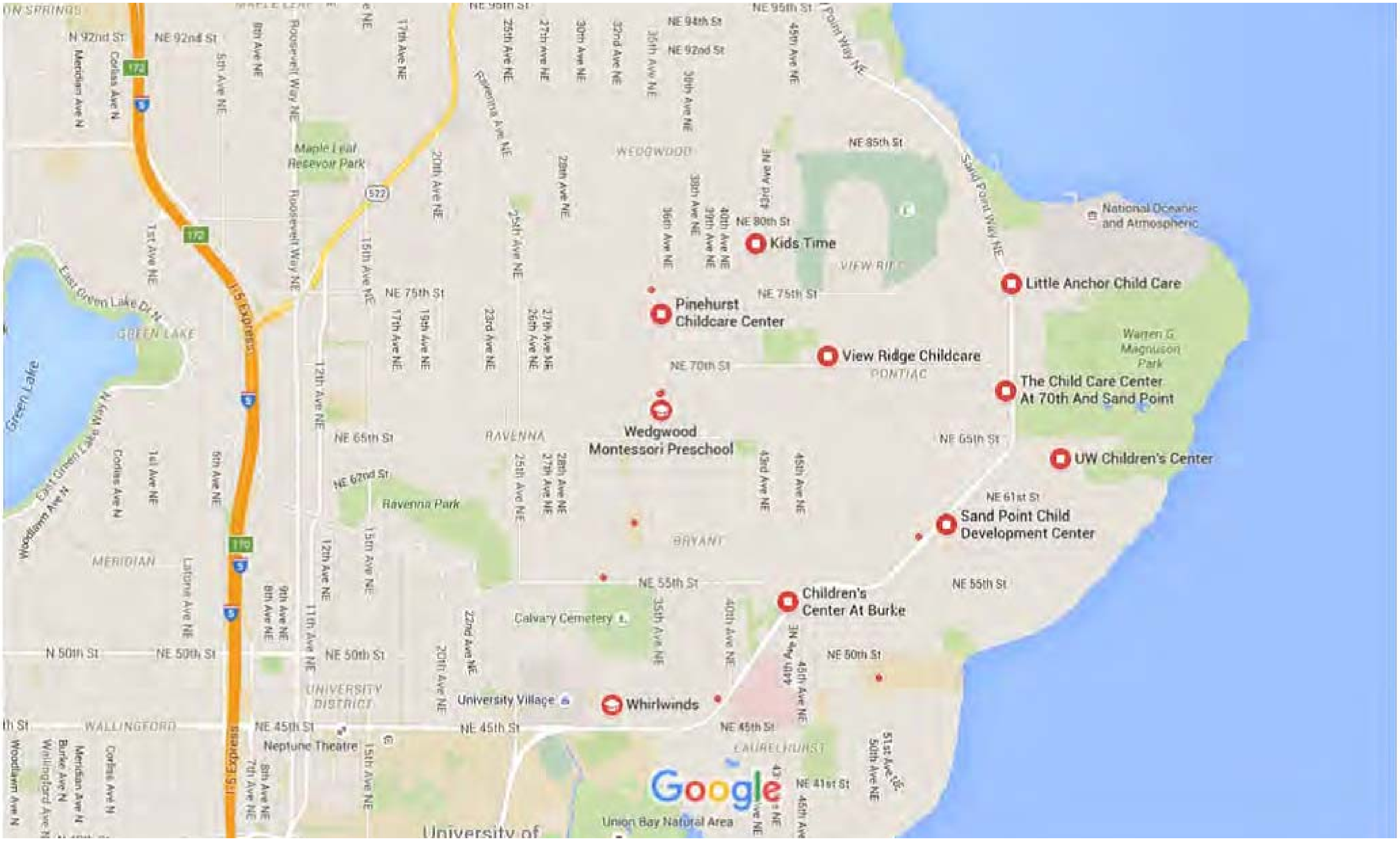


Figure 8-3. Four-mile target distance limit, NAS Seattle (Sand Point) site, King County, WA.





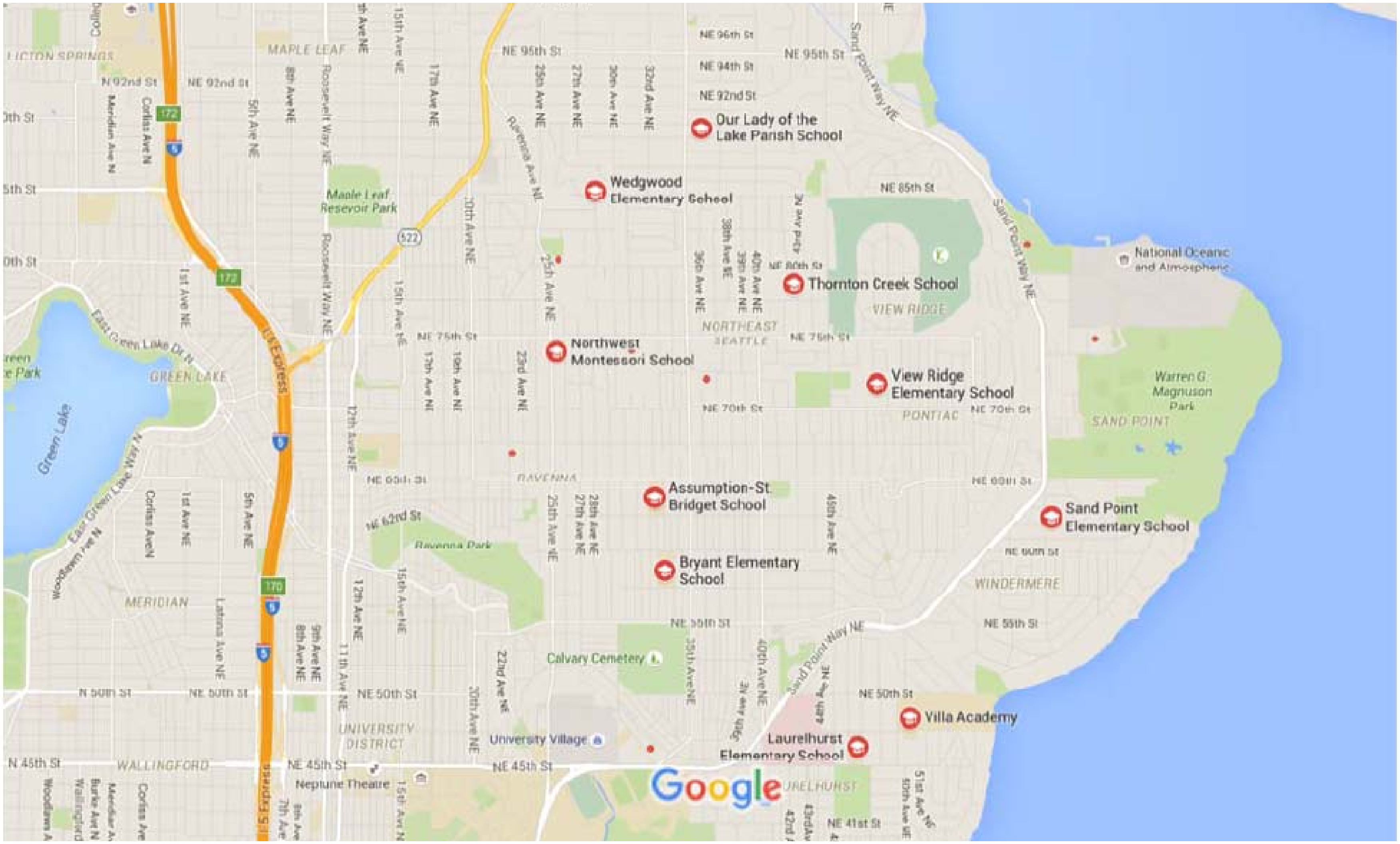
Note: Results of Google Map search for child and day care facilities located near Magnuson Park, Seattle, Washington.

US Army Corps of Engineers ®

Figure 8-4

Child/Day Care Facilities near Magnuson Park

NAS SEATTLE
SEATTLE, WASHINGTON



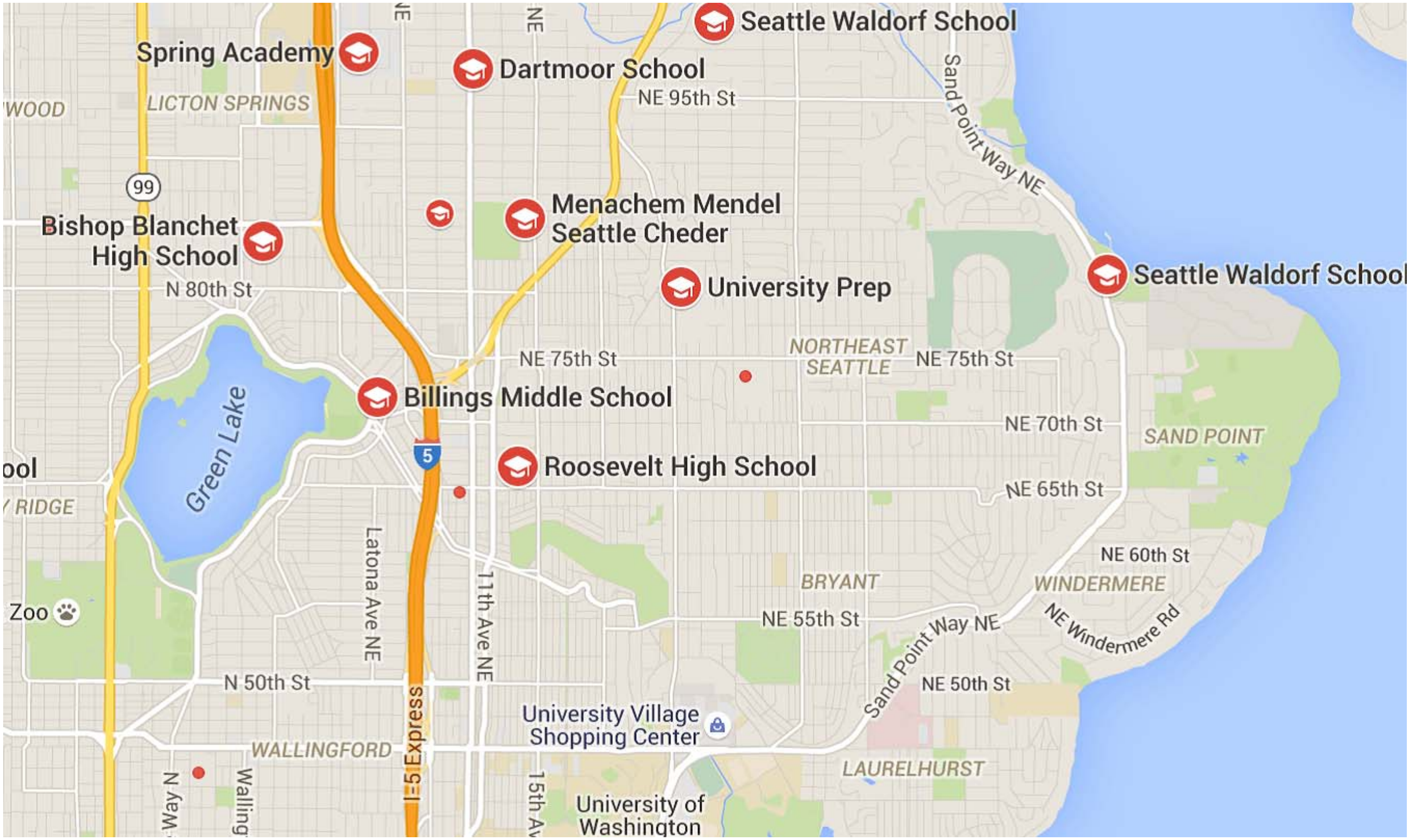
Note: Results of Google Map search for elementary schools located near Magnuson Park, Seattle, Washington.

US Army Corps of Engineers ®

Figure 8-5

Elementary Schools Located Near Magnuson Park

NAS SEATTLE
SEATTLE, WASHINGTON



Note: Results of Google Map search for high schools located near Magnuson Park, Seattle, Washington.

US Army Corps of Engineers ®

Figure 8-6

High Schools Located Near Magnuson Park

NAS SEATTLE
SEATTLE, WASHINGTON

Legend

DERP-FUDS Eligible
DERP-FUDS Non-eligible
DERP-FUDS Non-eligible Land Use Restriction

0 250 500 1,000 Feet

US Army Corps of Engineers ®

Figure 9-1
AREAS THAT MAY WARRANT FUDS PROJECTS
PRELIMINARY ASSESSMENT REPORT
NAS SEATTLE
SEATTLE, WASHINGTON

Document Path: K:\MissionProjects\htw\NDAI_properties\Properties\PA INPR NWS\F10WA0031 Sand Point (Seattle NAS)\FDE\Figures\Eligible_Parcels_1944 Plan.mxd

TABLES

Table 4-1. Operations Involving Military Munitions

Building Type	Building Number	DERP-FUDS Property Eligibility	Location Coordinates[1]	Notes
Magazine	16	Eligible	O 28	Dynamite storage; igloo type; Fig. 3-2, parcel 32.
	19	Eligible	X 19	Arch type; Fig. 3-2, parcel 32.
	21	Eligible	U 12	Arch type; Fig. 3-2, parcel 29.
	54	Eligible	V 20	High explosives; Fig. 3-2, parcel 32.
	55	Eligible	S 19	High explosives; Fig. 3-2, parcel 32.
	60	Ineligible	N 28	Fuse and detonator; Fig. 3-2, parcel 31.
	61	Ineligible	K 28	Small arms & pyrotechnics; Fig. 3-2, parcel 31.
Ready Locker	43	Eligible	G 8	Pyrotechnics; Fig. 3-2, parcel 29.
Firing Shed	64	Eligible	K 30	Machine gun range; Fig. 3-2, parcel 32.
Target Shelter	63	Eligible	N 30	Machine gun range; Fig. 3-2, parcel 32.
Trap Houses	147 thru 154	Eligible	V 9-10; U10; T 8-9; S 8	Shoreline location; Fig. 3-2, parcel 29.
Skeet Control Houses	160 thru 163	Eligible	R 8; Q 7	Shoreline location; Fig. 3-2, parcel 29.
Indoor Shooting Range	201	Eligible	N 28	Fig. 3-2, parcel 32.
Firing Shed	199	Eligible	N 29	Appears to be an outside small arms range; range is on eligible property, but firing point may be on ineligible property; Fig. 3-2, parcels 31 and 32.
Ordnance Material Storage	203	Eligible	R 8	Nature of stored ordnance is unknown; Fig. 3-2, parcel 29.

Table 4-1 (continued). Operations Involving Military Munitions

Building Type	Building Number	DERP-FUDS Property Eligibility	Location Coordinates[1]	Notes
Temp. Gunnery Training Bldg	214	Eligible	L 30	Not known if ordnance was used; Fig. 3-2, parcel 32.
Torpedo Shop	20	Ineligible	C 5	It is presumed that torpedo warheads were present; Fig. 3-2, parcel 33.

Notes: [1]Location is based upon the plan sheet titled "Map of Naval Air Station Seattle, Washington, Showing Conditions on June 30, 1944" (Appendix R).

Table 4-2. Operations Potentially Involving HTRW

Building Type	Building Number	DERP-FUDS Eligibility	Location Coordinates[1]	Notes
Hangers				
Hangar	1	eligible	G 8	Fig. 3-2, parcel 29.
	30	ineligible	G 15	Includes office building; Fig. 3-2, parcel 33 (adjacent parcel 32).
	32	eligible	G 10	landplane hangar; Fig. 3-2, parcel 29.
	33	eligible	G 12	landplane hangar; Fig. 3-2, parcel 29.
	27	ineligible	E 7	seaplane hangar; Fig. 3-2, parcel 44.
	193	ineligible	N 26	transport hangar; Fig. 3-2, parcel 33.
Repair/Maintenance				
Assembly and Repair Shop	2	ineligible	F 10	Navy EBS identifies metals in soil beneath slab as exceeding MTCA B cleanup levels (former plating shop); RA limited to deed restriction. Fig. 3-2, parcel 33.
Shop & Office Building, Public Works	11	ineligible	C 6	Fig. 3-2, parcel 33 (adjacent Lake Washington)
Engine Test Building	17	ineligible	E 10	Fig. 3-2, parcel 33 (north of parcel 39)
Bomb Sight Repair Shop	66	eligible	H 8	Fig. 3-2, parcel 29.
Motor Test Building	102	eligible	Q 9	Fig. 3-2, parcel 29.
Semi Portable Engine Test House	212	eligible	R 10	Fig. 3-2, parcel 29.
V.R.5. Radio Shop	215	ineligible	P 27	Fig. 3-2, parcel 33/
Maintenance shop	244	ineligible (BRAC)	---	Not depicted in the 1944 plan sheet, was constructed 1944; 5000 sq. ft.; modified in 1975.
Service Station	342	ineligible (BRAC)	---	Not depicted in the 1944 plan sheet; constructed 1974; 300 sq. ft.
Service Bay	345	ineligible (BRAC)	---	Not depicted in the 1944 plan sheet, constructed 1976; 5300 sq. ft.

Table 4-2 (continued). Operations Potentially Involving HTRW

Building Type	Building Number	DERP-FUDS Eligibility	Location Coordinates[1]	Notes
Fueling Operations				
Ships Service – Gasoline Station	41	ineligible	H 16	Fig. 3-2; parcel 33.
Gasoline Control Valve Pits	86 thru 93	ineligible	A 3, B 4	Fig. 3-2; parcel 33.
Gasoline Pressure Control Pits	94, 95	ineligible	A 3	Fig. 3-2; parcel 33.
Gasoline Manifold & Meter Pit	96	ineligible	A 4	Fig. 3-2; parcel 33.
Gasoline Meter Pit	97	ineligible	A 4	Fig. 3-2; parcel 33.
Gasoline Pump House	98	ineligible	B 4	EBS identifies a release; remedial actions taken.
Tank Truck Loading Rack	101	ineligible	B 4	Fig. 3-2; parcel 33.
Gasoline Control Pit	106	eligible	Q 9	Fig. 3-2; parcel 29.
Gasoline Meter Pit	136	ineligible	B 5	Fig. 3-2; parcel 33.
Gasoline Pump	142	ineligible	D 11	Fig. 3-2; parcel 33.
Distribution Lines	---	eligible and ineligible	---	lines are present on both eligible and ineligible property
Fuel Storage				
Avgas/Mogas Tank Farm	12A thru 12D; 310A; 340A, 340B, 340C; brig UST #406.	ineligible	A 3,4; B 4	3800 cu. yds. soil removed (exceeded MTCA A cleanup levels); groundwater contamination exceeds MTCA A cleanup levels. Fig. 3-2, parcel 33.
Fuel Oil Reservoir	44	ineligible	D 9	Appears to support the boiler plant (Bldg 12); Fig. 3-2, parcel 33.
Fuel Oil Tanks	45, 46	ineligible	D 10	Fig. 3-2; parcel 33.
Gasoline Tanks	70 thru 85	ineligible	A 3	Fig. 3-2; parcel 33.
Gasoline Tanks	103 thru 105	eligible	Q 9	Fig. 3-2; parcel 29.
Fuel Oil Tank	107	eligible	Q 9	Fig. 3-2; parcel 29.

Table 4-2 (continued). Operations Potentially Involving HTRW

Building Type	Building Number	DERP-FUDS Eligibility	Location Coordinates[1]	Notes
Gasoline Tank – Power Plant	127	ineligible	D 9	associated w/the power/boiler plant; Fig. 3-2, parcel 33.
Fuel Oil Storage Tank (Transmitter Site)	133	eligible	noncontiguous	bound by 40th Ave NE, Sandpoint Way NE and 39th Ave NE; Fig. 3-3, parcel 27.
Gasoline Tank	143 thru 144	ineligible	D 12, D 11	Navy EBS identifies that a release has occurred; remedial actions completed. All tanks: Fig. 3-2, parcel 33.
Diesel Oil Tank	145	ineligible	D 11	
Gasoline Tanks	166, 167	ineligible	H 16	
Gasoline Tanks	168 thru 169	ineligible	G 16	
Petroleum, Oil, Lubricant Storage				
Oil Storage Tank	146	eligible	R 9	Fig. 3-2, parcel 29.
Paint & Oil Storage (transmitter site)	165	eligible	noncontiguous	currently a city park; bound by 40th Ave NE, Sandpoint Way NE and 39th Ave NE .
Electrical Transformers				
Main Electric Substation	42	ineligible	D 18	Fig. 3-3, parcel 27.
Transformer House	226	eligible	G 8	Fig. 3-2, parcel 29.
Miscellaneous				
Boiler Plant	12	ineligible	D 9	fuel storage tanks 44, 45 and 46 are proximate to the plant. Fig. 3-2, parcel 33.
Paint Storage and Public Works	40	ineligible	B 5	Fig. 3-2, parcel 33.
Garage	67	ineligible	D 11	motor pool garage; Fig. 3-2, parcel 33.
Inflammable Stores	68	ineligible	D 12	Fig. 3-2, parcel 33.
Wastewater Treatment Plant	110 thru 113	Ineligible	B 4	Fig. 3-2, parcel 33.
Laboratory & Pump House	114	ineligible	B 4	associated w/the WWTP; Fig. 3-2, parcel 33.
Dope Storage Bldg	119	ineligible	F 11	Fig. 3-2, parcel 33.
Inert Storage Bldg	122	eligible	R 8	Fig. 3-2, parcel 29.
Radio Towers – Transmitter Site	129 thru 131	eligible	noncontiguous	bound by 40th Ave NE, Sandpoint Way NE and 39th Ave NE; Fig. 3-3, parcel 27.

Table 4-2 (continued). Operations Potentially Involving HTRW

Building Type	Building Number	DERP-FUDS Eligibility	Location Coordinates[1]	Notes
Laundry Building	137	Ineligible	E 14	Navy EBS identifies this as a former drycleaning operation; soils have exceeded MTCA A criteria; Fig. 3-2, parcel 33.
Radio Receiver	139	eligible	N 31	Fig. 3-2, parcel 32.
Radio Generator	140	eligible	W 10	Fig. 3-2, parcel 29.
Water Reservoir	164	eligible	noncontiguous	lead paint chips may have caused elevated soil lead; located at NE 75th St and 51st St Ave NE; Fig. 3-2, parcel 28.
Boiler Plant	186	ineligible	B 24	coal fired; coal stored nearby; residential land use; Fig. 3-2, parcel 45.
Public Works Storage	205	ineligible	L 29	Fig. 3-2, parcel 31.
Pesticide Residue Tank (former equipment shed – Bldg 206)	206	ineligible	B 4	EBS identifies a release; remedial actions taken; Fig. 3-2, parcel 33.
Foam Generator Building	217	ineligible	B 5	Fig. 3-2, parcel 33.
Laboratory	204 (is a duplicate bldg no.)	ineligible (BRAC)	---	constructed 1944; 9500 sq. ft.; bldg. 204 is the former Air Cargo terminal
Auto Hobby Shop	310	ineligible (BRAC)	---	constructed 1952; 4000 sq. ft.; modified 1989; EBS identifies a release; remedial actions taken.
Service Bay	345	ineligible (BRAC)	---	constructed 1976; 5300 sq. ft.
Boathouse	402	ineligible (BRAC)	---	constructed 1949; 1760 sq. ft.
Standby Generator Plant	403	ineligible (BRAC)	---	constructed 1971; 164 sq. ft.

Notes: [1]Location coordinates are sourced from the Map of Naval Air Station Seattle, Washington , Showing Conditions on 30 June 1944.

Table 3-1. Day Care Facilities and Schools

Day Care Facilities[1]	
Little Anchor Child Care	7600 Sand Point Way NE, Seattle, WA 98115
UW Children's Center	6311 65th Ave NE, Seattle, WA 98115
Global Communications Llc	6343 NE 61st St, Seattle, WA 98115
Sand Point Child Development Center	5837 56th Ave NE, Seattle, WA 98105
Sweet Pea Cottage Preschool of the Arts	5801 Sand Point Way NE, Seattle, WA 98105
Villa Academy	5001 NE 50th St, Seattle, WA 98105
Children's Center At Burke	5251 Sand Point Way NE # 5, Seattle, WA 98105
Sandhurst School (preschool)	4710 NE 70th St, Seattle, WA 98115
Kids Time	7711 43rd Ave NE, Seattle, WA 98115
Jonny Appleseed Preschool	7041 40th Ave NE, Seattle, WA 98115
Pinehurst Childcare Center	7330 35th Ave NE, Seattle, WA 98115
Blossoming Buds Cottage	7501 35th Ave NE, Seattle, WA 98115
Congregation Beth Shalom	6800 35th Ave NE, Seattle, WA 98115
Wedgewood Montessori Preschool	6556 35th Ave NE, Seattle, WA 98115
Assumption-St. Bridget School	6220 32nd Ave NE, Seattle, WA 98115
Dragon Fly Preschool	6226 31st Ave NE, Seattle, WA 98115
University Ravenna Cooperative Preschool	5751 33rd Ave NE, Seattle, WA 98105
The 55th Street School	3012 NE 55th St, Seattle, WA 98105
Elementary Schools[1]	
Sand Point Elementary School	6208 60th Ave NE, Seattle, WA 98115
View Ridge Elementary School	7047 50th Ave NE, Seattle, WA 98115
Villa Academy	5001 NE 50th St, Seattle, WA 98105
Laurelhurst Elementary School	4530 46th Ave NE, Seattle, WA 98105
Thornton Creek School	7711 43rd Ave NE, Seattle, WA 98115
Bryant Elementary School	3311 NE 60th St, Seattle, WA 98115
Eckstein Middle School	3003 NE 75th St, Seattle, WA 98115
Wedgwood Elementary School	2720 NE 85th St, Seattle, WA 98115
Loyal Heights Elementary	2511 NE 80th St, Seattle, WA 98115

Table 3-1 (continued). Day Care Facilities and Schools

High Schools[1]	
Roosevelt High School	1410 NE 66th St, Seattle, WA 98115
Seattle Waldorf School	7777 62 Ave NE Bldg #11, Seattle, WA 98115
University Prep	8000 25th Ave NE, Seattle, WA 98115
Ekstein Junior High School	Seattle, WA 98115
St Theodore	6410 9th Ave NE, Seattle, WA 98115

Notes: [1]Source of information is Google Maps.

Table 8-1. Estimated Wetlands Acreage and Population[1]

Distance Ring (miles)	Wetlands (acres)	Total Population per Distance Ring
0 – 0.25	1.3	10,411
0.25 – 0.5	0.2	12,409
0.5 – 1	16.7	17,404
1 – 2	114.5	58,907
2 – 3	82.0	119,153
3 – 4	156.5	164,672
Totals	**371.2**	**382,596**

[1]Sources: USFWS (2000), USCB (2000).