

**U.S. Army Corps of Engineers
Omaha District**

**Final Technical Project Planning
Memorandum
Port Angeles Combat Range
FUDS Property No. F10WA0033**

**Site Inspections at Multiple Sites, NWO Region
Formerly Used Defense Sites
Military Munitions Response Program**

**Contract No. W912DY-04-D-0010
Delivery Order No. 003**

June 2008


Shaw[®] Shaw Environmental, Inc.

7604 Technology Way, Suite 300
Denver, CO 80237

Final Technical Project Planning Memorandum

**Site Inspection
Port Angeles Combat Range
FUDS Property No. F10WA0033**

**Formerly Used Defense Sites
Military Munitions Response Program**

Documentation for Technical Project Planning Meeting
Meeting Location: Port Angeles City Hall
Port Angeles, Washington
Held February 14, 2008

Coordinated by:

U.S. Army Corps of Engineers

Prepared by:

Shaw Environmental, Inc.
7604 Technology Way, Suite 300
Denver, CO 80237

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List of Acronyms and Abbreviations

AOC	area of concern
ASR	Archives Search Report
CSM	Conceptual Site Model
DoD	Department of Defense
DQO	Data Quality Objective
EPA	U.S. Environmental Protection Agency
FUDS	Formerly Used Defense Site
HRS	Hazard Ranking System
IEP	Important Ecological Place
MC	munitions constituents
MD	munitions debris
MEC	munitions and explosives of concern
mm	millimeter
MRSPP	Munitions Response Site Prioritization Protocol
NDAI	No Department of Defense Action Indicated
NEODFC	Naval Explosives Ordnance Disposal Facility Center
NRCS	Natural Resources Conservation Service
NWO	Northwestern Division Omaha District
PACR	Port Angeles Combat Range
PUD	Public Utility District
RI/FS	Remedial Investigation/Feasibility Study
Shaw	Shaw Environmental, Inc.
SI	Site Inspection
SSWP	Site-Specific Work Plan
TPP	Technical Project Planning
USACE	U.S. Army Corps of Engineers
UXO	unexploded ordnance
WDAHP	Washington Department of Archaeology and Historic Preservation
WDFW	Washington Department of Fish and Wildlife
WDOE	Washington State Department of Ecology
Work Plan	<i>Type I Work Plan, Site Inspections at Multiple Sites</i>

Administrative Information

The Technical Project Planning (TPP) Memorandum is one in a series of documents used during the Site Inspection (SI) process to document the information collected and processes used to evaluate Formerly Used Defense Sites (FUDS) for the possible presence of munitions and explosives of concern (MEC) and/or munitions constituents (MC). TPP meeting information provided in the Memorandum reflects both the original version of information shared with meeting participants, as well as changes/updates to site-specific information obtained during the TPP meeting.

The TPP meeting for the former Port Angeles Combat Range (PACR) was conducted on February 14, 2008, at the Port Angeles City Hall located in Port Angeles, Washington. Representatives from the U.S. Army Corps of Engineers (USACE) – Omaha Design Center; USACE –Seattle District; Washington Department of Ecology (WDOE); U.S. National Park Service; City of Port Angeles; Clallam County; and Shaw Environmental, Inc. (Shaw) were in attendance. A site tour was not conducted as part of this meeting, except that Shaw representatives viewed parts of the site from a public road. A public information meeting was conducted on the evening of February 14 at the Port Angeles City Hall. This was attended by six members of the public as well as the representatives from the USACE, WDOE, City of Port Angeles, and Clallam County who attended the afternoon meeting.

The TPP Memorandum documents discussions for the TPP meeting and includes the sections described below:

- **Administrative Information:** includes meeting logistics, list of attendees, and a summary of the meeting;
- **Site Inspection Objectives:** provides the goal and objectives of the SI, roles and responsibilities, the SI process, and the TPP process;
- **Background Information:** includes site and project history, area physical setting, a summary of previous environmental work, and an introduction to the areas of concern (AOCs) addressed by the SI;
- **Conceptual Site Model (CSM):** used to identify environmental attributes, potential human and ecological receptors in the area's environment, and the relationships between these factors;
- **Proposed Field Investigation:** used to describe the reconnaissance to be performed, the type and quantity of samples to be taken, and the analytical methods to be used for characterizing the AOC;
- **TPP Notes and Development of Data Quality Objectives (DQOs):** used to capture project and site-specific information as discussed during the TPP Meeting to ensure the necessary and appropriate information is shared among meeting participants, and that meeting participants concur with the identified goal, objectives, and approach used to complete the SI process;

- **Data Quality Objectives:** Summary of decision rules to be applied for determining recommendations for further investigations or No Department of Defense Action Indicated (NDAI); and
- **Worksheets:** includes the Site Information Worksheet, Draft Munitions Response Site Prioritization Protocol (MRSPP) Data Gaps, and Hazard Ranking System (HRS) Data Gaps.

Technical Project Planning Meeting Summary of Agreements

The TPP meeting for the Port Angeles Combat Range was held at the Port Angeles City Hall on February 14, 2008. Representatives from the USACE – Omaha Design Center and Seattle District, WDOE, City of Port Angeles, Olympic National Park, Clallam County, and Shaw were in attendance. The U.S. Environmental Protection Agency (EPA) has an agreement that WDOE is the lead agency for FUDS work in Washington State and the EPA was not invited to the TPP meeting.

Shaw summarized the SI process, reviewed the site information, presented a summary of the site including potential MEC and MC, and the proposed approach for the SI addressing MEC and MC sampling. All parties were in agreement with the approach presented.

Specific discussions included:

AOCs: All parties were in agreement with the AOCs as shown in the presentation.

Stakeholders: Stakeholders include the City of Port Angeles, Olympic National Park, and Clallam County Public Utility District Number 1 (PUD No. 1). Local tribal nations may also be a stakeholder because of aboriginal land rights. Mike Nelson of the USACE will contact the tribes to inquire about interest.

Concerns were expressed by the Clallam County representative that the Clallam County PUD No. 1 water intake is likely upstream of the FUDS but that we should inquire directly with the PUD. The Clallam County PUD No. 1 was contacted; it was noted that there are two water intakes on Morse Creek (Kitz, 2008). The upstream intake is within the northwest finger of the FUDS property at a point labeled as “Port Angeles Dam.” The second intake point is located approximately 1,200 feet downstream of the dam.

Screening Criteria: It was agreed by the WDOE that human health and ecological screening values consistent with those used for previous SIs (Fort Flagler Military Reservation and Fort Townsend) are appropriate for this FUDS. The city of Port Angeles stated that they had no basis from which to comment on the screening criteria and look to WDOE for guidance.

An Olympic National Park representative questioned whether the screening criteria adequately address impacts to vegetation. It was indicated that no direct sampling of vegetation is completed. Following the meeting, Shaw inquired with its ecological risk assessor whether plant values were included in the development of the ecological screening values. The risk assessor indicated that when plant values were available for a particular compound they were used in the development of the screening value.

Sampling: The group questioned whether an adequate investigation could be conducted with the heavy vegetative cover found in a rain forest. It was explained that the visual reconnaissance

and field sampling will follow established trails and paths and that these trails and paths are the most likely exposure points for human and wildlife exposure.

It was asked whether any special permits would be required from the Olympic National Park to collect soil samples. The Olympic National Park representative indicated that they would evaluate. This will be resolved during the request for right-of-entry between the Olympic National Park and USACE-Seattle District.

Data Quality Objectives: The proposed DQOs and decision rules for MEC and MC at Port Angeles Combat Range are as follows:

Objective 1: Due to the historically documented presence of MEC, the PACR will be recommended for a Remedial Investigation/Feasibility Study (RI/SF).

DQO #1 – Using trained unexploded ordnance (UXO) personnel and handheld magnetometers, a visual search of the PACR will be conducted to document current site conditions and for physical evidence of range activity to be used for collection of samples. The visual search will consist of a meandering path survey along trails and in accessible areas. The following decision rule will apply:

- If there is indication of an imminent MEC hazard, the site may be recommended for a removal action.

Objective 2: Determine if the site requires an additional investigation or can be recommended for NDAI based on the presence or absence of MC above screening values.

DQO #2 – Soil and sediment samples will be collected and analyzed as proposed in Table 4. Analytical results will be compared to background values, and, if exceeded compared to screening values for human health and ecological risk assessment. The following decision rules will apply:

- If sample results are less than background concentrations, the site will be recommended for NDAI relative to MC.
- If sample results exceed background concentrations, but do not exceed human health screening values the site will be recommended for NDAI relative to MC.
- If sample results exceed background concentrations and human health screening values, the site will be recommended for additional investigation.
- If sample results exceed background concentrations and ecological screening values but do not exceed human health screening values, additional evaluation of the data will be conducted in conjunction with the stakeholders to determine if additional investigation is warranted.

Objective 3: Obtain data required for HRS scoring.

Data required for HRS scoring are identified in the HRS Data Gaps worksheet.

Objective 4: Obtain data required for MRSPP ranking.

Data required for MRSPP ranking are identified in the MRSPP worksheet.

Port Angeles Combat Range, Washington
Technical Project Planning Meeting
February 14, 2008

Name	Organization	Phone	Cell Phone	Email
Dale Landon	Shaw Environmental, Inc.	509-946-2069	509-521-1437	Dale.landon@shawgrp.com
Peter Kelsall	Shaw Environmental, Inc.	720-554-8178		Peter.kelsall@shawgrp.co ,
Jack Hughes	Olympic National Park (Former Olympic National Park Employee)	--	--	--
Kevin Hendricks	Olympic National Park	360-565-3110		Kevin_hendricks@nps.gov
Glenn A. Cutler	City of Port Angeles	360-417-4800		gcutler@cityofpa.us
John Miller	Clallam County	360-417-2323		jmiller@co.clallam.wa.us
Mike Doherty	Clallam County	360-417-2233		Doherty_mike@co.clallam.wa.us
Mike Nelson	USACE Seattle	206-764-3458	206-390-9873	Michael.d.nelson@usace.army.mil
Paul Gleeson	Olympic ND	206-764-3458		Paul_gleeson@nps.gov
John Miller	USACE NWO	402-221-7720	402-350-3735	John.m.miller@usace.army.mil
Greg Johnson	WDOE	360-407-6487		Gjoh461@ecy.wa.gov
Nathan West	City of Port Angeles	360-417-4751		nwest@cityofpr.us

1.0 *Site Inspection Objectives*

1.1 *Goal*

- The USACE is conducting SIs of FUDS properties to determine if any MEC or related MC are present on property formerly owned or leased by the U.S. Department of Defense (DoD).

1.2 *Objectives*

- Determine if the site requires further response action under Comprehensive Environmental Response, Compensation, and Liability Act due to the presence of MEC or MC.
- Collect minimum information needed to:
 - Eliminate a site from further consideration if:
 - No evidence of MEC; and/or
 - Concentrations of MC in site media are below background or below risk-based screening levels.
 - Determine the potential need for removal action or initiation of the RI/FS if:
 - Evidence of MEC identified; and/or
 - Concentrations of MC in site media exceed background and risk-based screening levels.
 - Determine the potential need for a removal action based on risk to site users from MEC.
 - Provide sufficient data for the EPA to complete the HRS.
 - Evaluate the FUDS using the MRSPP.

1.3 *Roles and Responsibilities*

- USACE: Acts as the executing agency for the DoD with regard to the FUDS program. In this role, the USACE has decision making authority and is responsible for ensuring work is conducted in accordance with applicable USACE and federal guidance. Additionally, USACE coordinates and works with project team members to meet needs expressed by regulatory agencies and stakeholders.
- Regulatory Agency: Participates in planning of SI activities to ensure the project meets applicable state standards and requirements.
- Property Owner(s): Provides available and pertinent information about the area, provides insight on current and anticipated future land uses for the property, and participates in project team discussions.
- Shaw: As a contractor to the USACE, conducts work on behalf of the USACE, provides TPP materials, makes site information available to the project team through a web-based information portal, and conducts and reports SI activities.

1.4 *Site Inspection Process*

- Data review;
- TPP;
- Site-Specific Work Plan (SSWP);
- SI field activities – reconnaissance, sampling, and analysis; and
- SI Report.

1.5 *Technical Project Planning Process*

- Conduct TPP meeting(s)* with key organizations and stakeholders,
- Identify stakeholder(s) concerns,
- Identify all AOCs for this SI,
- Review site information,
- Verify current and anticipated future land use,
- Develop CSM,
- Identify data gaps,
- Plan how to address data gaps,
- Develop DQOs for meeting SI requirements, and
- Concur on SI field work approach.

* Second TPP meeting to be determined by team members following review of results from SI field activities.

2.0 Background Information

Historical information contained in this package was obtained from the *Archives Search Report* (ASR) (USACE, 1996) and the *ASR Supplement* (USACE, 2004) for the PACR.

2.1 Site Name and Location

The PACR, property number F10WA0033, is located approximately 7 miles southeast of the city of Port Angeles, in Clallam County, Washington (Figure 1). The PACR is located in Township 29 North, Range 5 West – Sections 5, 8, and 17 (Figure 2).

2.2 Range Inventory

The PACR is included in the Military Munitions Response Program Inventory in the *Defense Environmental Programs Annual Report to Congress Fiscal Year 2007* (DoD, 2007) with range information as follows:

Range Name	Federal Facility Identification	Range Total Acres
Port Angeles Combat Range	WA09799F318400	2,629

The area of the FUDS property is approximately 1,600 acres. The exact area of the FUDS property is not known; however, the ASR lists the acreage as “1,600 (+/-) acres” (USACE, 1996). As shown on Figure 2 the range boundaries extend beyond the FUDS boundary. The acreage of the Range areas and coordinates are listed in the *ASR Supplement* (USACE, 2004) as follows:

Range Name	Range Identification	Approximate Area (acres)	UTM Coordinates (meters)
Range Complex No. 1	F10WA003301R01	2,629	N 5318355 E 473503
Direct Fire Impact Area	F10WA003301R01-SR01	119	N 5319614 E 474222
Direct Fire and Combat Training	F10WA003301R01-SR02	37	N 5245500 E 474341
Indirect Fire Impact Area	F10WA003301R01-SR03	483	N 5319084 E 473895
Buffer Zone	F10WA003301R01-SR04	856	N 5317495 E 473788
Buffer Zone and Combat Training	F10WA003301R01-SR05	23	N 5319758 E 474317
Combat Training Area	F10WA003301R01-SR06	41	N 5320231 E 474337
Impact/Buffer Area	F10WA003301R01-SR07	960	N 5318355 E 473503

Coordinates for the ranges are in Universal Transverse Mercator (UTM), Zone 10N, NAD 83.

Figure 3 shows the outline of the FUDS, Range Complex No. 1, and subranges. Note that the area of Range Complex No. 1 exceeds the total area of the subranges combined.

2.3 Property History

The following discusses the history of the PACR. Information presented below was obtained from the ASR (USACE, 1996) and *ASR Supplement* (USACE, 2004). Figure 4 shows the site layout on a historical aerial photograph.

2.3.1 Historical Military Use

In early 1943, the 115th Cavalry Squadron (mechanized) requested that land be leased in the area of Port Angeles, Washington for use as a combat range. The range was intended to be used for tactical firing problems and short range known distance firing (200 to 300 yards). Through leases and use permits approximately 1,600 acres were obtained within Sections 5, 8, and 17 within Township 29 North, Range 5 West for use as the PACR. The range was sited for use of 37 millimeter (mm) and 75mm ammunition and small arms. However, there are reports that mortars and land mines were also used at the FUDS. There were no buildings or improvements other than a spotting tower. Troops were encamped at the Port Angeles Fair Grounds/Conservation Corps Camp.

Records indicate that the range consisted of a single firing line, with firing occurring to the south into the hilly and mountainous terrain. All firing apparently occurred from a single firing line. Interviews with former residents of the area and enlisted personnel who used the range indicated that all firing was west of Deer Park Road. Firing occurred at direct stationary and moving targets (targets and tanks pulled across range using cables) and indirect firing using coordinates.

In April and May 1944, the range was declared excess and all leases and permits were canceled. There is no information to suggest that at the time of closing any attempt was made by the Army to perform any range clearance prior to returning to private ownership. In addition, there was no information to indicate that the Army attempted to disseminate the actual use of the former range in terms of potential hazards that could remain.

Two young boys were killed in August 1948, when a 37mm shell exploded while they were cutting some downed timber within the former range. The 37mm shell was embedded in a log they were sawing. Immediately after the death of the two boys, the Army initiated the dedudiving of the area expected to be contaminated. On May 7, 1949, a Certificate of Clearance was issued noting that approximately 775 acres had been cleared of dangerous/explosive material. Figure 5 shows the area of the accident and the 1948 range clearance.

Subsequent clearances of the PACR occurred in 1952, 1955, 1956, and 1957. At some point in the 1950s signs were posted warning the public of dangers from munitions and explosive materials at the site. In 1963, 652 acres were purchased by the Army to restrict and control access to contaminated property. The 652 acres were retained until 1968 when it was transferred

to the city of Port Angeles and Mr. Raymond Diehl. Records indicated that the quitclaim deed included a “surface use only” and indemnity clause. This area is currently included in parcel identification numbers 5, 10, and 25 through 31 (Figure 6).

2.3.2 Munitions Information

The ASR (USACE, 1996) and *ASR Supplement* (USACE, 2004) indicate that the following munitions were used at PACR: 37mm (target practice, high explosive, and armor piercing), 75mm (practice, high explosive, and white phosphorus smoke), 60mm mortar (high explosive and practice), 81mm mortar (high explosive, practice, and white phosphorus smoke), rifle grenade M9A1 anti-tank, 2.36-inch rockets (practice and high explosive anti-tank), and anti-personnel and anti-tank practice mines. The munitions quantities used are not known. None of these munitions are reported as containing perchlorate. Table 1 lists the probable munitions used and munitions constituents for PACR.

2.3.3 Ownership History

Through leases and use permits approximately 1,600 acres were obtained within Sections 5, 8, and 17 within Township 29 North, Range 5 West for use as the PACR. The original request was to also obtain property within Sections 4 and 9; however, there is no record of that property being acquired.

In April and May 1944 the range was declared excess and all leases and permits were canceled. In 1963, 652 acres were purchased by the Army to restrict and control access to contaminated property. The 652 acres were retained until 1967 when it was transferred to the city of Port Angeles and Mr. Raymond Diehl. Records indicated that the quitclaim deed included a “surface use only” and indemnity clause. Figure 6 shows the current ownership of the FUDS. The southern and southwestern portion of the FUDS is part of the Olympic National Park.

2.4 Physical Setting

2.4.1 Topography and Vegetation

The PACR is located on the Olympic Peninsula of Washington State. The land is hilly and semi-mountainous. The northern portion of the FUDS contains areas of meadowland/grassland, but other areas are densely forested. Review of historical aerial photographs indicates that the areas of meadowland/grassland have been present since at least 1939. This portion was the area used for actual firing. The southern portion of the property is located within the Olympic National Park and is contained in the Buffer Zone. The minimum and maximum elevations of the PACR are approximately 700 feet in the north and 3,541 feet in the south at Round Mountain (Figure 2). Deep ravines associated with Morse and Surveyor Creeks are present at the site.

The FUDS consists of primarily second growth fir and alder with some cedar trees. Where forested, the site has very heavy undergrowth that makes traverse difficult. A general depiction

of the area’s topography and vegetation, including surface elevations and prominent features is provided on Figures 2 and 3.

2.4.2 Surface Water

Three creeks transect the FUDS flowing from south to north: Surveyor Creek, Frog Creek, and Morse Creek (Figure 7). A wetland is present north of the site (Figure 8).

2.4.3 Sensitive Environments

The Washington Department of Fish and Wildlife (WDFW), Washington Department of Natural Resources Natural Heritage Program, and U.S. Fish and Wildlife Service were contacted to determine whether any threatened or endangered species are present at the FUDS. Database searches by the WDFW indicated that “priority wildlife heritage points” and occupied Marbled Murrelet sites are present on the FUDS (WDFW, 2008). In addition, priority anadromous and resident fish are present in the area. Inquiries on the U.S. Fish and Wildlife Service website for Clallam County, Washington (www.fws.gov/westwafwo/speciesmap/Clallam.html) indicated that federally listed species may use the FUDS. The Washington Department of Natural Resources indicated that there were no records for rare plants or high quality native ecosystems in the vicinity of the FUDS (2008). This information is general to the area and not site specific. The status of threatened or endangered species in the area of PACR is shown in the table below.

Listing	Status	Common Name	Scientific Name
State and Federal	Listed	Bull Trout	<i>Salvelinus confluentus</i>
State and Federal	Listed	Northern Spotted Owl	<i>Strix occidentalis caurina</i>
State and Federal	Listed	Marbled Murrelet	<i>Brachyramphus marmoratus</i>

There is a designated wetland within the FUDS.

The PACR does qualify as Important Ecological Places (IEPs) or Sensitive Environments as defined by USACE (2006) and EPA (1997) and shown in Table 2.

The Washington Department of Archaeology and Historic Preservation (WDAHP) has been contacted to determine if there are any historical or cultural sites located at the FUDS. The WDAHP recommended that consultation with nearby tribes and an archaeological survey be conducted (WDAHP, 2008). The USACE Seattle District will conduct an archaeological evaluation of the FUDS, which will be documented in the SI Report.

2.4.4 Climate

The PACR area is tempered by winds from the Pacific Ocean. Summers are warm but hot days are rare. In winter, temperatures are cool; however, freezing temperatures and snow are infrequent except in the mountains.

The average maximum high at Port Angeles occurs in July and August at 68.4 degrees Fahrenheit and the minimum average low occurs in January at 34.0 degrees Fahrenheit. The

average annual precipitation is 25.57 inches, which occurs primarily between October and April. Average total snow fall is 3.8 inches.

2.5 Geologic and Hydrogeologic Setting

2.5.1 Bedrock Geology

Bedrock geology of the area is controlled by the converging of two tectonic plates (Juan de Fuca and North American plates). Underlying the PACR, are accreted Tertiary sediments and pillow basalt rocks once on the floor of the Pacific Ocean. During the Pleistocene Epoch, colder climates brought about glaciation over much of the Olympic Peninsula and Puget Lowland leaving thick glacial outwash deposits over older rocks (Orr and Orr, 2002).

2.5.2 Overburden Soils

Overburden soils present at the PACR are Elwha gravelly sandy loam, Neilton very gravelly sandy loam, Puget silt loam, and Terbies very gravelly sandy loam (NRCS, 2007).

2.5.3 Hydrogeology

Shallow groundwater occurs in gravelly units within the glacial outwash deposits. Based on well logs groundwater occurs in these units at a depth ranging from 30 to 74 feet. Groundwater flow is to the north from the highlands to the Strait of Juan de Fuca.

2.6 Population and Land Use

2.6.1 Nearby Population

The closest population center is the city of Port Angeles, Washington located approximately 7 miles to the northwest. The 2000 census population was 18,379 persons (U.S. Census, 2000). The population density is less than 100 persons per square mile. There are several residences within the FUDS boundary. Figure 9 shows the population distribution for the PACR vicinity. Note that Figure 9 indicates that there are no residents or housing units located within ¼ mile of the FUDS, which disagrees with direct observation of the area indicating several residences. There are likely inaccuracies in the census data.

2.6.2 Land Use

Land use is primarily as a protected watershed for the city of Port Angeles, timber production, a National Park, and private residences. The site is accessible to the general public. Members of the public who attended the public information meeting indicated that the area is used for hiking and hunting. Fencing (condition unknown) and a few remaining signs warning of munitions hazards are still present.

2.6.3 Area Water Supply

Drinking water in the area is obtained from Clallam County PUD No. 1 and private water supply wells. Clallam County PUD No. 1 obtains water from Morse Creek at two water intake structures and from wells. The upstream structure is located at the location labeled as “Port

Angeles Dam” on Figure 2 and the second intake is located approximately 1,200 feet downstream of the dam. The intake at “Port Angeles Dam” is within the PACR FUDS boundary. Some wells are located on private property within the FUDS. Figure 10 shows the locations of nearby wells.

2.7 Previous Investigations for MC and MEC

The following describes range decontamination activities at the PACR. The information was summarized from the ASR (USACE, 1996):

- In April and May 1944 the range was declared excess. No information exists to indicate that any range cleanup was conducted at that time.
- In August 1948 two boys were killed when sawing some downed timber within the former range area. A live 37mm shell, embedded in the log they were sawing, exploded.
- Following the accident, a range clearance was conducted and in May 1949 a Certificate of Clearance was issued noting that approximately 775 acres had been cleared of dangerous/explosive material.
- Subsequent clearances were completed in 1952, 1955, 1956, and 1957.
- In 1986 a Range Clearance Technology Assessment was completed for the PACR. The report concluded that “Additional mechanical clearance of the range is environmentally, technically, and economically unfeasible at this time or in the foreseeable future” (NEODFC, 1986).

An Inventory Project Report (USACE, 1993) was prepared and issued in 1993. The report determined that the PACR was formerly used by the DoD and is eligible for Defense Environmental Restoration Program-FUDS. It was also proposed that further evaluation of the site be completed to better determine the hazards posed by the presence of UXO.

An ASR (USACE, 1996) was prepared and issued in 1996 summarizing historical information and performing a site visit to confirm site conditions. The ASR identified six areas of interest:

- Area A – Direct Fire Impact Area,
- Area B – Indirect Fire Impact Area,
- Area C – Buffer Zone,
- Area D – Combat Training Area,
- Area E – All remaining land, and
- Area F – Impact/Buffer Area (additional acreage).

The ASR (USACE, 1996) identified the likely munitions used at PACR.

An *ASR Supplement* (USACE, 2004) identified one range and seven sub-ranges as follows:

- Range Complex No. 1,
 - Direct Fire Impact Area,

- Direct Fire and Combat Training Area,
- Indirect Fire Impact Area,
- Buffer Zone,
- Buffer Zone and Combat Training,
- Combat Training Area, and
- Impact/Buffer Area.
- No other investigations/removal actions have been conducted at PACR.
- MEC was located and disposed of during the multiple range clearance activities that occurred in 1949 and in the 1950s.

2.8 Other Land Uses that May Have Contributed to Contamination

Available information indicates that portions within the PACR are being used for cattle grazing and timber harvesting. Other than occasional use of fertilizers and pesticides/insecticides no other potential sources of contamination are known.

2.9 Summary of Previous Investigations

Table 3 summarizes the results of the range clearances and MEC/munitions debris (MD) recovered during the clearance.

3.0 *Conceptual Site Model – Range Complex No. 1*

3.1 *Overview*

A site-specific CSM summarizes available site information and identifies relationships between exposure pathways and associated receptors. A CSM is used to determine the data types necessary to describe site conditions and quantify receptor exposure, and discusses the following information:

- Current site conditions and future land use.
- Potential contaminant sources (e.g., lead projectiles in an impact berm);
- Affected media.
- Governing fate and transport processes (e.g., surface water runoff and/or groundwater migration).
- Exposure media (i.e., media through which receptors could contact site-related contamination).
- Routes of exposure (e.g., inhalation, incidental ingestion, and dermal contact).
- Potential human and/or representative ecological receptors at the exposure point. Receptors likely to be exposed to site contaminants are identified based on current and expected future land uses.

The CSM is evaluated for completeness and further developed as needed through TPP meetings and additional investigation.

The entire PACR FUDS is considered one AOC based on the presence of only one identified range – Range Complex No. 1.

3.2 *Background*

3.2.1 *History of Use*

Based on the *ASR Supplement* (USACE, 2004) the entire FUDS property is one range, Range Complex No. 1, which contains seven subranges (see Section 2.2 and Figure 3). Range Complex No. 1 was used between 1943 and 1944 for combat training of the 115th Cavalry Squadron (mechanized). The range was originally identified for training using 37mm and 75mm ammunition and small arms. However, evidence from clearance activities indicate that 61mm and 81mm mortars and 2.25-inch rockets were also used at the range.

A table of organization and equipment provided in the ASR (USACE, 1996, Appendix F-8) indicates that armament for the 115th Cavalry Squadron included small arms (.30, .45, and .50 caliber hand, rifle, and machine guns), anti-tank rocket launcher, 60mm and 81mm mortars, and light tanks with armament. Although not listed in the inventory, an interview with a former member of the 115th Cavalry Squadron indicated that 75mm Howitzer Motor Carriage M8 Tank, and M3 and M5 Light Tanks fitted with 37mm weapons.

Both direct and indirect firing was conducted at fixed and moving targets (targets and tanks) to the south. Figure 3 shows the position of the firing point and line. Range clearance activities were performed in 1949, 1952, 1955, 1956, and 1957. Figure 11 shows the conceptual model for the range and likely firing configurations.

3.2.2 Munitions and Associated MC

Table 1 lists the munitions and associated MC likely used at the AOC.

3.2.3 Previous MEC Finds

MEC and MD finds are limited to those recovered during range clearance activities. Table 3 lists the MEC and MD that were recovered during the range clearance activities.

3.2.4 Previous MC Sample Results

There has been no previous sampling for MC at PACR.

3.2.5 Current and Future Land Use

The PACR is currently used for a protected watershed for the city of Port Angeles, for timber production, cattle grazing, hiking, hunting, and as private rural residences.

Barbed wire fencing, in an unknown condition, is present around the AOC. The condition of the fencing will be evaluated during field activities. The southern portion of the FUDS is within the Olympic National Park.

Future land use, based on Clallam County zoning (Gray, 2008), is as commercial forest and rural character conservation. Portions within the Olympic National Park will remain as a national park.

3.2.6 Ecological Receptors

Based on the presence of wetlands and streams and that the southern portion of the AOC is within the Olympic National Park the AOC qualifies as an IEP (Table 2).

3.3 MEC Evaluation

The PACR is a former range used to train troops in the firing of anti-tank weapons. Shells (37mm and 75mm) and mortars (60mm and 81mm) were known to have been used at the range. Both practice and high explosives rounds with sensitive fuzes were used at the range. M9 rifle grenades and 2.36-inch rockets may also have been used, although no direct evidence exists for their use. The ASR (USACE, 1996) speculated that infantry troops from Fort Lewis may have used the ranges as well as the 115th Cavalry. The risk for finding MEC is considered moderate based on reports from range clearance activities in the 1950s. Munitions with high explosives and sensitive fuzes were used at the range.

In 1948 two boys were killed when a 37mm round that was embedded in a log exploded. There have been no additional reports of MEC or MD being found by civilians (USACE, 1996).

MEC and MD have been previously found on the surface. Previous range clearance reports have recommended that the range use be restricted to “surface use only,” due to the subsurface MEC risk.

Much of the property is owned by the city of Port Angeles as part of a watershed. The Olympic National Park occupies the very southern portion of the FUDS. Other uses are for rural residences with limited farming and livestock use and timber production. There currently is a barbed wire fence in poor condition surrounding a portion of the property. However, for all practical purposes the range has uncontrolled access.

The range impact area has had limited disturbance since DoD use, due to ownership by the city of Port Angeles as a watershed. There are fewer than 100 persons per square mile in the vicinity of the site.

3.4 MC Pathway Evaluation

3.4.1 Overview of Site Characteristics

The PACR is located in a rural area approximately 7 miles south east of the city of Port Angeles, Washington. The majority of the site is heavily forested with dense underbrush. Portions of the site have open non-timbered areas. Morse Creek, Surveyor Creek, and Frog Creek traverse through the FUDS and are shown on Figure 3. Figure 3 shows the general layout of Range Complex No. 1. There was only one firing point at the FUDS. There are impact areas for direct firing and indirect firing targets.

3.4.2 Terrestrial Pathway

3.4.2.1 Sources of MC

Table 1 lists the MC associated with the munitions used at PACR. MC, if present, will be most likely found in the target areas when incomplete detonation may have occurred. Some MC, propellants or fuze residue may be found at the firing line. There have been no previous studies for MC at this site.

3.4.2.2 Migration Pathway

Land surface may have been somewhat disturbed since DoD use. As described earlier some logging activities may have occurred. There are no known tilling activities that may have occurred.

Much of the site has been and is currently being used as a watershed for the city of Port Angeles. Possible migration routes for MC are through overland transport via surface erosion into nearby surface water drainage.

3.4.2.3 Land Use and Access

Current land use is rural with livestock grazing. Portions of the site are protected as a watershed for the city of Port Angeles. Members of the public who attended the public information meeting indicated that the area is used for hiking and hunting.

The southern portion of the site is within the Olympic National Park. Future land use is likely to remain the same. Future land use, based on Clallam County zoning (Gray, 2008), is as commercial forest and rural character conservation.

There is unrestricted access to the site.

3.4.2.4 Human Receptors

Potential human receptors would be exposed through direct ingestion of the soil. The human exposure pathway is considered potentially complete.

3.4.2.5 Ecological Assessment

The Range Complex No. 1 is identified as an IEP due to its use as a watershed and portions being within a National Park (Table 2). There have been no threatened or endangered species identified as specifically residing in the FUDS. However, transient use of the site is probable.

3.4.3 Surface Water/Sediment Pathway

3.4.3.1 Sources of MC

Soil impacted from metals and explosives (Table 1) may migrate to surface waters and sediment through soil erosion. There are no previous investigations for MC impacts to surface water/sediment.

3.4.3.2 Migration Pathway

Potential pathway is through the erosion of soils into Survivor and Frog creeks and into Morris Creek.

3.4.3.3 Surface Water/Sediment Use and Access

A portion of the surface water from Morris Creek is currently diverted for domestic water and irrigation purposes. Access to the three streams that traverse through the FUDS is unrestricted.

3.4.3.4 Human Receptors

Human ingestion of resident and migratory fish exposed to contaminants in the streams. Determination of impacts will be assessed by comparing concentrations of select metals and explosives in sediments to background concentrations and human health screening values. The exposure pathway is potentially complete based on the presence of streams in the FUDS and the unrestricted access to the streams both on site and downgradient. Surface water conditions will be assessed through the stream sediments, as the likely source of contaminants is from soil erosion into stream sediments.

3.4.3.5 Ecological Assessment

The presence of wetlands and streams within the FUDS and the southern portion of the FUDS is within the Olympic National Park and qualify the FUDS as an IEP (Table 2). There are no known resident threatened and endangered species. However, migratory use of the FUDS by threatened and endangered species is probable.

Comparison of stream sediment sample analytical results will be first compared to background. If background is exceeded then comparison to ecological screening values will be completed. The ecological pathway is potentially complete based on the FUDS being an IEP

3.4.4 Groundwater Pathway

3.4.4.1 Sources of MC

Soil impacted from metals and explosives (Table 1) may migrate to groundwater waters through infiltration. There are no previous investigations for MC impacts to groundwater.

3.4.4.2 Migration Pathway

MC may be leached from soil into groundwater and then groundwater is used for domestic use. Nearby wells may be located within the FUDS boundary (Figure 10). Depth to the producing aquifer is approximately 115 feet below ground surface.

3.4.4.3 Groundwater Use and Access

Private domestic wells are located downgradient of the firing line and impact areas within FUDS property.

3.4.4.4 Human Receptors

Residents in the area may use groundwater for domestic use. Results from groundwater sampling will be compared to groundwater human health screening values. The pathway to groundwater is considered potentially complete due to the relatively shallow occurrence of groundwater (approximately 115 feet below ground surface); wells located on FUDS property and located downgradient of firing lines and impact areas.

3.4.5 Air Pathway

3.4.5.1 Sources of MC

Metals and explosives in soil may be a potential source for airborne exposure.

3.4.5.2 Migration Pathway

The potential for airborne migration of contaminated soils is minimized by the presence of native grasses and vegetation present on the FUDS. This vegetation minimizes the likelihood of airborne entrainment of soils.

3.4.5.3 Human Receptors

Potential human receptors would be agricultural workers who till the soil and construction workers who disturb the soil. Exposure would be through entrainment of fine soil particles in air.

Due to the presence of native vegetation and current land (forested and watershed) use the air pathway is considered incomplete for human receptors.

3.5 CSM Summary/Data Gaps

Evaluation of the CSM indicates the following known conditions or data gaps.

CSM Section	Known	Unknown	Notes
MEC	MEC has been identified in previous range clearance operations		37mm high explosive rounds, munitions debris of M51 type fuzes, munitions debris from 81mm mortars
Terrestrial pathway – human receptors		X	Collect soil samples
Terrestrial pathway – ecological receptors		X	Collect soil samples
Sediment/Surface water pathway – human receptors		X	Evaluated through collection of sediment samples
Sediment/Surface water pathway – ecological receptors		X	Evaluated through collection of sediment samples
Groundwater pathway		X	Collect groundwater sample
Air pathway	X		Incomplete pathway

4.0 *Proposed Field Investigation*

The proposed field activities (reconnaissance and sampling) to be conducted at the former PACR are detailed below. The inspection approach will be defined in more detail in an SSWP that will be submitted to WDOE and other stakeholders for review. The SSWP will reference technical details that are described in the *Type I Work Plan, Site Inspections at Multiple Sites (Work Plan)* (Shaw, 2006).

4.1 *Reconnaissance*

A visual surface reconnaissance will be conducted along a meandering path through portions of the FUDS. The reconnaissance has three main objectives:

- Document general site conditions;
- Identify and locate MEC, MD, and/or other evidence of range activities that may be present in order to test and verify the CSM; and
- Optimize sample locations, biased to locations where MC is most likely to be present.

The reconnaissance effort will be focused within the AOCs in areas where MEC or MC are most likely to be found based on the CSM. Specifically, reconnaissance will include, but not be limited to, the following focus areas:

- The firing line where all weapons were fired,
- Direct and indirect fire target areas, and
- Reconnaissance in downrange buffer areas will be limited to accessible trails.

General site conditions will be documented throughout the AOC and as appropriate in other parts of the FUDS. A global positioning system will be used to record discovered MEC, MD, and sample point locations. Digital photographs will be taken to document significant features. Based on USACE guidance, reconnaissance of this type will be limited to the identified former range areas, in the absence of evidence suggesting munitions-related activities in other portions of the FUDS.

Because of the anticipated heavy vegetation cover and for worker safety, the visual reconnaissance will be conducted in open areas and along established wildlife trails. Visual reconnaissance will not be conducted in areas that will jeopardize the safety of the field crew.

The magnetometer-assisted, visual inspection will be conducted by a qualified UXO technician at suspect locations within the FUDS. If MEC is found, the qualified UXO technician will attempt to make a determination of the hazard, and appropriate notifications will be made as detailed in the Work Plan (Shaw, 2006) and a future SSWP.

4.2 Sampling

Sampling within the PACR will include surface soils, sediment, and groundwater. Surface water will be evaluated using the results of a stream sediment sample. Proposed SI soil sampling at the PACR will consist of the collection of eight soil samples (Figure 12). One soil sample will be collected from the firing line to determine impacts from firing. One sample will be collected from the Combat Training Area Subrange. Two samples will be collected from each of the two impact areas. One sample will be collected from the location of the Swagerty accident and one sample will be collected from the area of “heavy contamination” based on historical range clearance activities. The exact locations of these samples may be adjusted to more biased locations based on the results of the visual reconnaissance survey. Surface soil samples from the range will be collected as composite samples (7-point, wheel pattern with a 2-foot radius). Proposed sample locations are shown on Figure 12. The proposed sampling approach is shown in Table 4.

One sediment sample will be collected from Surveyor Creek at a location downstream of the impact areas (Figure 12). One sample will be collected from a domestic groundwater well located downgradient of the FUDS.

4.3 Analytical

Analysis of the proposed SI sampling (soil, sediment, and groundwater) at the PACR will use EPA SW-846 Method 6020A to analyze for total metals (chromium, copper, iron, lead, mercury, and nickel) in soil. In addition, the metals analyses will include aluminum, copper, magnesium, manganese, and zinc. The additional metals may be used to conduct geochemical evaluation for determination of naturally occurring metals of concern concentrations. Soil samples that are possibly impacted by small arms fire will be passed through an ASTM International No. 10 (2mm) wire mesh sieve at the laboratory prior to analysis for lead in order to remove coarser particles and foreign objects, including large metallic lead fragments from bullets, which have a low degree of bio-availability (Interstate Technical and Regulatory Council, 2003).

Analysis of SI samples collected at the PACR will use EPA SW-846 Method 8330A to analyze for explosives in soil, sediment, and groundwater.

Quality control samples, including field duplicates and matrix spike/matrix spike duplicate samples, will be collected in accordance with the Work Plan (Shaw, 2006).

4.4 Background Sampling

Site-specific or regional data regarding background concentrations of metals in soil, sediment, and groundwater are not known to be available. Ten background surface soil samples (including one duplicate sample) will be collected from nearby areas outside the range impact area boundaries. The discrete samples locations will be determined in the field in areas that do not appear to have been impacted by past site operations. The soil background samples will be collected using the same procedures and analyzed for the metals of concern (chromium, iron,

lead, mercury, and nickel) plus metals aluminum, copper, magnesium, manganese, and zinc. The additional metals may be used to conduct geochemical evaluation for determination of naturally occurring metals of concern concentrations. The results of the background sampling will be used for comparison to the results from the samples collected at the firing line and two target impact areas. Proposed background sampling is summarized in Table 4.

A comparison of site sample data to background data will be necessary to distinguish a munitions-related release from ambient conditions resulting from naturally occurring or anthropogenic sources. Where the body of background data includes sufficient samples (i.e., soil), a background threshold comparison of site concentrations to the background 95th upper tolerance limit or 95th percentile, as appropriate, will be made (EPA, 1989, 1992, 1994, and 2002). If one or more site samples exceed the background threshold, the following tests may also be applied:

- A nonparametric comparison of the central tendencies or medians of the site and background distributions, using the Wilcoxon rank sum test (EPA, 1994, 2002, and 2006; U.S. Navy, 2002 and 2003),
- A geochemical evaluation using correlation plots of trace element versus reference element concentrations (EPA, 1995; Myers and Thorbjornsen, 2004), for any element that fails either of the above two statistical tests.

Two background sediment samples will be collected from Surveyor Creek at a location upstream of the impact areas. The sample will be analyzed for the metals listed above for the soil background samples and the data will be used for comparison to the sediment sample collected downstream of the impact areas.

One background groundwater sample will be collected from a groundwater source located either up or cross gradient of the firing line and impact areas. The sample will be analyzed for the metals listed above for the soil background sample and used for comparison to the groundwater sample collected downgradient of the firing line and impact areas.

5.0 *Technical Project Planning and Development of Data Quality Objectives*

5.1 *TPP Process*

- The USACE TPP process is a four-phase process:
 - Identify the current project,
 - Determine data needs,
 - Develop data collection options, and
 - Finalize data collection program.
- The purpose of TPP is to develop DQOs that document how the project makes decisions.
- DQOs are intended to capture project-specific information such as the intended data use(s), data needs, and how these items will be achieved.
- Information captured through DQOs will be used as a benchmark for determining whether identified objectives are met.

5.2 *TPP Phases*

Phase I: Identify the Current Project

1. Team members identified to date include the USACE – representatives from the Omaha Design Center and the Seattle and Kansas City Districts; city of Port Angeles; Clallam County, National Park Service; WDOE; and Shaw.

Question: Is there any person or organization missing from this Team?

Answer: Clallam County PUD # 1, Indian Tribes.

2. The AOC identified is Range Complex No. 1. The area is known to have MEC and MD and was assigned a Risk Assessment Code score of 2 completed for the *ASR Supplement* (USACE, 2004). The site has had confirmed MEC based on MEC and MD recovered during range clearance activities in the 1950s.

Question: Are there any other AOCs to be identified?

Answer: None identified.

3. Based on information available about the site and shared through discussions with the USACE, concerns about this area have been expressed by the WDOE, as well as by landowners.

Question: Are there additional concerns or issues from landowners or other stakeholders regarding the PACR area?

Answer: None identified.

Question: Are there any administrative or stakeholder concerns or constraints that would prevent site inspection activities from going forward on the decision path for this site?

Answer: None identified.

Phase II: Determine Data Needs

4. Existing site information includes an ASR and *ASR Supplement* both prepared by the USACE in 1996 and 2004, respectively.

Question: Are there any other pertinent documents relating to the site available?

Answer: The City of Port Angeles provided a packet of pertinent real estate documents and maps.

5. The site-specific approach for this SI involves collating and assessing available site information, to include site geology, hydrogeology, groundwater, surface water, ecological information, human use/access, and current and future land uses; as well as considering conduct of site inspection and sampling activities.

Question: Are there any other site aspects/information that should be considered?

Answer: None identified.

6. Based on prior site investigations, soil is the primary affected medium at the PACR. Surface water/sediment is a potential pathway of MC because of the presence of three streams that traverse through the site. Groundwater is a potential pathway based on current and future land use. Air is not considered to be a potential pathway based on current and future land use scenarios. Primary receptors of any contaminants that may be present would most likely be individuals and animals using the area.

Question: Do team members concur with the CSM?

- **MEC and MC are both to be evaluated;**
- **Potential MC are metals (chromium, copper, iron, lead, mercury, and nickel) and explosives; and**
- **Exposure pathways are through soils, surface water/sediment, and groundwater.**

Answer: All agreed with CSM.

7. Technical considerations and/or constraints need to be identified and addressed before conducting any additional sampling, and would depend on the approach and additional data needs decided upon by team members.

Questions:

- **Are any data missing?**

Answer: None identified.

- **What is the nature of needed data?**

Answer: Not applicable.

- **What data gaps would additional data meet for making a decision about the site?**

Answer: Not applicable.

- **Are there any considerations/constraints that need to be addressed for collecting additional data?**

Answer: Not applicable.

Phase III: Develop Data Collection Options

8. Proposed Approach:

1. Conduct surface reconnaissance in the AOCs.
2. Find suitable background sample location and sample.
3. Collect composite soil samples from the Range Complex No. 1.
4. Collect sediment samples from Surveyor Creek, which is the most likely impacted surface water body.
5. Collect groundwater sample downgradient of FUDS.

Question: Based on the desired decision endpoints and information known to date, what additional information is needed to reach a determination of NDAI or further action?

Answer: None identified.

Question: Are the stakeholders in agreement with the sampling approach program?

Answer: Yes.

Phase IV: Finalize Data Collection Program

9. Background Data.

Site sampling results will be compared to background concentrations. Site will be considered NDAI for MC if site results do not exceed background.

Questions:

- **What background data will be used for evaluation?**

Answer: Site-specific samples.

- **Are background data sets available from previous site studies?**

Answer: None identified.

- **Are background data sets available from statewide studies?**

Answer: None identified.

- **If background data are to be collected as part of the SI, how many samples will be collected and what methods will be used to define the background range and compare to site sample results?**

- Soil – 10 samples

- Sediment – 2 sample
- Surface Water – 0 samples
- Groundwater – 1 sample

10. Human Health Screening Level Risk Assessment.

Sample results that exceed background will be compared to screening values. Site will be considered NDAI for MC if site results do not exceed screening values (depending also on ecological evaluation).

Question: What concentrations of potential MC (select metals and explosives) lead to decision end-points for human health?

Answer: Potential human health screening values are provided in Tables 5 and 6, which are based on Washington State and EPA standards.

Question: Are these the correct standards to be applied as screening values for Human Health Risk Assessment?

Answer: Yes, confirmed with WDOE. The City of Port Angeles indicated that they have no basis from which to voice an opinion and that they look to WDOE for concurrence.

11. Ecological Screening Level Risk Assessment.

The USACE has defined a process for conducting screening level ecological risk assessment. A determination is first made whether the site qualifies as an IEP. A second determination is made whether the site is managed for ecological purposes. If neither criterion is met, then a screening level ecological risk assessment is not required and the process is limited to making observations during the site visit of any acute effects to flora and fauna that may be related to MC. If the site does qualify as an IEP or is managed for ecological purposes, site results that exceed background will be compared to ecological screening values. The site will be considered NDAI for MC if site results do not exceed screening values (depending also on human health evaluation).

Questions:

- **Does the site qualify as an IEP?**
- *Answer: Yes.*
- **Is the site managed for ecological purposes?**
- *Answer: Yes.*
- **If the site is an IEP or is managed for ecological purposes, what concentrations of potential MC (explosives) lead to decision end-points for ecological risks?**

Answer: Potential ecological screening values are provided in Tables 7 and 8, which are based on Washington State and EPA standards.

Question: Are these the correct standards to be applied as screening values for ecological risk assessment?

Answer: Yes, confirmed with WDOE. The City of Port Angeles indicated that they have no basis from which to voice an opinion and that they look to WDOE for concurrence.

12. Other Sampling Issues.

Question: Are there any additional sampling and analysis methodologies needed for all team members to arrive at a decision end-point?

Answer: None identified.

Question: Given the additional sampling and analysis methodologies, are there impacts to the project schedule that need to be accommodated?

Answer: Not applicable.

6.0 Data Quality Objectives

Upon agreement at the TPP meeting, the following decision rules will be applied with regard to MC sampling results:

- Below background concentrations (naturally occurring compounds) and nondetect for explosives equals NDAI;
- Above background and detected explosive compounds and below risk-based screening levels equals NDAI; and
- Above background and detected explosive compounds and above risk-based screening levels and background equals RI/FS.

The following expanded project objectives have been developed.

Objective 1: Due to the historically documented presence of MEC, the PACR will be recommended for a RI/FS.

DQO #1 – Using trained UXO personnel and handheld magnetometers, a visual search of the PACR will be conducted to document current site conditions and for physical evidence of range activity to be used for collection of samples. The visual search will consist of a meandering path survey along trails and in accessible areas. The following decision rule will apply:

- If there is indication of an imminent MEC hazard, the site may be recommended for a removal action.

Objective 2: Determine if the site requires an additional investigation or can be recommended for NDAI based on the presence or absence of MC above screening values.

DQO #2 – Soil and sediment samples will be collected and analyzed as proposed in Table 4. Analytical results will be compared to background values, and if exceeded compared to screening values for human health and ecological risk assessment. The following decision rules will apply:

- If sample results are less than background concentrations, the site will be recommended for NDAI relative to MC.
- If sample results exceed background concentrations, but do not exceed human health screening values the site will be recommended for NDAI relative to MC.
- If sample results exceed background concentrations and human health screening values, the site will be recommended for additional investigation.
- If sample results exceed background concentrations and ecological screening values but do not exceed human health screening values, additional evaluation of the data will be conducted in conjunction with the stakeholders to determine if additional investigation is warranted.

Objective 3: Obtain data required for HRS scoring.

Data required for HRS scoring are identified in the HRS Data Gaps worksheet.

Objective 4: Obtain data required for MRSPP ranking.

Data required for MRSPP ranking are identified in the MRSPP worksheet.

Next Steps

- USACE will obtain necessary rights-of-entry.
- Shaw will prepare the Final TPP Memorandum and distribute for concurrence.
- Shaw will prepare the SSWP for review and comment.
- Shaw will conduct field work.
- Shaw will prepare the SI Report and submit for stakeholder review.
- USACE/Shaw will schedule a second TPP meeting to review comments on the Draft Final SI Report.

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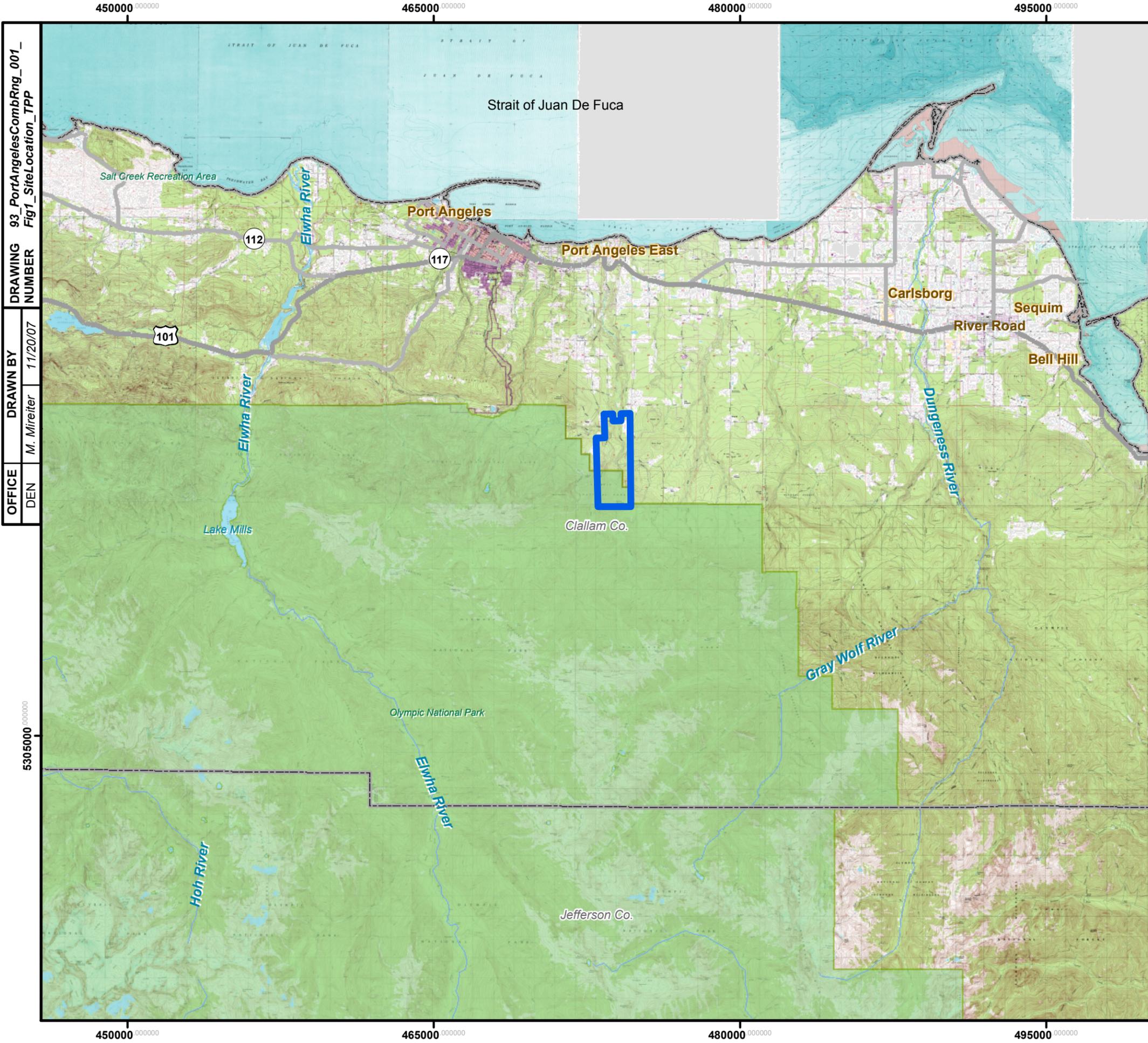
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Figures



DRAWING NUMBER: 93_PortAngelesCombRng_001_Fig1_SiteLocation_TPP
 DRAWN BY: M. Mireiter
 DATE: 11/20/07
 OFFICE: DEN

Legend

 Port Angeles Combat Range FUDS Property

NOTES:
 1) FUDS property boundary was obtained from a GIS dataset provided by the USACE.
 2) Topographic map (Clallam County) was obtained from the U.S. Department of Agriculture, Service Center Agencies, 1999.



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

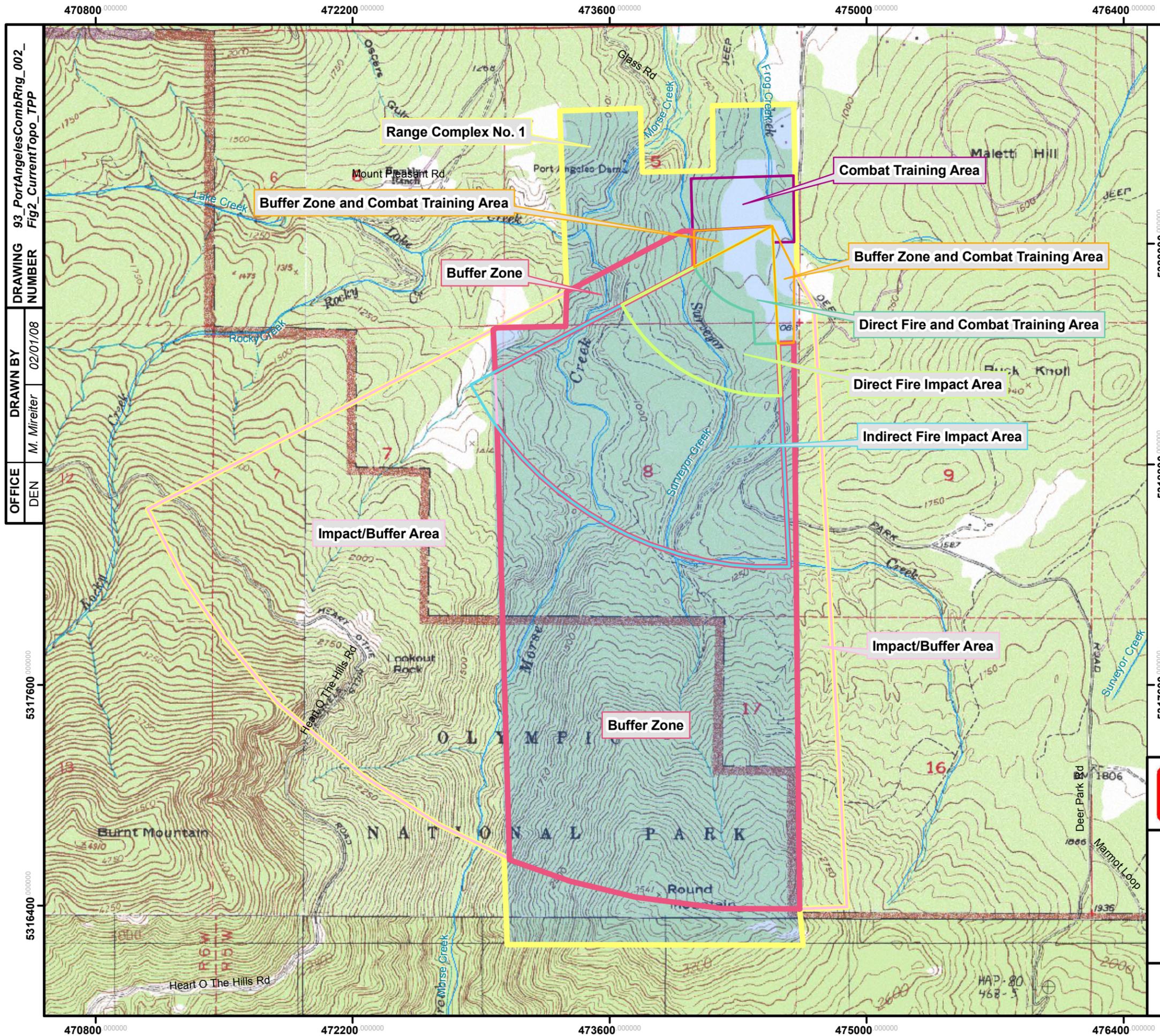


U.S. ARMY CORPS OF ENGINEERS
 OMAHA DESIGN CENTER

FIGURE 1
SITE LOCATION

PORT ANGELES COMBAT RANGE
 FUDS PROPERTY NUMBER F10WA0033

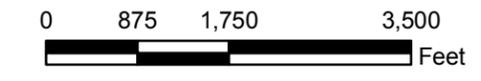
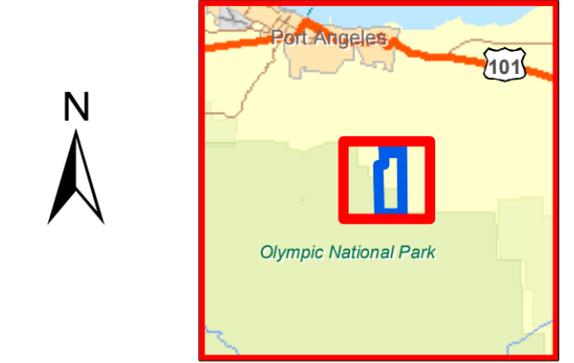




Legend

- Port Angeles Combat Range FUDS Property
- Ranges in the MMRP Inventory**
 - Range Complex No. 1
- Sub-Ranges in the MMRP Inventory**
 - Direct Fire Impact Area
 - Direct Fire and Combat Training Area
 - Indirect Fire Impact Area
 - Buffer Zone
 - Buffer Zone and Combat Training Area
 - Combat Training Area
 - Impact/Buffer Area

NOTES:
 1) FUDS property and range boundaries were obtained from a GIS dataset provided by the USACE.
 2) Topographic map (Clallam County) was obtained from the U.S. Department of Agriculture, Service Center Agencies, 1999.



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

 U.S. ARMY CORPS OF ENGINEERS
 OMAHA DESIGN CENTER

FIGURE 2
CURRENT TOPOGRAPHIC MAP

PORT ANGELES COMBAT RANGE
 FUDS PROPERTY NUMBER F10WA0033



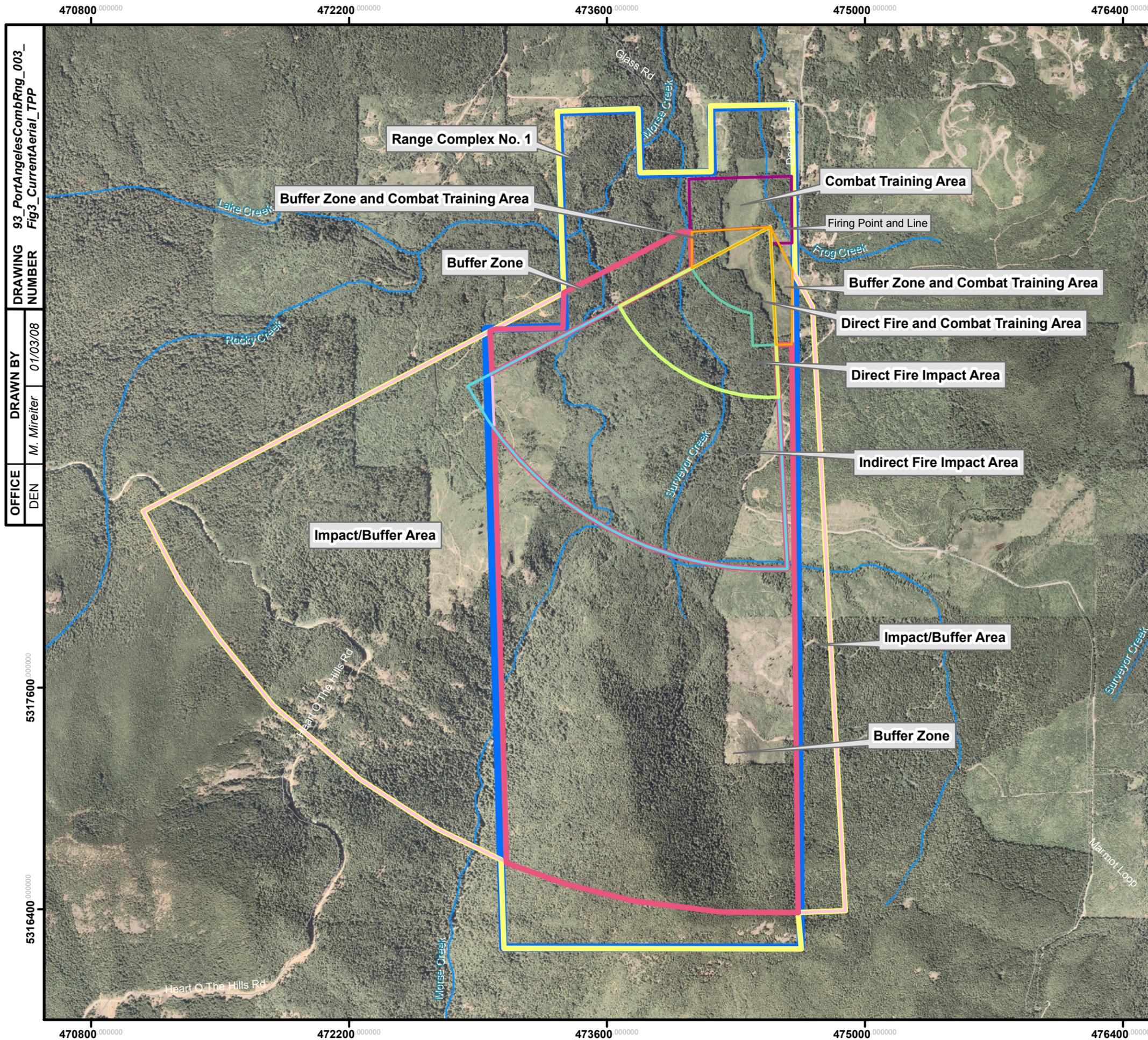
DRAWING 93 PortAngelesCombRng_002_ Fig2_CurrentTopo_TPP
 NUMBER
 DRAWN BY M. Mireiter 02/01/08
 OFFICE DEN

5317600
 5316400

5320000
 5318800
 5317600

470800.000000 472200.000000 473600.000000 475000.000000 476400.000000

470800.000000 472200.000000 473600.000000 475000.000000 476400.000000



DRAWING NUMBER: 93_PorAngelesCombRng_003_Fig3_CurrentAerial_TPP
 DRAWN BY: M. Mireiter
 DATE: 01/03/08
 OFFICE: DEN

Legend

- Port Angeles Combat Range FUDS Property
- Ranges in the MMRP Inventory**
- Range Complex No. 1
- Sub-Ranges in the MMRP Inventory**
- Direct Fire Impact Area
- Direct Fire and Combat Training Area
- Indirect Fire Impact Area
- Buffer Zone
- Buffer Zone and Combat Training Area
- Combat Training Area
- Impact/Buffer Area

NOTES:

- 1) FUDS property and range boundaries were obtained from a GIS dataset provided by the USACE.
- 2) Aerial photograph (Clallam County) was obtained from the U.S. Department of Agriculture, Service Center Agencies; photograph is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

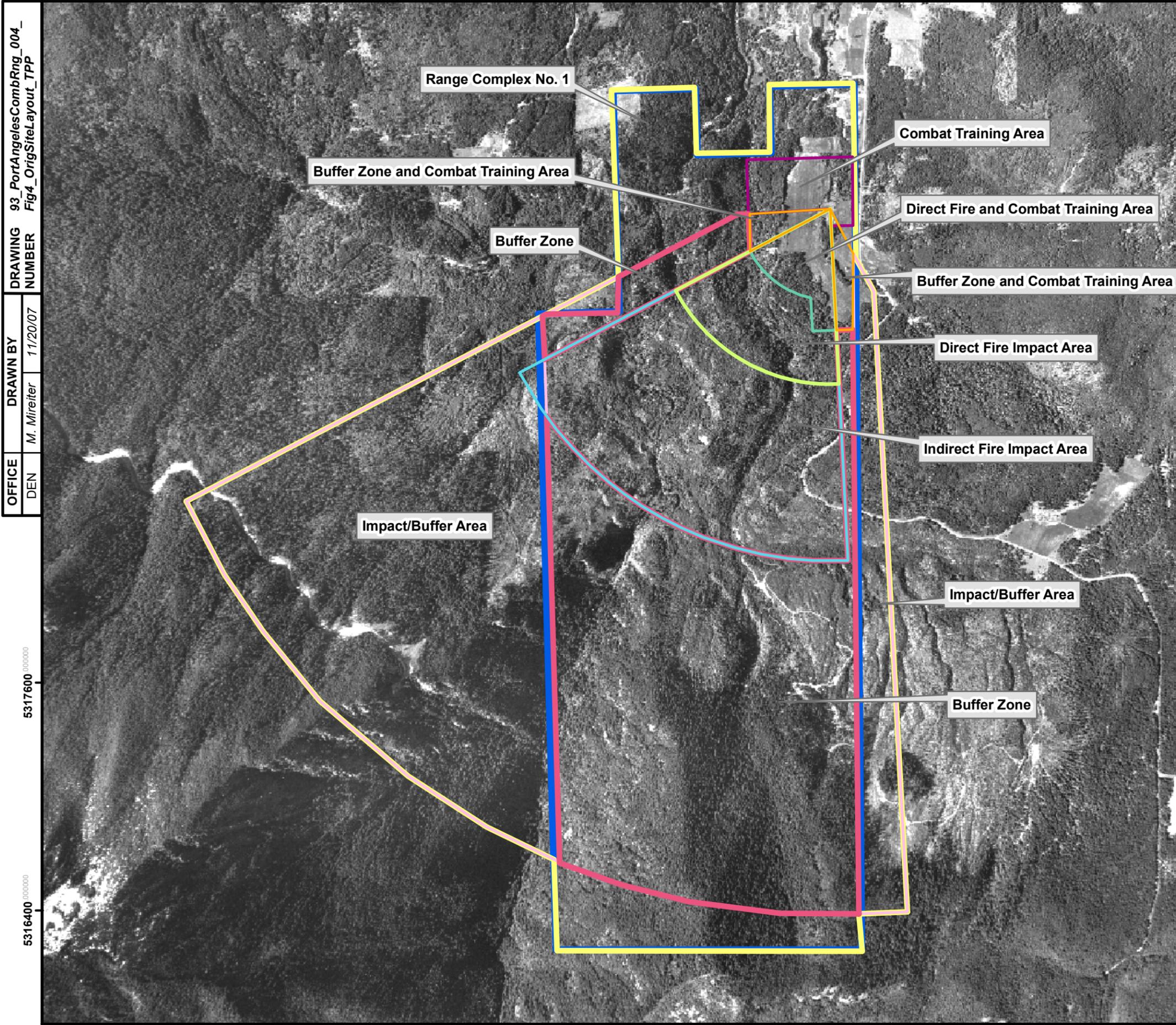
U.S. ARMY CORPS OF ENGINEERS
 OMAHA DESIGN CENTER

FIGURE 3
SITE LAYOUT AND
CURRENT AERIAL PHOTOGRAPH

PORT ANGELES COMBAT RANGE
 FUDS PROPERTY NUMBER F10WA0033

Shaw Environmental, Inc.

470800 000000 472200 000000 473600 000000 475000 000000



DRAWING NUMBER: 93_PortAngelesCombRng_004_Fig4_OrigSiteLayout_TPP

DRAWN BY: M. Mireiter

DATE: 11/20/07

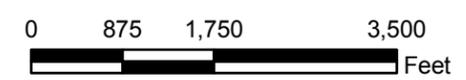
OFFICE: DEN

Legend

- Port Angeles Combat Range FUDS Property
- Ranges in the MMRP Inventory**
 - Range Complex No. 1
- Sub-Ranges in the MMRP Inventory**
 - Direct Fire Impact Area
 - Direct Fire and Combat Training Area
 - Indirect Fire Impact Area
 - Buffer Zone
 - Buffer Zone and Combat Training Area
 - Combat Training Area
 - Impact/Buffer Area

NOTES:

- 1) FUDS property and range boundaries were obtained from a GIS dataset provided by the USACE.
- 2) Aerial photograph was obtained from the U.S. Geological Survey and is dated May 24, 1954.



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

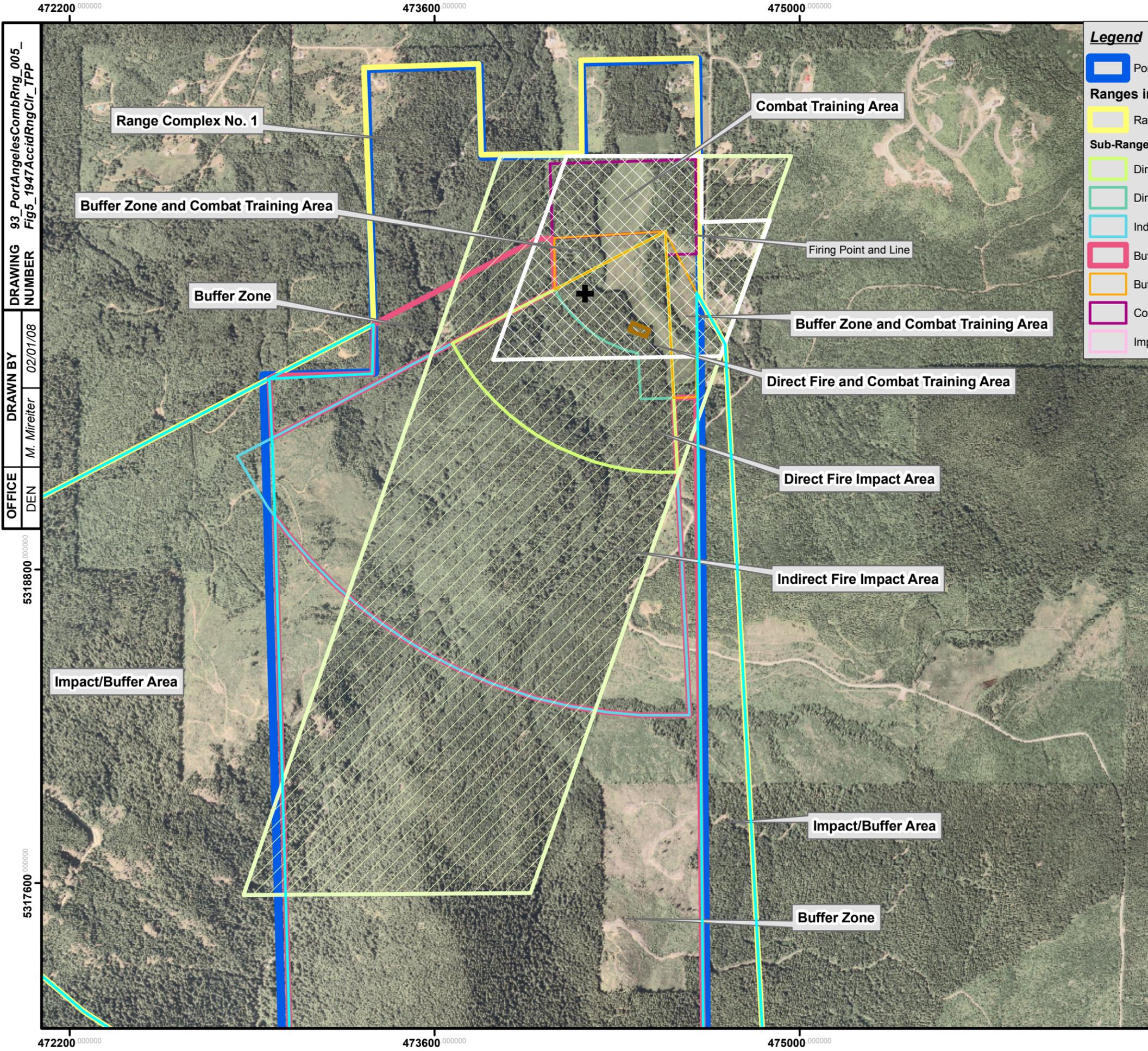
 U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

FIGURE 4
HISTORICAL AERIAL PHOTOGRAPH AND SITE LAYOUT

PORT ANGELES COMBAT RANGE
FUDS PROPERTY NUMBER F10WA0033



470800 000000 472200 000000 473600 000000 475000 000000



DRAWING NUMBER: 93_PortAngelesCombRng_005_Fig5_1947AccidRngClr_TPP
 DRAWN BY: M. Mireiter
 DATE: 02/01/08
 OFFICE: DEN
 UTM Coordinates: 472200, 473600, 475000 (X); 5317600, 5318800 (Y)

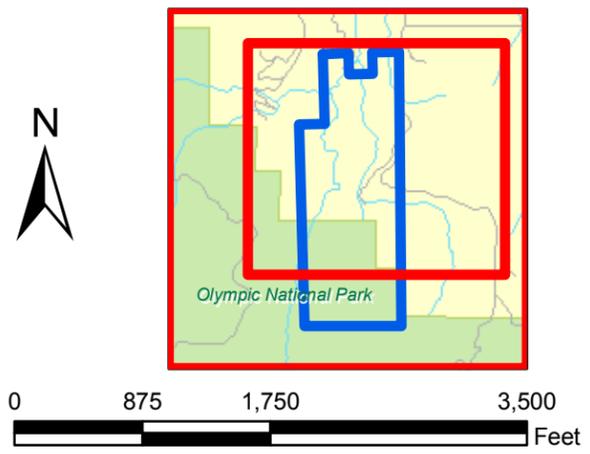
Legend

- Port Angeles Combat Range FUDS Property
- Range Complex No. 1
- Direct Fire Impact Area
- Buffer Zone
- Buffer Zone and Combat Training Area
- Combat Training Area
- Impact/Buffer Area
- Area of Greatest Contamination
- Area of Heavy Contamination
- Probable Limit of Contamination
- + Location of Swagerty Accident

Ranges in the MMRP Inventory

Sub-Ranges in the MMRP Inventory

- NOTES:**
- 1) FUDS property and range boundaries were obtained from a GIS dataset provided by the USACE.
 - 2) Accident and clearance locations from ASR, Appendix L-3 (USACE, 1996).
 - 3) Aerial photograph (Clallam County) was obtained from the U.S. Department of Agriculture, Service Center Agencies; photograph is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.



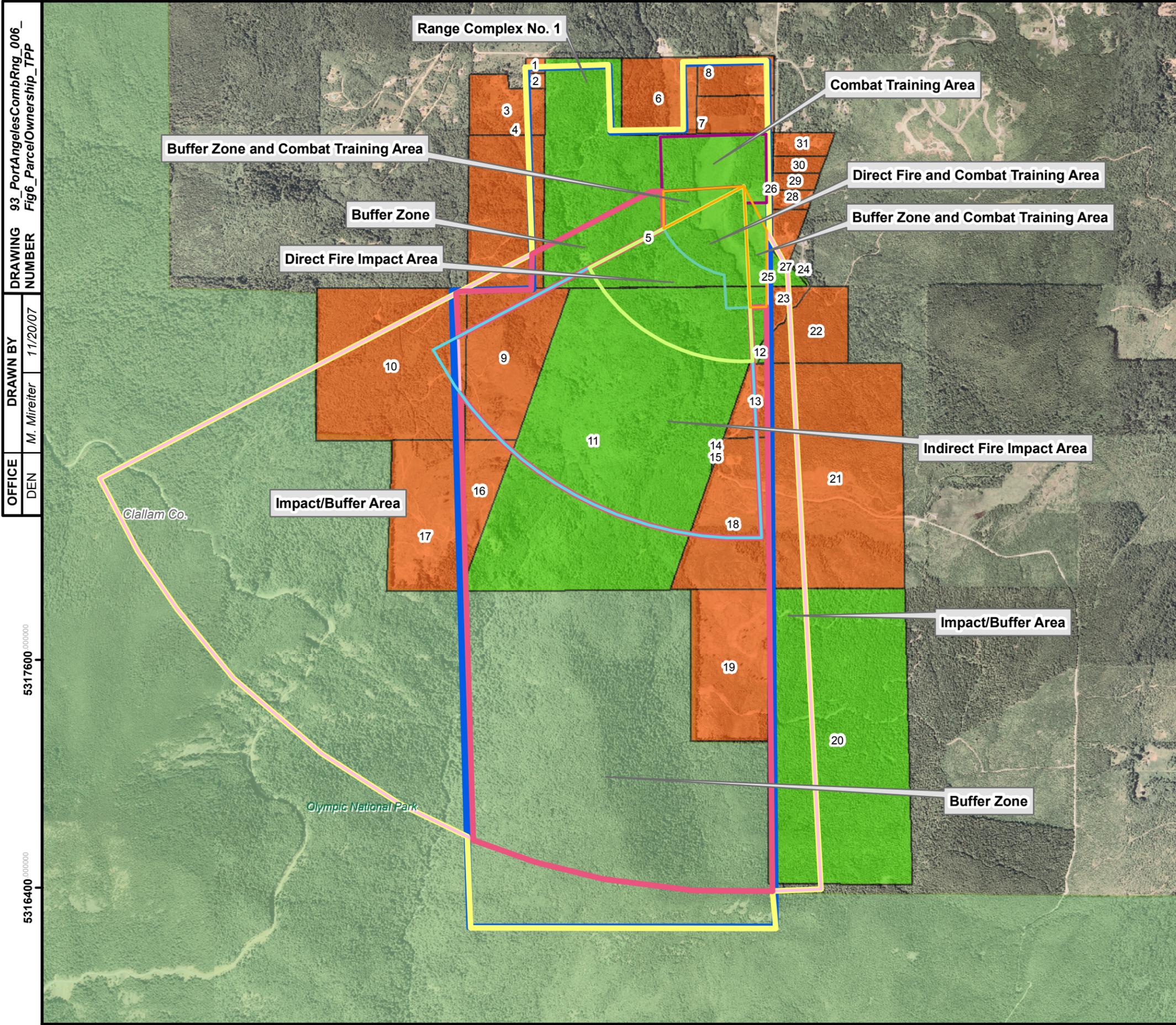
U.S. ARMY CORPS OF ENGINEERS
 OMAHA DESIGN CENTER

FIGURE 5
LOCATION OF 1948 ACCIDENT AND
RANGE CLEARANCE

PORT ANGELES COMBAT RANGE
 FUDS PROPERTY NUMBER F10WA0033



470800 000000 472200 000000 473600 000000 475000 000000 476400 000000



Legend

- Port Angeles Combat Range FUDS Property
- Olympic National Park
- Taxlot Parcel - Private
- Taxlot Parcel - Public
- 10 Parcel ID Number

Ranges in the MMRP Inventory

- Range Complex No. 1

Sub-Ranges in the MMRP Inventory

- Direct Fire Impact Area
- Direct Fire and Combat Training Area
- Indirect Fire Impact Area
- Buffer Zone
- Buffer Zone and Combat Training Area
- Combat Training Area
- Impact/Buffer Area

NOTES:
 1) FUDS property and range boundaries were obtained from a GIS dataset provided by the USACE.
 2) Parcel data were obtained from Pacific County website.
 3) Aerial photograph (Clallam County) was obtained from the U.S. Department of Agriculture, Service Center Agencies; photograph is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

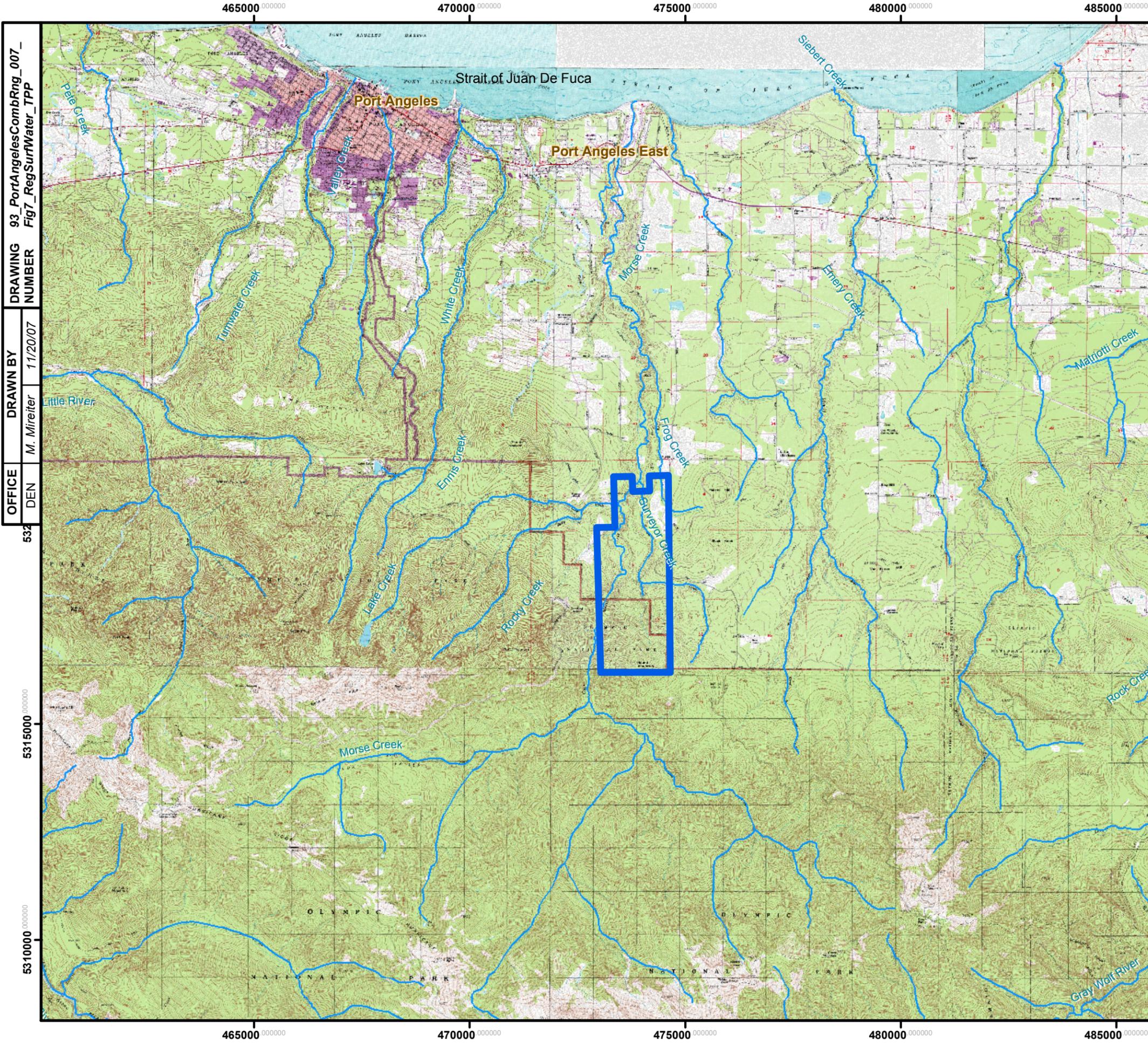
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 DRAWN BY: M. Mireiter
 DATE: 11/20/07
 OFFICE: DEN

U.S. ARMY CORPS OF ENGINEERS
 OMAHA DESIGN CENTER

FIGURE 6
PARCEL OWNERSHIP
 PORT ANGELES COMBAT RANGE
 FUDS PROPERTY NUMBER F10WA0033

Shaw Environmental, Inc.

470800 000000 472200 000000 473600 000000 475000 000000 476400 000000



DRAWING NUMBER: 93_PortAngelesCombRng_007_Fig7_RegSurfWater_TPP
 DRAWN BY: M. Mireiter
 DATE: 11/20/07
 OFFICE: DEN
 ID: 532

Legend

 Port Angeles Combat Range FUDS Property

NOTES:
 1) FUDS property and range boundaries were obtained from a GIS dataset provided by the USACE.
 2) Topographic map (Clallam County) was obtained from the U.S. Department of Agriculture, Service Center Agencies, 1999.



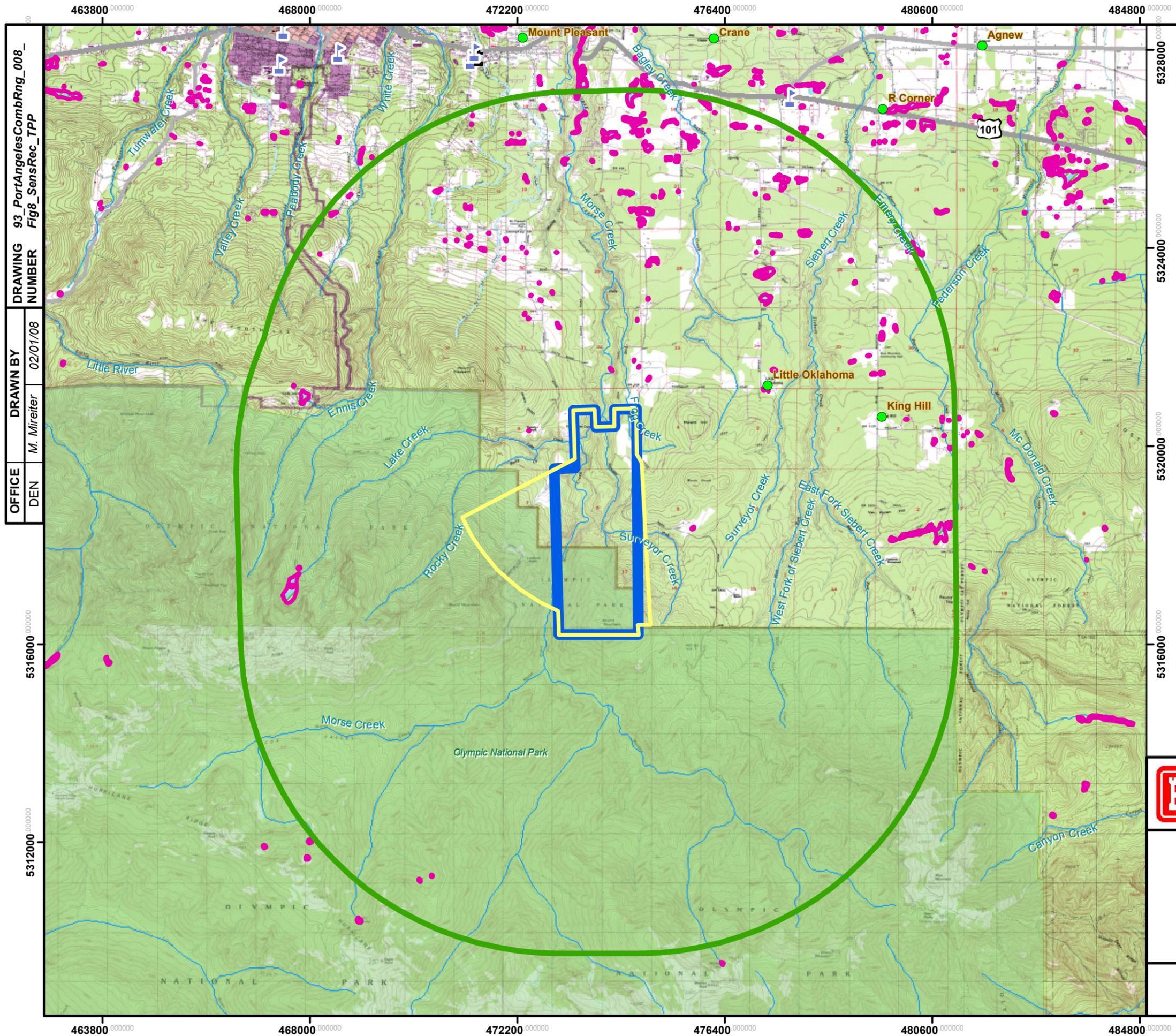
REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

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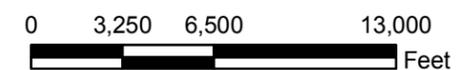
FIGURE 7
REGIONAL SURFACE WATER DRAINAGE

PORT ANGELES COMBAT RANGE
 FUDS PROPERTY NUMBER F10WA0033

 Shaw Environmental, Inc.



DRAWING NUMBER: 93_PortAngelesCombRng_008_
 Fig8_SensRec_TPP
 DRAWN BY: M. Mireiter
 DATE: 02/01/08
 OFFICE: DEN



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

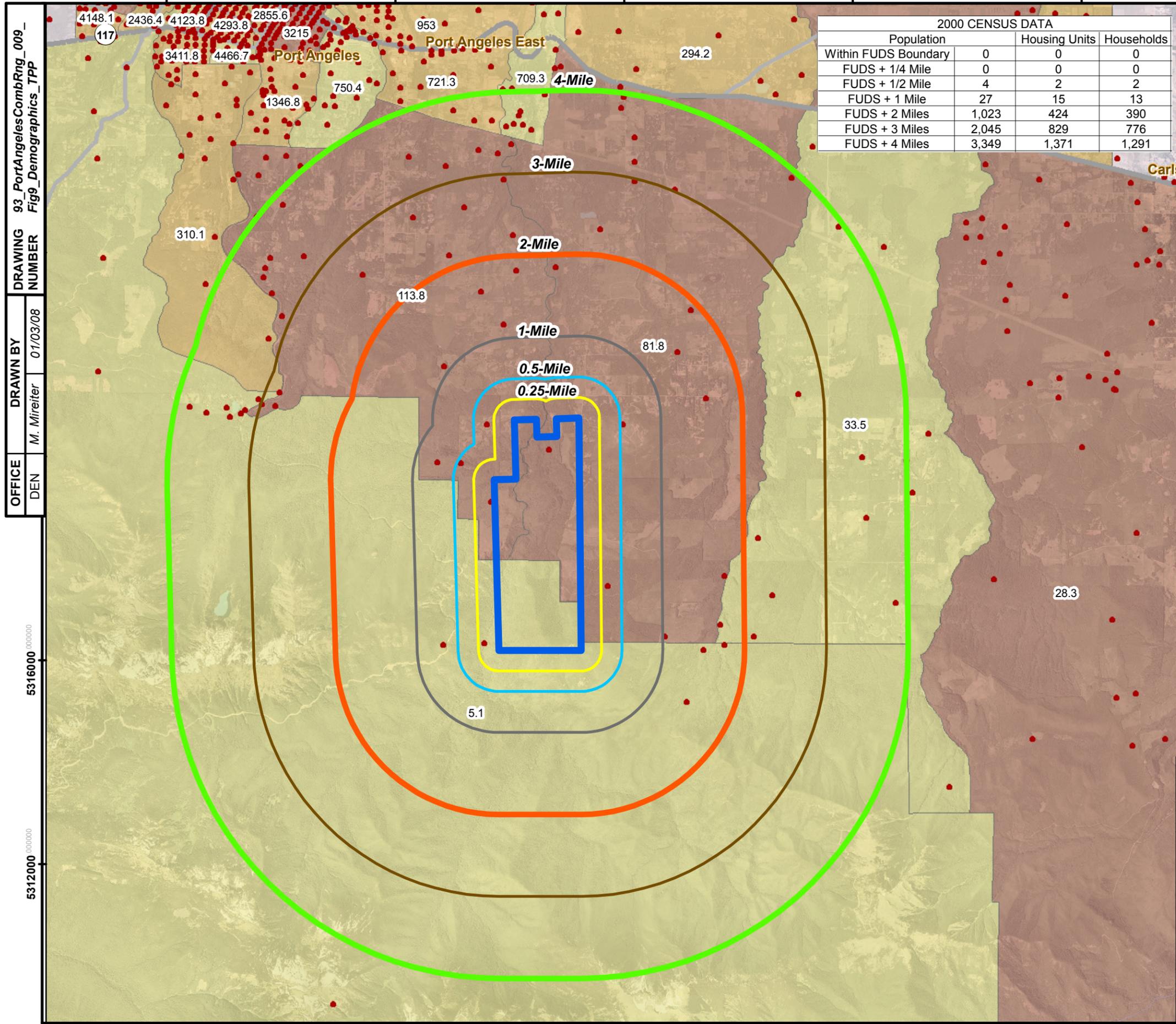


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FIGURE 8
SENSITIVE RECEPTOR LOCATIONS

PORT ANGELES COMBAT RANGE
FUDS PROPERTY NUMBER F10WA0033





Legend

- Port Angeles Combat Range FUDS Property
- 2005 Census Block Group Population**
 - 0 - 500
 - 501 - 1000
 - 1001 - 1500
 - 1501 - 2000
 - 2001 - 2500
- Census Block Centroid Unit
- 8.5 Number of People Per Square Mile

- NOTES:**
- FUDS property and range boundaries were obtained from a GIS dataset provided by the USACE.
 - Census data was obtained from StreetMap, ESRI, 2006.
 - The 2005 population of Clallam County was 38.4 people per square mile.
 - The Census Block Centroid Units represent centroids of the smallest entities for which the Census Bureau tabulates census information, bounded on all sides by visible features such as streets, streams, and railroad tracks, and/or invisible boundaries such as city, town, and county limits. The population assigned to a centroid unit may be a positive integer or zero. The centroid populations were summed within defined distances from the FUDS boundary to generate population totals presented on the inset table.
 - Aerial photograph (Clallam County) was obtained from the U.S. Department of Agriculture, Service Center Agencies; photograph is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.

0 3,250 6,500 13,000 Feet

REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

OFFICE DEN
 DRAWN BY M. Mireiter 01/03/08
 DRAWING NUMBER 93_PortAngelesCombrng_009_Fig9_Demographics_TPP

U.S. ARMY CORPS OF ENGINEERS
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FIGURE 9
CENSUS DATA WITHIN 4-MILE RADIUS
 PORT ANGELES COMBAT RANGE
 FUDS PROPERTY NUMBER F10WA0033

Shaw Environmental, Inc.

RANGE FAN

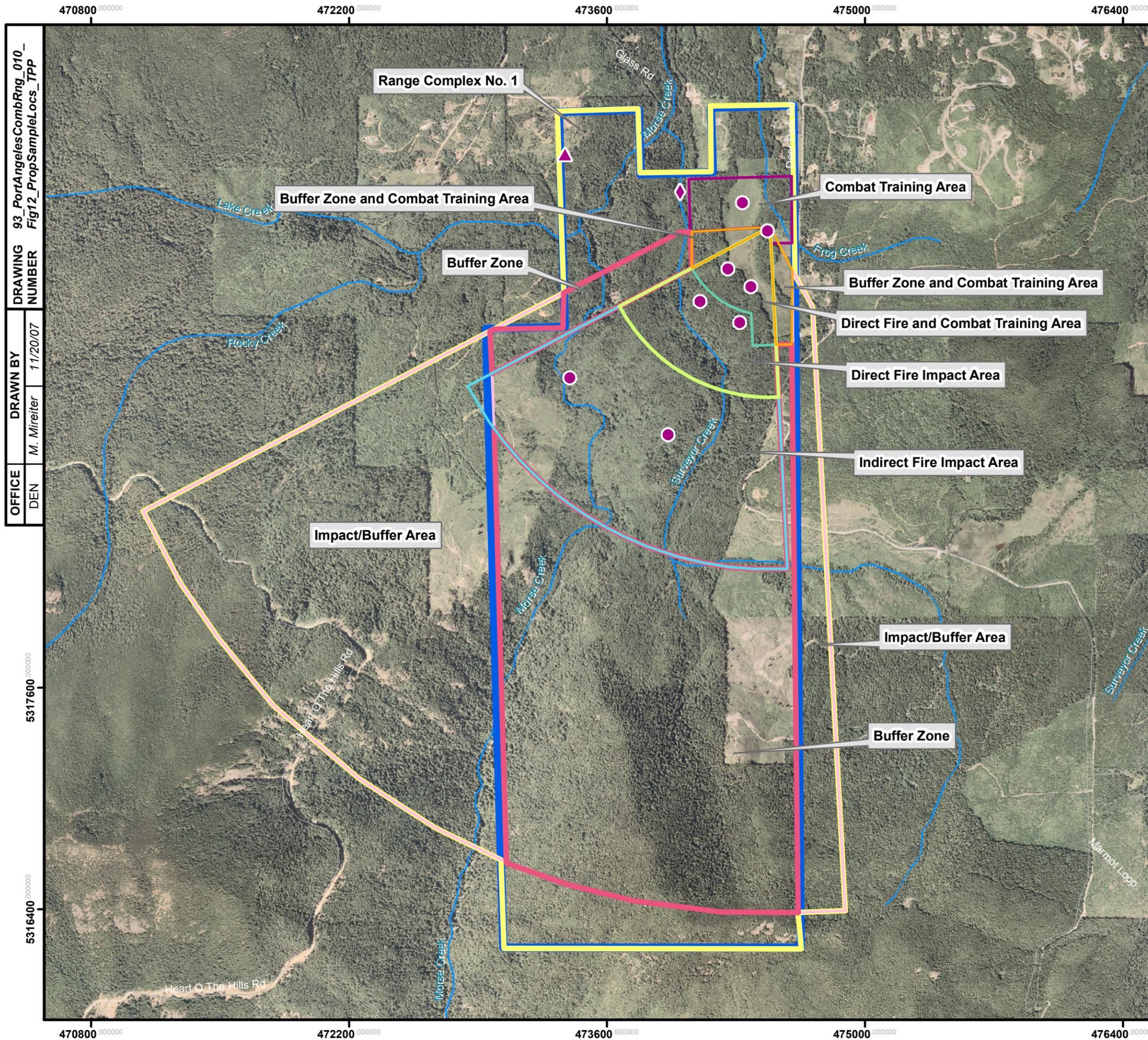
OFFICE: S.J.
DRAWN BY: K. Black
DRAWING NUMBER: 116188SJ-A96
DATE: 12/03/07



U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

FIGURE 11
CONCEPTUAL SITE MODEL
COMBAT RANGE
PORT ANGELES COMBAT RANGE





DRAWING 93_PorAngelesCombRng_010 -
NUMBER Fig12_PropSampleLocs_TPP -

DRAWN BY M. Mireiter 11/20/07

OFFICE DEN

5317600

5316400

Legend

- Port Angeles Combat Range FUDS Property
- Proposed Soil Sample Location
- Proposed Sediment Sample Location
- Proposed Groundwater Sample Location

Ranges in the MMRP Inventory

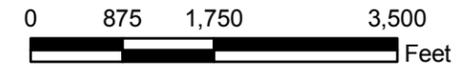
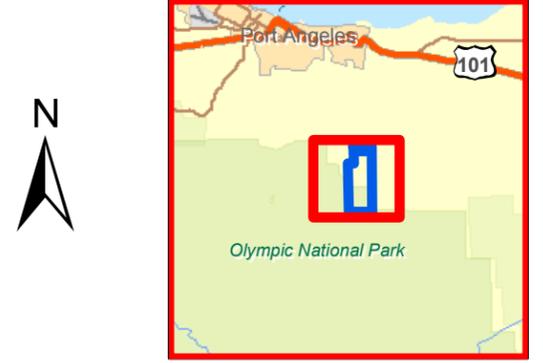
- Range Complex No. 1

Sub-Ranges in the MMRP Inventory

- Direct Fire Impact Area
- Direct Fire and Combat Training Area
- Indirect Fire Impact Area
- Buffer Zone
- Buffer Zone and Combat Training Area
- Combat Training Area
- Impact/Buffer Area

NOTES:

- 1) FUDS property and range boundaries were obtained from a GIS dataset provided by the USACE.
- 2) Aerial photograph (Clallam County) was obtained from the U.S. Department of Agriculture, Service Center Agencies; photograph is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N



U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

FIGURE 12
PROPOSED SAMPLE LOCATIONS

PORT ANGELES COMBAT RANGE
FUDS PROPERTY NUMBER F10WA0033



Tables

Table 1
Potential Munitions and Munitions Constituents
Port Angeles Combat Range, Washington

Area of Concern	Munitions	Munitions Constituents
Range Complex No. 1	Small Arms (.30, .45, .50 caliber)	Lead; Propellant: single-base (nitrocellulose) or double-base (nitrocellulose and nitroglycerin); Tracer composition: strontium nitrate, polyvinyl chloride, strontium peroxide, magnesium powder.
	Shell 37 millimeter (mm)	M63 HE: Steel (chromium, copper, iron, nickel); Explosive – trinitrotoluene (TNT); Fuze M58 – lead azide, tetryl; Primer M23 – Black powder (sulfur, potassium nitrate, charcoal), primer mixture (mercury fulminate, potassium chlorate, antimony sulfide); Propellant – FNH powder (nitrocellulose, dibutylphthalate, dinitrotoluene, diphenylamine)
		M74 AP: Steel (chromium, copper, iron, nickel); Tracer – Tracer composition (strontium nitrate, polyvinyl chloride, strontium peroxide, magnesium powder); Primer M23 – primer mixture (mercury fulminate, potassium chlorate, antimony sulfide); Propellant – FNH powder (nitrocellulose, dibutylphthalate, dinitrotoluene, diphenylamine)
		M51 TP: Steel (chromium, copper, iron, nickel); Primer M23 – primer mixture (mercury fulminate, potassium chlorate, antimony sulfide); Propellant – FNH powder (nitrocellulose, dibutylphthalate, dinitrotoluene, diphenylamine)
	Shell 75mm	M48 HE: Steel (chromium, copper, iron, nickel); Explosive – TNT; Primer M32 – Black powder (sulfur, potassium nitrate, charcoal), primer mixture (mercury fulminate, potassium chlorate, antimony sulfide); Propellant – FNH powder (nitrocellulose, dibutylphthalate, dinitrotoluene, diphenylamine); Fuze M48 – Mercury fulminate, lead azide
		M64 WP: White phosphorus; Steel (chromium, copper, iron, nickel); Propellant – FNH powder (nitrocellulose, dibutylphthalate, dinitrotoluene, diphenylamine)
		M61 AP (practice): Steel (chromium, copper, iron, nickel); Propellant – FNH powder (nitrocellulose, dibutylphthalate, dinitrotoluene, diphenylamine); Tracer – Tracer composition: strontium nitrate, polyvinyl chloride, strontium peroxide, magnesium powder.

Table 1 (Cont.)

Area of Concern	Munitions	Munitions Constituents
	Mortar 60mm	M49 HE: Steel (chromium, copper, iron, nickel); Explosive – TNT; Primer M32 - Black powder (sulfur, potassium nitrate, charcoal), primer mixture (mercury fulminate, potassium chlorate, antimony sulfide); Propellant - double-base powder (nitrocellulose and nitroglycerin): Ignition cartridge - double-base powder (nitrocellulose and nitroglycerin): Fuze M52– Mercury fulminate, lead azide, tetryl
	Mortar 81mm	M43A1 HE: Steel (chromium, copper, iron, nickel); Explosive – TNT; Primer M33 – Black powder (sulfur, potassium nitrate, charcoal), primer mixture (mercury fulminate, potassium chlorate, antimony sulfide); Propellant – double-base powder (nitrocellulose and nitroglycerin): Ignition cartridge – double-base powder (nitrocellulose and nitroglycerin): Fuze M52– Mercury fulminate, lead azide, tetryl
	Rifle Grenade	M9A1: Steel (chromium, copper, iron, nickel); Pentolite – TNT and Pentaerythritol tetranitrate
	Mine AP	M8 Practice: Steel (chromium, copper, iron, nickel); Fuze: M10A1 - Black powder (sulfur, potassium nitrate, charcoal) Spotting charge - Red phosphorus
	Mine AT	M1 practice: Steel (chromium, copper, iron, nickel); Fuze M1 - Black powder (sulfur, potassium nitrate, charcoal) Spotting charge - Red phosphorus
	Rocket 2.36-inch Bazooka	M7 practice: Steel (chromium, copper, iron, nickel); Squib – Black powder (sulfur, potassium nitrate, charcoal) Propellant – double-base powder (nitrocellulose and nitroglycerin)
		M6 High Explosive Anti-tank: Steel (chromium, copper, iron, nickel); Explosive Pentolite – TNT and Pentaerythritol tetranitrate M7 powder

Table 2
Army Checklist for Important Ecological Places ^a
Port Angeles Combat Range, Washington

		Yes / No	Comments
1	Locally important ecological place identified by the Integrated Natural Resource Management Plan, BRAC Cleanup Plan or Redevelopment Plan, or other official land management plans	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
2	Critical habitat for Federal designated endangered or threatened species	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
3	Marine Sanctuary	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
4	National Park	<input checked="" type="checkbox"/> / <input type="checkbox"/>	Southern portion of site is within Olympic National Park
5	Designated Federal Wilderness Area	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
6	Areas identified under the Coastal Zone Management Act	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
7	Sensitive Areas identified under the National Estuary Program or Near Coastal Waters Program	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
8	Critical areas identified under the Clean Lakes Program	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
9	National Monument	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
10	National Seashore Recreational Area	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
11	National Lakeshore Recreational Area	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
12	Habitat known to be used by Federal designated or proposed endangered or threatened species	<input checked="" type="checkbox"/> / <input type="checkbox"/>	Occasional transient bald eagle, spotted owl, and/or marbled Murrelet site use possible
13	National preserve	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
14	National or State Wildlife Refuge	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
15	Unit of Coastal Barrier Resources System	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
16	Coastal Barrier (undeveloped)	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
17	Federal land designated for protection of natural ecosystems	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
18	Administratively Proposed Federal Wilderness Area	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
19	Spawning areas critical for the maintenance of fish/shellfish species within river, lake, or coastal tidal waters	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
20	Migratory pathways and feeding areas critical for maintenance of anadromous fish species within river reaches or areas in lakes or coastal tidal waters in which fish spend extended periods of time	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
21	Terrestrial areas utilized for breeding by large or dense aggregations of animals	<input type="checkbox"/> / <input checked="" type="checkbox"/>	

Table 2 (Cont.)

		Yes / No	Comments
22	National river reach designated as Recreational	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
23	Habitat known to be used by state designated endangered or threatened species	<input checked="" type="checkbox"/> / <input type="checkbox"/>	Occasional transient bald eagle, spotted owl, and/or marbled Murrelet site use possible
24	Habitat known to be used by species under review as to its Federal endangered or threatened status	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
25	Coastal Barrier (partially developed)	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
26	Federally designated Scenic or Wild River	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
27	State land designated for wildlife or game management	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
28	State-designated Scenic or Wild River	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
29	State-designated Natural Areas	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
30	Particular areas, relatively small in size, important to maintenance of unique biotic communities	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
31	State-designated areas for protection or maintenance of aquatic life	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
32	Wetlands	<input checked="" type="checkbox"/> / <input type="checkbox"/>	Wetlands present in northern portion of site
33	Fragile landscapes, land sensitive to degradation if vegetative habitat or cover diminishes	<input type="checkbox"/> / <input checked="" type="checkbox"/>	

a – Based on EPA, 1990, 55 FR 51624, Table 4-23 – Sensitive Environments Rating Values, Dec. 14, 1990. EPA, 1997, ERAGS, Exhibit 1-1 List of Sensitive Environments.

Table 3
MEC and MD Recovered During Clearance Sweeps
Port Angeles Combat Range, Washington

Date	Performed By	Acres	Items Recovered	Inspection Type	Comments
May 7, 1949	9800 th TSU-CE, Detachment 15	775	“Dangerous &/or explosive materials”	Surface with mine detector sweep of impact area	Due to use of high explosives and dispersivity of fire “surface use only” recommended
September 22, 1952	9800 th TSU-CE, Detachment 8	10 (Peterson property)	None	Surface with mine detector sweep of impact area	Despite no ordinance or scrap being found, “surface use only” should remain in place.
November 22, 1955	9800 th TSU-CE, Detachment 5	Approximately 1600	Unknown	Surface	All but 1 acre okay for any use
September 24, 1956	170 th Ordinance Detachment, Fort Lewis	0.71	26 – 37mm, M51 solid round 1-37mm, M63 High explosive 4 – rusted bodies, M51 Fuze type 3 – rusted fin fragments of 81mm mortar	Sub-surface to 12-inch depth	No recommendations made
March 22, 1957	548 Ordinance Detachment	0.71	“Dangerous &/or explosive materials”	“careful search”	This and remaining 776 acres recommended for “surface use only”

**Table 4
Proposed Sampling Approach
Port Angeles Combat Range, Washington**

AOC	Location to be Sampled	Number of Samples	Media to be Sampled			Potential MC				MEC Survey to be Conducted	Comments
			Surface Soil	Sediment	GW	Select Metals ¹		Explosives ²			
						Soil/Sed	GW	Soil/Sed	GW		
1	Range Complex No. 1	10	8	1	1	9	1	9	1	Yes	MC not previously assessed. Composite soil samples will be collected at the firing point, direct fire impact area and indirect fire impact area. Discrete samples will be collected for sediment and groundwater.
	Background	13	10	2	1	12	1	0	0	No	Discrete background soil samples will be collected in areas undisturbed by past operations to establish a baseline for naturally occurring metals. Discrete sediment samples will be collected from stream bottoms along Surveyor and Morse Creeks. One background groundwater sample will be collected from up or cross gradient source.
Sample Totals		23	18	3	2	21	2	9	1		
Quality Control Samples						2	1	1	1		
Total Samples to be Analyzed						23	3	9	2		

AOC = Areas of Concern

GW = groundwater

MC = munitions constituents

MEC = munitions and explosives of concern

¹ Select metals include chromium, iron, lead, mercury, and nickel.

² Explosives plus nitroglycerin and pentaerythritol tetranitrate.

Surface soil samples from the AOC are composite samples (7-point, wheel pattern with 2-foot radius). All other samples are discrete grab samples.

Table 5
Human Health Soil and Sediment Screening Criteria and Selected Values for Potential Munitions Constituents
Port Angeles Combat Range, Washington

Analyte	USEPA Region 6 ^a		USEPA Region 9 ^b		Washington Department of Ecology - Soil Cleanup Levels ^c					Final Screening Value ⁱ (mg/kg)
	Residential MSSLs (mg/kg)	Industrial Outdoor Worker MSSLs (mg/kg)	Residential PRGs (mg/kg)	Industrial PRGs (mg/kg)	Method B Level - Unrestricted ^d (mg/kg)	Leaching - Phase 3 Model - Unrestricted ^e (mg/kg)	Method B Level - Industrial ^f (mg/kg)	Leaching - Phase 3 Model - Industrial ^g (mg/kg)	Natural Background Level ^h (mg/kg)	
Explosives										
Hexahydro-1,3,5-trinitro-1,3,5-triazine	4.4	17	4.4	16	NVA	NVA	NVA	NVA	NA	4.4
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	3,100	34,000	3,100	31,000	NVA	NVA	NVA	NVA	NA	3,100
2,4,6-Trinitrotoluene	16	64	16	57	NVA	NVA	NVA	NVA	NA	16
1,3,5-Trinitrobenzene	1,800	21,000	1,800	18,000	NVA	NVA	NVA	NVA	NA	1,800
1,3-Dinitrobenzene	6.1	68	6.1	62	NVA	NVA	NVA	NVA	NA	6.1
2,4-Dinitrotoluene ^j	0.72	2.8	0.72	2.5	NVA	NVA	NVA	NVA	NA	0.72
2,6-Dinitrotoluene ^j	0.72	2.8	0.72	2.5	NVA	NVA	NVA	NVA	NA	0.72
2-Amino-4,6-dinitrotoluene	NVA	NVA	12	120	NVA	NVA	NVA	NVA	NA	12
2-Nitrotoluene	2.8	14	0.88	2.2	NVA	NVA	NVA	NVA	NA	0.88
3-Nitrotoluene	1,600	23,000	730	1,000	NVA	NVA	NVA	NVA	NA	730
4-Amino-2,6-dinitrotoluene	NVA	NVA	12	120	NVA	NVA	NVA	NVA	NA	12
4-Nitrotoluene	40	200	12	30	NVA	NVA	NVA	NVA	NA	12
Nitrobenzene	20	110	20	100	NVA	NVA	NVA	NVA	NA	20
Nitroglycerin	6.1	68	35	120	NVA	NVA	NVA	NVA	NA	6.1
Methyl-2,4,6-trinitrophenylnitramine	240	2,700	610	6,200	NVA	NVA	NVA	NVA	NA	240
Pentaerythritol tetranitrate	No MSSL	No MSSL	NVA	NVA	NVA	NVA	NVA	NVA	NVA	0.5 ^k
Metals										
Chromium (Total)	210	500	210	500	NVA	NVA	NVA	NVA	48	210
Chromium (VI)	30	71	30	64	128	19	1,226	19	NVA	19
Copper	2,900	42,000	3,100	41,000	NVA	NVA	NVA	NVA	36	2,900
Iron	55,000	100,000	23,000	100,000	NVA	NVA	NVA	NVA	58,700	58,700
Lead	400	800	400	800	NVA	3,000	NVA	3,000	24	400
Mercury (Inorganic)	23	340	23	340	18	2.09	252	2.09	0.07	23

Table 5
Human Health Soil and Sediment Screening Criteria and Selected Values for Potential Munitions Constituents
Port Angeles Combat Range, Washington

Acronyms and Abbreviations:

CLARC = Cleanup Level and Risk Calculation

mg/kg = milligrams per kilogram

MSSL = Medium-Specific Screening Level

NA = not applicable, compound considered not present in natural soils

NVA = no value available

PRG = Preliminary Remediation Goal

USEPA = U.S. Environmental Protection Agency

WAC = Washington Administrative Code

Notes:

^a Region 6 Medium-Specific Screening Level (MSSL) table; December 2007. Values are based on residential and industrial outdoor worker exposure to single chemicals.

^b Region 9 Preliminary Remediation Goals (PRG) table; October 2004. Values are based on residential and industrial exposure to single chemicals.

^c Cleanup levels are established under the Model Toxics Control Act (MTCA) Cleanup Regulation. Chapter 173-340 WAC.

^d Values from Notes on Method A Cleanup Levels WAC 173-340-720, 740, and 745, Table 740-1, Table 5: Method B Calculations for Carcinogens for Soil Ingestion Plus Dermal Contact and Table 6: Method B Calculation for Soil Ingestion Plus Dermal Contact. Based on Unrestricted land use. From CLARC Notes updated on November 23, 2004.

^e Values from Notes on Method A Cleanup Levels WAC 173-340-720, 740, and 745, Table 740-1, Table 7: 3-Phase Model Assumptions and Results. Based on protection of groundwater. From CLARC Notes updated on November 23, 2004.

^f Values from Notes on Method A Cleanup Levels WAC 173-340-720, 740, and 745, Table 745-1, Table 5: Method C Industrial Calculations for Carcinogens for Soil Ingestion Plus Dermal Contact and Table 6: Method C Industrial Calculations for Carcinogens for Soil Ingestion Plus Dermal Contact. Based on industrial land use. From CLARC Notes updated on November 23, 2004.

^g Values from Notes on Method A Cleanup Levels WAC 173-340-720, 740, and 745, Table 745-1, Table 7: 3-Phase Model Assumptions and Results. Based on protection of groundwater. From CLARC Notes updated on November 23, 2004.

^h Values from "Natural Background Soil Metals Concentrations in Washington State", Publication #94-115, October 1994. Based on data for Puget Sound.

ⁱ Final Screening Value selected based on the lowest value listed for chemical between USEPA Region 9 PRG and Washington Department of Ecology – Soil Cleanup Levels.

^j Carcinogenic DNT mixture values used if more conservative than noncarcinogenic isomer-specific values.

^k Value is laboratory practical quantitation limit.

Table 6
Human Health Groundwater Screening Criteria and Selected Values for Potential Munitions Constituents
Port Angeles Combat Range, Washington

Analyte	Chemical Abbre- viation	CAS No.	USEPA Region 6 Tap Water MSSL ^b (µg/L)	USEPA Region 9 Tap Water PRG ^c (µg/L)	Federal Drinking Water Maximum Contaminant Level ^d (µg/L)	Washington Dept. of Ecology Method A Level ^e (µg/L)	Washington Dept. of Ecology Method B Level ^f (µg/L)	Natural Background Level ^g (µg/L)	Final Screening Value ^h (µg/L)
Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX	121-82-4	0.61	0.61	NVA	NVA	NVA	NVA	0.61
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	HMX	2691-41-0	1,800	1,800	NVA	NVA	NVA	NVA	1,800
2,4,6-Trinitrotoluene	2,4,6-TNT	118-96-7	2.2	2.2	NVA	NVA	NVA	NVA	2.2
1,3,5-Trinitrobenzene	1,3,5-TNB	99-35-4	1,100	1,100	NVA	NVA	NVA	NVA	1,100
1,3-Dinitrobenzene	1,3-DNB	99-65-0	3.7	3.6	NVA	NVA	NVA	NVA	3.6
2,4-Dinitrotoluene ^h	2,4-DNT	121-14-2	0.099	0.099	NVA	NVA	NVA	NVA	0.099
2,6-Dinitrotoluene ^h	2,6-DNT	606-20-2	0.099	0.099	NVA	NVA	NVA	NVA	0.099
2-Amino-4,6-dinitrotoluene	2-Am-DNT	35572-78-2	NVA	7.3	NVA	NVA	NVA	NVA	7.3
2-Nitrotoluene	2-NT	88-72-2	0.29	0.049	NVA	NVA	NVA	NVA	0.049
3-Nitrotoluene	3-NT	99-08-1	120	120	NVA	NVA	NVA	NVA	120
4-Amino-2,6-dinitrotoluene	4-Am-DNT	19406-51-0	NVA	7.3	NVA	NVA	NVA	NVA	7.3
4-Nitrotoluene	4-NT	99-99-0	4.2	0.66	NVA	NVA	NVA	NVA	0.66
Nitrobenzene	NB	98-05-3	3.4	3.4	NVA	NVA	NVA	NVA	3.4
Nitroglycerin	NG	55-63-0	3.7	4.8	NVA	NVA	NVA	NVA	3.7
Methyl-2,4,6-trinitrophenylnitramine	Tetryl	479-45-8	150	360	NVA	NVA	NVA	NVA	150
Pentaerythritol tetranitrate	PETN	78-11-5	No MSSL	NVA	NVA	NVA	NVA	NVA	0.5 ^k
Chromium (Total)	Cr	7440-47-3	NVA	NVA	100	50	NVA	NVA	50
Chromium VI	Cr	7440-47-3	110	110	NVA	NVA	48 (N)	NVA	48
Copper	Cu	7440-50-8	1,400	1,500	1,000 ⁱ	NVA	NVA	NVA	1,000
					1,300 ^j			NVA	
Iron	Fe	7439-89-6	26,000	11,000	300 ⁱ	NVA	NVA	NVA	300
Lead	Pb	7439-92-1	15	NVA	15 ^j	15	NVA	5	15
Mercury (Inorganic)	Hg	7439-97-6	11	11	2	2	4.8(N)	NVA	2
Nickel	Ni	7440-02-0	730	730	NVA	NVA	NVA	NVA	730

Table 6
Human Health Groundwater Screening Criteria and Selected Values for Potential Munitions Constituents
Port Angeles Combat Range, Washington

Acronyms and Abbreviations:

C = Value for carcinogen
CLARC = Cleanup Levels and Risk Calculations
MCL = Maximum Contaminant Level
MSSL = Medium-Specific Screening Level
N = Value for noncarcinogen
NVA = no value available
PRG = Preliminary Remediation Goal
µg/L = micrograms per liter
USEPA = U.S. Environmental Protection Agency
WAC = Washington Administrative Code

Notes:

^a If laboratory cannot meet these quantitation limits (QLs) with routine SW 846 methodology (as supported by MDLs that are no greater than 1/3 QL), laboratory's QL must be identified in laboratory submittal as failing to meet the QL. Some screening values cannot be obtained with routine methodology to the QL.

^b Region 6 Medium-Specific Screening Level (MSSL) table; December 2007. Values are based on tap water and represent exposure to a single chemical.

^c Region 9 Preliminary Remediation Goals (PRGs) table; October 2004. Values are based on tap water and represent exposure to a single chemical.

^d Drinking Water MCL from the 2004 Edition of Drinking Water Standards and Health Advisories, dated Winter 2004.

^e Values from Notes on the Development of Method A Cleanup Levels, WAC 173-340-720, 740, and 745. Table 720-1, Table 2: Summary of Information Used in Developing the Method A Ground Water Values in Table 720-1.

^f Values from Notes on the Development of Method A Cleanup Levels, WAC 173-340-720, Table 3: Drinking Water - Method B Calculations for Noncarcinogens and Table 4: Drinking Water - Method B for Carcinogens. CLARC Notes dated November 23, 2004.

^g Final Screening Value selected based on the lowest value listed for chemical between USEPA and Washington Department of Ecology Cleanup Levels.

^h Carcinogenic DNT mixture values used if more conservative than noncarcinogenic isomer-specific values.

ⁱ Secondary MCL from the 2004 Edition of Drinking Water Standards and Health Advisories, dated Winter 2004.

^j Action level from the 2004 Edition of Drinking Water Standards and Health Advisories, dated Winter 2004.

^k Value is laboratory practical quantitation limit

Table 7
Ecological Soil Screening Criteria and Selected Values for Potential Munitions Constituents
Port Angeles Combat Range, Washington

Analyte	Proposed Benchmarks										Potential Bioaccumulative Constituent? ^h	Final Proposed Ecological Screening Value Soil ⁱ (mg/kg)
	Washington Department of Ecology Lowest Value for Plants/ Soil Biota/Wildlife ^a (mg/kg)	USEPA Region 5 ESLs ^b (2003) (mg/kg)	USEPA Region 7 ^c (mg/kg)	USEPA Region 8 ^d (mg/kg)	USEPA Region 10 ^e (mg/kg)	Other Values: Talmage et al. (1999) ^f or LANL (2005) ^g (mg/kg)						
Explosives												
1,3,5-Trinitrobenzene	NVA	0.376	0.376	EPA-R4	NVA		0.376	EPA-R4	6.6	LANL		0.376
1,3-Dinitrobenzene	NVA	0.655	0.655	EPA-R4	NVA		0.655	EPA-R4	0.073	LANL		0.655
2,4,6-Trinitrotoluene	NVA	NVA	NVA		NVA		NVA		6.4	LANL		6.4
2,4-Dinitrotoluene	NVA	1.28	1.28	EPA-R4	NVA		1.28	EPA-R4	0.52	LANL		1.28
2,6-Dinitrotoluene	NVA	0.0328	0.0328	EPA-R4	NVA		0.0328	EPA-R4	0.37	LANL		0.0328
2-Amino-4,6-Dinitrotoluene	NVA	NVA	NVA		NVA		NVA		2.1	LANL		2.1
2-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		2.0	LANL		2.0
3-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		2.4	LANL		2.4
4-Amino-2,6-Dinitrotoluene	NVA	NVA	NVA		NVA		NVA		0.73	LANL		0.73
4-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		4.4	LANL		4.4
HMX	NVA	NVA	NVA		NVA		NVA		27	LANL		27
Nitrobenzene	40	1.31	1.31	EPA-R4	NVA		1.31	EPA-R4	2.2	LANL		40
Nitroglycerin	NVA	NVA	NVA		NVA		NVA		71	LANL		71
RDX	NVA	NVA	NVA		NVA		NVA		7.5	LANL		7.5
Pentaerythritol tetranitrate	NVA	NVA	NVA		NVA		NVA		8600	LANL		8600
Tetryl	NVA	NVA	NVA		NVA		NVA		0.99	LANL		0.99
Metals												
Chromium (total)	42	0.4	26	SSL	26	SSL	26	SSL	2.3	LANL	Yes	42
Copper	50	5.4	28	SSL	28	SSL	28	SSL	10	LANL	Yes	50
Iron	NVA	NVA	200	EPA-R4	NVA		200	EPA-R4	NVA			200
Lead	50	0.0537	11	SSL	11	SSL	11	SSL	14	LANL	Yes	50
Mercury	0.1	0.1	0.00051	ORNL	0.00051	ORNL	0.00051	ORNL	0.013	LANL	Yes	0.1
Nickel	30	13.6	38	SSL	38	SSL	38	SSL	20	LANL	Yes	30

Acronyms and Abbreviations:

EPA-R4 = USEPA Region 4
 ESLs = Ecological Screening Levels
 HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
 LANL = Los Alamos National Laboratory
 mg/kg = milligrams per kilogram
 NVA = No value available
 ORNL = Oak Ridge National Laboratory Ecological PRGs (Efroymson et al.)
 RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
 SSL = USEPA Eco Soil Screening Levels
 USEPA = U. S. Environmental Protection Agency

Table 7
Ecological Soil Screening Criteria and Selected Values for Potential Munitions Constituents
Port Angeles Combat Range, Washington

Notes:

^a Washington Department of Ecology, Toxics Cleanup Program, Table 749-3, Ecological Indicator Soil Concentrations for Protection of Terrestrial Plants and Animals. Developed under WAC 173-340-7493 (2)(a)(i).

^b Ecological Screening Levels (ESLs), USEPA Region V, August 2003.

^c USEPA Region 7: Catherine Wooster-Brown (Eco Risk Assessor) recommends the following hierarchy: USEPA EcoSSLs; ORNL Efrogmson values; USEPA Region 4 values; other published values

^d USEPA Region 8: Dale Hoff (Eco Risk Assessor) recommends the following hierarchy: USEPA SSLs; Dutch Intervention Values or ORNL Efrogmson values

^e USEPA Region 10: Joseph Goulet (Eco Risk Assessor) says Region 10 has no recommended hierarchy, therefore, values from the USEPA Region 7 approach were used

^f Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F.M. Cretella, P.H. Reno, and F.B. Daniel, 1999, Nitroaromatic Munition Compounds: Environmental Effects and Screening Values, Rev. Environ. Contam. Toxicol.

^g Los Alamos National Laboratory (LANL), Eco Risk Database, Release 2.2, September 2005

^h Potential bioaccumulative constituents will be evaluated in more detail, as some screening values do not take into account bioaccumulation.

Potential bioaccumulative potential from: *Bioaccumulation and Interpretation for the Purposes of Sediment Quality Assessment: Status and Needs* (USEPA, 2000) and ODEQ EQSLVs (ODEQ, 2001).

ⁱ Final Screening Value selected using the following hierarchy:

1. State Value (Washington)
2. USEPA Region State Located In (USEPA Region 10)
3. Lower of Talmage et al. (1999) or LANL (2005) values.

Other References:

U.S. Environmental Protection Agency, 2007, *Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs)*, Office of Solid Waste and Emergency Response, Website version last updated November 28, 2007: <http://www.epa.gov/ecotox/ecossl>.

U.S. Environmental Protection Agency, 2001, *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment*. Originally published November 1995. Website version last updated November 30, 2001: <http://www.epa.gov/region4/waste/ots/ecolbul.htm>.

Efrogmson, R.A., Suter II, G.W., Sample, B.E. and Jones, D.S., 1997. Preliminary Remediation Goals for Ecological Endpoints. Lockheed Martin Energy Systems, Inc. (ORNL) ES/ER/TM-162/R2. Dutch Intervention Values:

Swartjes, F.A. 1999. *Risk-based Assessment of Soil and Groundwater Quality in the Netherlands: Standards and Remediation Urgency*. Risk Analysis 19(6): 1235-1249

The Netherlands Ministry of Housing, Spatial Planning and Environment's Circular on target values and intervention values for soil remediation http://www2.minvrom.nl/Docs/internationaal/S_I2000.pdf and Annex A: Target Values, Soil Remediation Intervention Values and Indicative Levels for Serious Contamination http://www2.minvrom.nl/Docs/internationaal/annexS_I2000.pdf were also consulted.

Table 8
Ecological Sediment Screening Criteria and Selected Values for Potential Munitions Constituents
Port Angeles Combat Range, Washington

Analyte	Proposed Benchmarks							Potential Bioaccumulative Constituent? ^g	Final Ecological Screening Value Sediment ^h (mg/kg)			
	Washington Department of Ecology Screening Level Values Freshwater ^a (mg/kg)	USEPA Region 5 Ecological Screening Levels ^b (mg/kg)	USEPA Region 7 ^c (mg/kg)	USEPA Region 8 ^d (mg/kg)	USEPA Region 10 ^e (mg/kg)	Other Ecological Screening Levels ^f (mg/kg)						
Explosives												
1,3,5-Trinitrobenzene	NVA	NVA	NVA	NVA	NVA	2.40E-02	TAL		2.40E-02			
1,3-Dinitrobenzene	NVA	8.61E-03	NVA	NVA	NVA	6.70E-02	TAL		6.70E-02			
2,4,6-Trinitrotoluene	NVA	NVA	NVA	NVA	NVA	9.20E-01	TAL		9.20E-01			
2,4-Dinitrotoluene	NVA	1.44E-03	NVA	NVA	NVA	2.90E-01	LANL		2.90E-01			
2,6-Dinitrotoluene	NVA	3.98E-03	NVA	NVA	NVA	1.90E+00	LANL		1.90E+00			
2-Amino-4,6,-Dintrotoluene	NVA	NVA	NVA	NVA	NVA	7.00E+00	LANL		7.00E+00			
2-Nitrotoluene	NVA	NVA	NVA	NVA	NVA	5.60E+00	LANL		5.60E+00			
3-Nitrotoluene	NVA	NVA	NVA	NVA	NVA	4.90E+00	LANL		4.90E+00			
4-Amino-2,6,-Dintrotoluene	NVA	NVA	NVA	NVA	NVA	1.90E+00	LANL		1.90E+00			
4-Nitrotoluene	NVA	NVA	NVA	NVA	NVA	1.00E+01	LANL		1.00E+01			
HMX	NVA	NVA	NVA	NVA	NVA	4.70E-02	TAL		4.70E-02			
Nitrobenzene	NVA	1.45E-01	NVA	NVA	NVA	3.20E+01	LANL		3.20E+01			
Nitroglycerin	NVA	NVA	NVA	NVA	NVA	1.70E+03	LANL		1.70E+03			
RDX	NVA	NVA	NVA	NVA	NVA	1.30E-01	TAL		1.30E-01			
Pentaerythritol tetranitrate	NVA	NVA	NVA	NVA	NVA	1.20E+05	LANL		1.20E+05			
Tetryl	NVA	NVA	NVA	NVA	NVA	1.00E+02	LANL		1.00E+02			
Metals/Inorganics												
Chromium	2.60E+02	4.34E+01	4.34E+01	MAC	4.34E+01	MAC	4.34E+01	MAC	5.60E+01	LANL	Yes	2.60E+02
Copper	3.90E+02	3.16E+01	3.16E+01	MAC	3.16E+01	MAC	3.16E+01	MAC	1.70E+01	LANL	Yes	3.90E+02
Iron	NVA	NVA	NVA		NVA		NVA		2.00E+04	LANL		2.00E+04
Lead	2.60E+02	3.58E+01	3.58E+01	MAC	3.58E+01	MAC	3.58E+01	MAC	2.70E+01	LANL	Yes	2.60E+02
Mercury	4.10E-01	1.74E-01	1.80E-01	MAC	1.80E-01	MAC	1.80E-01	MAC	1.80E-02	LANL	Yes	4.10E-01
Nickel	4.60E+02	2.27E+01	2.27E+01	MAC	2.27E+01	MAC	2.27E+01	MAC	3.90E+01	LANL	Yes	4.60E+02

Table 8
Ecological Sediment Screening Criteria and Selected Values for Potential Munitions Constituents
Port Angeles Combat Range, Washington

Acronyms and Abbreviations:

EPRGs = Oak Ridge National Laboratory Ecological PRGs
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
ISQGs = Canadian Interim Sediment Quality Guidelines
LANL = Los Alamos National Laboratory
MAC = MacDonald Consensus Values
mg/kg = milligram per kilogram
NVA = No Value Available
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
TAL = Talmage et al. (1999)
USEPA = U. S. Environmental Protection Agency

Notes:

^a Washington Department of Ecology, Creation and Analysis of Freshwater Sediment Quality Values in Washington State, July, 1997, Pub. No. 97-323a (Table 11).

^b Ecological Screening Levels (ESLs), USEPA Region V, August 2003.

^c USEPA Region 7: Catherine Wooster-Brown (Eco Risk Assessor) recommends the following hierarchy: MacDonald Consensus Values (MacDonald, 2000); ORNL Efrogmson values (ORNL, 1977

^d USEPA Region 8: Dale Hoff (Eco Risk Assessor) recommends the following hierarchy: MacDonald Consensus Values (MacDonald, 2000); Canadian ISQG values (CCME, 2003) or ORNL Efrogmson values (ORNL, 1977).

^e USEPA Region 10: Joseph Goulet (Eco Risk Assessor) says Region 10 has no recommended hierarchy, therefore, values from the USEPA Region 7 Approach were used.

^f Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F.M. Cretella, P.H. Reno, and F.B. Daniel (TAL), 1999, *Nitroaromatic Munition Compounds: Environmental Effects and Screening Values*, Rev. Environ. Contam. Toxicol. or Los Alamos National Laboratory (LANL), Eco Risk Database, Release 2.2, September 2005; the Talmage [TAL] screening values assume 10% organic carbon in the sediment.

^g Potential bioaccumulative constituents will be evaluated in more detail, as some screening values do not take into account bioaccumulation. Potential bioaccumulative potential from: Bioaccumulation and Interpretation for the Purposes of Sediment Quality Assessment: Status and Needs (USEPA, 2000) and ODEQ EQSLVs (ODEQ, 2001).

^h Final Screening Value selected using the following hierarchy:

1. State Value (Washington)
2. USEPA Region State Located In (USEPA Region 10)
3. Lower of Talmage et al. [TAL] (1999) or LANL (2005) values.

Other References:

Efrogmson, R.A., et al., 1997, *Preliminary Remediation Goals* (EPRGs), ORNL, ES/ER/TM-162/R2,

Canadian Interim Sediment Quality Guidelines (ISQGs) Summary Table, CCME, December 2003.

MacDonald, D.D, C.G. Ingersoll and T.A. Berger, 2000, *Development and Evaluation of Consensus-Based Sediment Quality Criteria for Freshwater Ecosystems*, Archives of Environmental Contamination and Toxicology 39:20-31.

Draft Worksheets

Site Information Worksheet

MRSPP Data Gaps

HRS Data Gaps

Site Information Worksheet

Site: Port Angeles Combat Range

Project: FUDS

	Site Information Needed^a	Suggested Means to Obtain Site Information	Potential Source(s) of Site Information	Responsible for Obtaining	Deadline for Obtaining Site Information
1	Threatened or endangered species within AOC	Information request	Washington Department of Fish and Wildlife, and Department of Natural Resources	Shaw	For inclusion in SSWP
2	Areas of cultural significance within AOC	SHPO	Letter inquiry to SHPO	Shaw	For inclusion in SSWP
3	Restrictions to site access	Right of Entry Request	Landowners	USACE – NWO	For inclusion in SSWP

^a Refer to EM 200-1-2, Paragraphs 1.1.3 and 2.2.

**Munitions Response Site Prioritization Protocol (MRSPP) Data Gaps
32 CFR Part 179**

Installation: Port Angeles Combat Range
AOC: Range Complex No. 1
RMIS Range ID: F10WA003301R01

Module	Table No.	Table Description	Data Gap	Potential Source of Information to Fill Data Gap	No Data Gap	Description of Known Data
Explosive Hazard Evaluation (EHE)	1	Munitions Type			x	Small arms (up to .50-caliber), 37mm and 75mm shells, 60mm and 81mm mortars.
	2	Source of Hazard			x	Former practice range
	3	Location of Munitions			x	Suspected (historical evidence)
	4	Ease of Access			x	No barrier
	5	Status of Property			x	Non-DoD control
	6	Population Density			x	< 100 persons per square mile
	7	Population Near Hazard			x	U.S. Census, aerial photos, maps
	8	Activities/Structures			x	Logging, watershed, National Park
	9	Ecological and/or Cultural Resources	x	WA State Historical Preservation Office		
	10	EHE Module Score	x	Evaluation pending		
Chemical Warfare Materiel (CWM) Hazard Evaluation (CHE)	11	CWM Configuration			x	Historical evidence indicates that CWM are not present
	12	Sources of CWM			x	Historical evidence indicates that CWM are not present
	13	Location of CWM			x	Historical evidence indicates that CWM are not present
	14	Ease of Access			x	Historical evidence indicates that CWM are not present
	15	Status of Property			x	Historical evidence indicates that CWM are not present
	16	Population Density			x	Historical evidence indicates that CWM are not present
	17	Population Near Hazard			x	Historical evidence indicates that CWM are not present
	18	Activities/Structures			x	Historical evidence indicates that CWM are not present
	19	Ecological and/or Cultural Resources			x	Historical evidence indicates that CWM are not present
	20	CHE Module Score		No Known or Suspected CWM Hazard	x	

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Installation: Port Angeles Combat Range
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Module	Table No.	Table Description	Data Gap	Potential Source of Information to Fill Data Gap	No Data Gap	Description of Known Data
Health Hazard Evaluation (HHE)	21	Groundwater	x	Evaluation pending analytical results		
	22	Surface Water (Human Endpoint)	x	Evaluation pending analytical results		
	23	Sediment (Human Endpoint)	x	Evaluation pending analytical results		
	24	Surface Water (Ecological Endpoint)	x	Evaluation pending analytical results		
	25	Sediment (Ecological Endpoint)	x	Evaluation pending analytical results		
	26	Surface Soil	x	Evaluation pending analytical results		
	27	Supplemental Contaminant Hazard	x	Evaluation pending analytical results		
	28	HHE Module Score	x	Evaluation Pending		
MRS Priority	29	MRS Priority (Based on Highest Hazard Evaluation Module Rating)	x	Evaluation pending		
	A	MRS Background Information	x	Evaluation pending		

Port Angeles Combat Range, Washington HRS Data Gaps

Information required to complete the MEC-HRS data collection form:

Item	Number	Comment – Missing Data Element
1	1.8	Confirm the latitude / longitude of potential source(s) and the accuracy of the information (in meters)
2		Source scale (i.e., 1:24,000, etc.)
3	1.12	Site Permits
4	2.4	Confirm if there are other NPL sites within 1 mile of the site
5	5.3	Population within 1 mile, within 4 miles
6	6	Water use (GW within 4 miles, SW within 15 miles)
7	6.1	Total drinking water population served
8	6.2	Type of drinking water supply system (GW or SW?)
9	6.3	Other water uses of GW within 4 miles
10	6.5	Surface water uses
11	6.6	Type of SW adjacent to (within 2 miles) of the site
12	8.1	Types of action(s) that have occurred at or near the site
13	8.2	Who did the action? (EPA, Private parties, other, etc.?)