U.S. Army Corps of Engineers
Omaha District

Final Technical Project Planning Memorandum
Fort Townsend
FUDS ID F10WA0322

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

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Final Technical Project Planning Memorandum

Site Inspection
Fort Townsend
Formerly Used Defense Site
FUDS ID F10WA0322

Military Munitions Response Program

Documentation for Technical Project Planning Meeting
Lacey, Washington
Held May 1, 2007

Hosted by U.S. Army Corps of Engineers

Prepared by Shaw Environmental, Inc.

September 2007

Concurrences

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ABBREVIATIONS AND ACRONYMS

°F	degrees Fahrenheit
AOC	area of concern
ASR	Archives Search Report
BLM	Bureau of Land Management
CSM	Conceptual Site Model
DoD	Department of Defense
DQO	Data Quality Objective
FS	Feasibility Study
FUDS	Formerly Used Defense Site
HRS	Hazard Ranking System
IEP	Important Ecological Place
MC	munitions constituents
MEC	munitions and explosives of concern
MMRP	Military Munitions Response Program
MRSPP	Munitions Response Site Prioritization Protocol
NDAI	No Department of Defense Action Indicated
PETN	pentaerythritol tetranitrate
RI/FS	Remedial Investigation/Feasibility Study
ROE	right-of-entry
Shaw	Shaw Environmental, Inc.
SI	Site Inspection
SLERA	screening level ecological risk assessment
SSWP	Site-Specific Work Plan
State Parks	Washington State Parks Department
T&E	threatened and endangered
TPP	Technical Project Planning
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
UXO	unexploded ordnance

Administrative Information

This 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 this 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 Fort Townsend FUDS was held on May 1, 2007 and was conducted in two parts. A daytime meeting was held at the Washington Department of Ecology office located in Lacey, Washington. Representatives from the U.S. Army Corps of Engineers (USACE) - Omaha Design Center, USACE - Seattle District, the Washington Department of Ecology, Washington State Parks Department (State Parks), Port of Port Townsend, and Shaw Environmental, Inc. (Shaw) were in attendance. Following the meeting, a site tour of Fort Townsend and the Jefferson County International Airport were conducted. In the evening, a separate public meeting was held at Fort Warden, Washington. No members of the general public attended.

This TPP Memorandum documents discussions from the TPP Meeting and includes the sections described below:

- **Administrative Information:** includes meeting logistics and the list of attendees;
- **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 Sampling Scheme:** used to describe the type and quantity of samples to be taken, and the analytical methods to be used for characterizing the AOC;
- **TPP Notes and 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; 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 Fort Townsend FUDS was held on May 1, 2007 at the Washington Department of Ecology offices located in Lacey, Washington. In attendance were representatives of the following:

- USACE - Omaha Design Center,
- USACE - Seattle District,
- Washington Department of Ecology,
- Shaw,
- Washington State Parks Department, and
- Port of Port Townsend.

Shaw reviewed site information and presented a summary of the proposed SI approach for Fort Townsend, addressing MEC reconnaissance and MC sampling.

The original purpose of the installation was for protection of settlers starting in 1857. In 1942, the Navy used the northern portion of the site as an explosives x-ray laboratory. In 1947, the southwestern portion of the site was conveyed to Jefferson County for the Jefferson County International Airport. The Washington State Parks Commission purchased the northeastern portion of the site in 1958 for the creation of Old Fort Townsend State Park. The site has been identified as consisting of three AOCs, the Demo Range, the Burn Pit, and the Possible Small Arms Range. Attendees were in general agreement with the approach and the decision rules that were developed. Attendees may provide further review and comments on the approach and decision rules as documented in this TPP Memorandum and eventually in the Site-Specific Work Plan (SSWP) for the FUDS. Key agreements reached at the meeting included:

Area of Concern: The AOCs (Demo Area, Burn Pit, and Possible Small Arms Range) as presented in the *Archives Search Report* (ASR; USACE, 2005) were agreed upon. During the site walk, the park ranger escorted the stakeholders to the locations of the Navy's explosives x-ray laboratory and the explosive components bunker. No obvious indications of MEC or MC were present. However, visual reconnaissance will be conducted in order to dismiss them as possible AOCs. At the Jefferson County International Airport, the stakeholders observed that the Possible Small Arms Range has likely been effectively removed by construction of the airport. However, visual reconnaissance and soil sampling will be conducted.

Reconnaissance Objectives: The TPP team agreed that the SI would include visual field reconnaissance activities. Reconnaissance will be performed to:

- Confirm site conditions and land usage,
- Observe evidence of MEC and munitions history, and
- Select optimal sample locations (biased toward evidence of MEC, if observed).

MC Sampling: The TPP team agreed in principle that sampling for MC is appropriate for the site.

Background Sampling: The TPP team agreed in principle that background sampling for the site is appropriate. The Washington Department of Ecology recommended reviewing the State of Washington soil sample database and the results of the sampling of the cliff area at Fort Flagler for application to background.

Screening Values: The TPP team agreed the human health and ecological screening values applied at other Washington sites (such as Fort Flagler) were appropriate for use.

Other Stakeholders: Representatives of the State Parks and Port of Port Townsend, who own a large portion of the land within the Fort Townsend FUDS were present at the TPP Meeting and were provided the right-of-entry (ROE) request documentation. Private landowners will be provided an opportunity to review this TPP Memorandum and other documents pertaining to the site, as well as the ROE request documentation. Landowner-provided information with respect to site history, site conditions, land use, or other information relevant to the SI will be shared with the TPP team. The USACE - Seattle District indicated that they would contact the applicable native-american tribes regarding the planned investigation.

Site: Fort Townsend

Location: Port Townsend, Washington

USACE District: Seattle

TPP #1 Meeting Location: Washington Department of Ecology, Lacey, Washington

TPP #1 Meeting Date: May 1, 2007

AGENDA

Tuesday May 1, 2007

- **Convene at Washington Department of Ecology offices**
  - **Introductions**
  - **Review Site Inspection Objectives**
    - **Goals, Objectives, and Roles & Responsibilities**
    - **Site Inspection Process**
    - **Technical Project Planning Process**
    - **Review of Background Information**
- **Technical Project Planning Discussion**
- **Public Meeting (evening at Fort Warden – no public participants attended)**

Name	Organization
Dick Devlin	USACE-Seattle
Mike Nelson	USACE-Seattle
Jerome Stolinski	USACE-Omaha
Peter Kelsall	Shaw
Tony Searls	Shaw
Kate Burke	Washington Department of Parks
Larry Crockett	Port of Port Townsend
Greg Johnson	Washington Department of Ecology
Barry Rogowski	Washington Department of Ecology

1.0 Site Inspection Objectives

1.1 Goal

- The USACE is conducting SIs of FUDS properties to determine if any MEC or related MC is 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 of 1980 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
    - Concentrations of MC in site media samples are below background or below risk-based screening levels.
  - Determine the potential need for initiation of the Remedial Investigation / Feasibility Study (RI/FS) if:
    - Evidence of MEC identified 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 U.S. Environmental Protection Agency (USEPA) to complete the HRS.
  - Evaluate the FUDS using the MRSPP.

1.3 Roles & Responsibilities

- USACE: Acts as the executing agency for the U.S. Department of Defense 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,
- 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.

* A second TPP meeting will be held after the draft final SI Report has been submitted for review in order to discuss the results and recommendations of the SI.

2.0 Background Information

Historical information contained in this package was obtained from the *Archives Search Report* (ASR) (USACE, 2005) and the *Inventory Project Report* (INPR) *Supplement* (USACE, 2004) for the former Fort Townsend.

2.1 Site Name and Location

The former Fort Townsend, identification number F10WA0322, is located approximately 4 miles south of Port Townsend, Washington in Jefferson County, Washington (Figure 1).

2.2 Range Inventory

The former Fort Townsend is included in the Military Munitions Response Program (MMRP) Inventory in the Defense Environmental Programs Annual Report to Congress Fiscal Year 2006 (DoD, 2006) with range information as follows:

Range Name	Federal Facility Identification	Range Total Acres
Fort Townsend	F10WA0322	23

The ASR (USACE, 2005) indicates the area of the FUDS is 614.75 acres and the area of the ranges is 23.37 acres.

Range areas and coordinates are listed in the INPR Supplement (USACE, 2004) and in the MMRP Inventory (DoD, 2006) as follows (Figure 2):

Range Name	Range Identification	Approximate Area (acres)	UTM Coordinates (meters)
Demo Range	F10WA032201M01	1	X: 515861.00 Y: 5324472.00
Burn Pit	F10WA032201M02	1	X: 515798.00 Y: 5324460.00
Possible Small Arms Range	F10WA032201R01	21.37	X: 513981.00 Y: 5322346.00

Coordinates for the ranges are in Universal Transverse Mercator, Zone 10, NAD 83.

2.3 Property History

The information presented in the following sections is primarily obtained from the ASR (USACE, 2005) and the INPR Supplement (USACE, 2004).

2.3.1 Historical Military Use

- Fort Townsend was acquired by the War Department on January 29, 1859 by Executive Order. Fort Townsend was originally built to protect settlers on the Olympic Peninsula from hostile northern Indians, with troops stationed there until 1861, when they were withdrawn for service in the Civil War. In 1874, the post was rebuilt and had an active garrison for the next 20 years. Structures on the developed northeastern area included officers quarters, barracks, a canteen, a mess hall and kitchen, a hospital, an administration building, a guard house, a school house, a bakery, carpenter and paint shops, stables, a hay shed, a magazine, a pump house, a water tank house, a granary, a sawmill, and a post traders. The southeastern portion of the fort was used for pasture.
- In 1895, a fire destroyed the barracks and the fort was under caretaker status until World War II.
- In May 1930, an emergency landing field was built on the old garden plots of Fort Townsend. Although no historical documentation has been located, it is believed that a small arms range also existed in this area some time between 1930 and 1947. In August 1945, the War Department requested and received permission from the Department of Navy to use the landing field as a municipal landing field.
- In July 1942, the Navy was allowed to use the northern portion of the site as an explosives x-ray laboratory. The primary mission of the laboratory was the x-ray examination of and disassembly of enemy naval mines, torpedoes, and other munitions. The fort was listed as excess in 1944. The War Assets Administration assumed accountability of the southwestern portion of Fort Townsend on October 22, 1946. In 1947, the southwestern portion was conveyed for the Jefferson County International Airport (1947-1959). In 1958, Washington State Parks and Recreation Commission purchased the northeastern portion for Old Fort Townsend State Park.
- According to a person stationed at Fort Townsend between 1944 and 1946, excess munitions were disposed of by detonation in pits on the beach. Included was a wide array of explosives, both foreign and domestic, including torpedoes, mines, TNT, dynamite, Japanese balloon bombs, grenades, and depth charges kept onsite.

2.3.2 Munitions Information

- The MEC present, examined, or destroyed at Fort Townsend consisted of:
  - A wide array of explosives, both foreign and domestic, including torpedoes, mines, TNT, dynamite, Japanese balloon bombs, grenades, and depth charges.
  - Small arms.

2.3.3 Ownership History

- Current landowners and usage are as follows:
  - State of Washington. – state park for camping and hiking - 369 acres.
  - Eagle Eye, Inc. – forest for timber production - 117 acres.
  - Port of Port Townsend – county airport - 128 acres.

- Former owners and operators, prior to and after DoD use were:
  - Acquired by War Department January 29, 1859 by Executive Order.
  - Property briefly turned over to the Department of the Interior on April 1, 1895 by Executive Order; however, the Order was revoked on April 30, 1896.
  - Fire destroyed barracks in 1895 and orders were issued to decommission the fort; was in caretaker status from 1895 until WW II.
  - Navy received permission on July 2, 1942 to use northeastern portion as an explosives x-ray laboratory (369 acres and 5-year term).
  - Navy requested to use the landing field in 1945.
  - War Assets Administration assumed accountability of the southwestern 245.75 acres on October 22, 1946.
  - The southwestern portion was conveyed to Jefferson County for an airport in 1947, which operated until 1959. In 1959, The Port of Port Townsend took over operations.
- In 1958, Washington State Parks and Recreation Commission purchased the northeastern portion for Old Fort Townsend State Park.

2.4 Physical Setting

2.4.1 Topography and Vegetation

- Flat open grassland with gorges or gullies in the southern portion of the site (around the airport) to gently rolling hills in the northern section. Most of the site is covered by heavy shrubs with large evergreen timber.
- Steep cliffs ranging from 40 feet to 80 feet in height line the shoreline of the former Fort Townsend, leaving only one access to the rocky shoreline (NOAA, 1982).

2.4.2 Surface Water

- There are no streams or ponds located on the former Fort Townsend.
- The only surface water located on the site is Puget Sound running along the northeast edge of the site shoreline (NOAA, 1982).
- Figure 3 presents the drainage for the area surrounding the AOCs. If additional AOCs are identified as a result of the visual field reconnaissance activities, the figures will be modified as required.

2.4.3 Sensitive Environments

- Only one species, the bald eagle, has been identified on or near the former Fort Townsend site (per the Washington Department of Fish and Game).
- The entire main post area of the former Fort Townsend (the area now operated as a state park) is considered a historical preservation area. (Any intrusive operations will have to be cleared through the Office of Archaeology and Historic Preservation.)

- Table 1 presents the Army's checklist for Important Ecological Places (IEPs). Based on the above information, the former Fort Townsend is considered an IEP.
- Figure 4 presents the sensitive receptor locations surrounding the AOCs. If additional AOCs are identified as a result of the visual field reconnaissance activities, the figures will be modified as required.

2.4.4 Climate

- The climate at Fort Townsend is a mid-latitude, west coast marine type with comparatively cool, dry summers and mild but wet and cloudy winters. The Olympic Mountains and the extension of the Coastal Range on Vancouver Island shield this area from winter storms moving inland over the ocean. The area is within the "rain shadow" of the Olympic Mountains and is the driest area in western Washington State. The average July maximum temperature ranges from 65 degrees Fahrenheit (ºF) near the water to 70ºF or 75ºF inland. In January, maximum temperatures are in the 40s and minimums in the 30s. The average annual precipitation is 18 inches per year.

2.5 Geologic and Hydrogeologic Setting

2.5.1 Bedrock Geology

- The geology of the area is controlled by the last glaciation period between 12,000 and 15,000 years ago. Glacial deposits consist of thick sequences of glacial till and sand and gravel.

2.5.2 Overburden Soils

- Soil at the site consists of coastal beaches, Whidbey gravelly sandy loam and Dick loamy sand.

2.5.3 Hydrogeology

- There are two wells on the site that indicate the water table is between 100 feet and 175 feet.

2.6 Population and Land Use

2.6.1 Nearby Population

- The former Fort Townsend is located in Jefferson County, Washington, approximately 4 miles south of Port Townsend, Washington on the west side of Puget Sound.
- Port Townsend, Washington, is the nearest incorporated community (approximately 4 miles north) with a population of 8,810 (2004 estimated census).
- Based on the size and population of Jefferson County, Washington, the population density is approximately 10 persons per square mile.
- Fort Townsend has permanent residents (park employees) and offers camping facilities to recreational users.

2.6.2 Land Use

Current land use is:

- State of Washington. – State park for camping and hiking - 369 acres.
- Eagle Eye, Inc. – forest for timber production - 117 acres.

- Port of Port Townsend – county airport - 128 acres.

2.6.3 Area Water Supply

- Groundwater is used for domestic drinking water, irrigation, and industrial purposes.
- Domestic wells located within 4 miles of the site are presented on Figure 5.

2.7 Previous Investigations for MC and MEC

- Figure 2 presents a layout of the former Fort Townsend. Figure 6 and Figure 7 presents a layout of the three ranges.
- An INPR site visit was conducted on March 9, 2001 to gather information on a reported explosives detonation area used during World War II (USACE, 2004).
- The original INPR was completed in 1989. The INPR Supplement identified a Demo Range, a Burn Pit, and a Possible Small Arms Range.
- No areas of confirmed or potential MEC are present at the former Fort Townsend.
- The potential munitions used at the former Fort Townsend and the associated MC are presented in Table 2.

3.0 Conceptual Site Model – Demo Range

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., metals and explosives from bombs);
- 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); and
- 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.

3.2 Background

- The CSM for the Demo Range is based on information presented in the ASR (USACE, 2005) and INPR Supplement (USACE, 2004).

3.2.1 History of Use

- According to an interview with a former soldier stationed at the former Fort Townsend (1944 to 1946), excess munitions were disposed of in detonation pits located on the beach. He recalled participating in the destruction of munitions around the time the facility closed in 1946. Not certain if other disposal events occurred.
- A wide array of explosives, both foreign and domestic, including torpedoes, mines, TNT, dynamite, Japanese balloon bombs, grenades, and depth charges were reportedly disposed of by detonation.
- Used from 1944 to 1946.
- Located on the beach.
- A 4000-foot radius (the distance that a hazardous fragment could be thrown from the demo pit).

- Land is currently a state park (Fort Townsend State Park since 1958).
- The beach area was extensively searched with magnetometer during the ASR site walk and only expended cartridge casings could be found.
- Figure 8 illustrates the CSM for the Demo Range at the former Fort Townsend.

3.2.2 Munitions and Associated MC

Area of Concern	Munitions	Munitions Constituents
Demo Range	Torpedo	Sheet metal (chromium, iron, copper, lead, manganese, and nickel) and tetryl
	Explosives	TNT, RDX, PETN, and black powder (potassium nitrate, sulfur, and charcoal)
	Blasting Caps	Aluminum, lead, smokeless powder (potassium nitrate and sulfur)
	Small Arms	Brass casing with lead bullet, nitroglycerin, nitrocellulose
	Foreign and domestic explosives, including torpedoes, mines, TNT, dynamite, Japanese balloon bombs, grenades, and depth charges	Sheet metal (chromium, iron, copper, lead, manganese, and nickel) and tetryl TNT, RDX, PETN, and black powder (potassium nitrate, sulfur, and charcoal)

3.2.3 Previous MEC Finds

- 1800's era rifle and pistol brass.
- No other MEC was reported or detected during the site inspection.

3.2.4 Previous MC Sample Results

- None.

3.2.5 Current and Future Land Use

- Land is currently part of a state park (Old Fort Townsend State Park), this should continue into the future.

3.2.6 Ecological Receptors

- This FUDS does qualify as an IEP because habitat is known to be used by state and/or federal designated or proposed designated endangered or threatened species.

3.3 MEC Evaluation

- Interviewee stated a wide array of explosives, both foreign and domestic, including torpedoes, mines, TNT, dynamite, Japanese balloon bombs, grenades, and depth charges were supposedly disposed of by detonation.
- Special emphasis was placed on searching the beach demo area during the 2003 site inspection. The only OE related items located were a few pieces of 1800's era expended brass cartridges (.45-.70 caliber). No magnetic anomalies were found.
- The site is part of a State park (since 1958). Based on approximately 50 years of park use, no evidence of MEC has been reported.
- There is only one access point to the site. This is due to extreme erosion of the beachfront.

3.3.1 MEC Evaluation/Investigation Needed

- Visual field reconnaissance of the beach demo range will be conducted by a qualified unexploded ordnance (UXO) technician.

3.4 MC Evaluation

- Metals from small arms and munitions debris.
- Propellants (nitrocellulose and/or nitroglycerin).
- Explosives from detonation of munitions.
- Figure 8 illustrates the CSM for the Demo Range and potential pathways of MC contamination.
- The site is part of a State park.
- There is only one access point to the site. This is due to extreme erosion of the beachfront.

3.4.1 Overview of Pathways

Affected media and potential pathways for MC include:

- Beach Sand and Gravel: Beach sand and gravel are the primary medium of concern due to the presence of small arms debris, munitions debris, or explosives and possibly MC in the beach sand and gravel resulting from the detonation of munitions in the demo range. The soil also serves as a secondary source of air contamination.
- Sediment: Sediment is not considered a potentially affected media for the Demo Range.
- Surface Water: The primary water body at Fort Townsend is Puget Sound, which is a very large tidal saltwater body that contains abundant ecological receptors. Surface water is considered a potentially affected media for the Demo Range. However, based on the size of the water body and the tidal influence it would not be practicable to sample.
- Groundwater: Groundwater is not considered a potentially affected media for the Demo Range.

- Air: Air is a possible completed pathway through inhalation of contaminated soil particles. The prevailing wind direction is from the southeast. Blowing dust from the target could mobilize soil particles. The pathway is considered to be complete.
- An analysis of exposure pathways and receptors for MEC is provided in Table 3.

3.4.2 Terrestrial Pathway

3.4.2.1 Sources of MC

- MC from small arms and munitions debris could include metals (chromium, iron, copper, lead, manganese, and nickel), black powder, and propellants (nitrocellulose and/or nitroglycerin). MC from explosives could include TNT, PETN, RDX, and black powder.

3.4.2.2 Migration Pathway

- Wildlife in the area potentially may be exposed to MC through the soil pathways.
- Humans may come in contact with MC contamination through intrusive and non-intrusive work and recreational activities in areas where munitions debris may be present.

3.4.2.3 Land Use and Access

- Current land use is a beach area that is part of Old Fort Townsend State Park. It is assumed this use will remain the same in the future.
- Access to the Demo Range is limited to one access point from the park and water access.

3.4.2.4 Human Receptors

- The most likely current and future human receptors at the site would be the park residents and recreational users.

3.4.2.5 Ecological Assessment

- Site has been determined to be an IEP based on potential for threatened and endangered (T&E) to use the property.
- The pathway for ecological receptors is complete.

3.4.3 Sediment Pathway

- Sediment is not a pathway of concern for the Demo Range.

3.4.4 Surface Water Pathway

- Surface water is a pathway of concern for the Demo Range; however, sampling of Puget Sound is not practical.

3.4.5 Groundwater Pathway

- Groundwater is not a pathway of concern for the Demo Range.

3.4.6 Air Pathway

- Air is a possible completed pathway through inhalation of contaminated soil particles. Exposure to the air pathway is considered in the human health screening values and is not assessed further here.

4.0 Conceptual Site Model – Burn Pit

4.1 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., metals and explosives from bombs);
- 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); and
- 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.

4.2 Background

- During the 2003 site inspection, a small burn pit was reportedly found off the southeast corner of the parade grounds, between an outhouse and the park marker that indicated the end of the walking trail.

4.2.1 History of Use

- Used from approximately 1875 to 1885.
- Area of burn pit is six square feet and 2 to 3 inches deep.
- Charred and burst small arms brass (dated 1800's), small pieces of melted glass, and a few sporadic pieces of lead slag were found.
- Current use recreational (Fort Townsend State Park since 1958).
- Figure 8 illustrates the CSM for the Burn Pit at the former Fort Townsend.

4.2.2 Munitions and Associated MC

The INPR (USACE, 2004) lists a number of munitions that are not consistent with the CSM or what was observed during the site inspection. Therefore, the appropriate munitions are listed below:

Area of Concern	Munitions	Munitions Constituents
Burn Pit	Small arms	Lead

4.2.3 Previous MEC Finds

- No MEC was reported or detected during the site inspection.

4.2.4 Previous MC Sample Results

- No MC was sampled.

4.2.5 Current and Future Land Use

- Current use is recreational (Fort Townsend State Park) since 1958. It is assumed this will continue into the future.

4.2.6 Ecological Receptors

- This FUDS does qualify as an IEP because the habitat is known to be used by state and/or federal designated or proposed designated endangered or threatened species.

4.3 MEC Evaluation

- Charred and burst small arms brass (dated 1875-1885) were found**.**

4.3.1 MEC Evaluation/Investigation Needed

- Visual field reconnaissance of the burn pit area will be conducted by a qualified UXO technician.

4.4 MC Pathway Evaluation

- Lead from small arms.
- Figure 8 illustrates the CSM for the Burn Pit and potential pathways of MC contamination.
- The site is part of Old Fort Townsend State Park.
- There is unrestricted access to the site.

4.4.1 Overview of Pathways

Affected media and potential pathways for MC include:

- Soil: Soil is the primary medium of concern due to the presence of small arms debris and possibly MC in the soil resulting from lead. The soil also serves as a secondary source of air contamination.
- Sediment: Sediment is not a completed pathway.
- Surface Water: Surface water is not a completed pathway
- Groundwater: Groundwater may be a completed pathway. However, not recommending sampling groundwater because of small arms findings.
- Air: Air is a possible completed pathway through inhalation of contaminated soil particles. Blowing dust from the target could mobilize soil particles. The pathway is considered to be complete.
- An analysis of exposure pathways and receptors for MEC is provided in Table 3.

4.4.2 Terrestrial Pathway

4.4.2.1 Sources of MC

- MC from small arms could include lead.

4.4.2.2 Migration Pathway

- Wildlife in the area potentially may be exposed to MC through soils.
- Humans may come in contact with MC contamination through intrusive and non-intrusive work and recreational activities in areas where small arms debris may be present.

4.4.2.3 Land Use and Access

- The site is part of Old Fort Townsend State Park.
- There is unrestricted access to the site

4.4.2.4 Human Receptors

- The most likely current and future human receptors at the site would be the park residents (workers) and recreational uses.

4.4.2.5 Ecological Assessment

- Site has been determined to be an IEP based on potential for T&E to use the property.
- The pathway for ecological receptors is complete.

4.4.3 Sediment Pathway

- Sediment is not a pathway of concern.

4.4.4 Surface Water

- Surface water is not a pathway of concern.

4.4.5 Groundwater Pathway

- Groundwater is not a pathway of concern.

4.4.6 Air Pathway

- Air is a possible completed pathway through inhalation of contaminated soil particles. The prevailing wind direction is from the southeast. Exposure to the air pathway is considered in the human health screening values and is not assessed further here.

5.0 Conceptual Site Model – Possible Small Arms Range

5.1 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., metals and explosives from bombs);
- 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); and
- 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.

5.2 Background

- The ASR (USACE, 2004) references a Possible Small Arms Range. One interviewee referenced that a small arms range was located in the vicinity of the present day Jefferson County Airport. However, the location of the area could not be confirmed through any official documentation.

5.2.1 History of Use

- No historical documentation has been located to confirm that a small arms range existed at the landing field some time between 1930 and 1947.
- Figure 9 illustrates the CSM for the Possible Small Arms Range at the former Fort Townsend.

5.2.2 Munitions and Associated MC

The INPR (USACE, 2004) lists a number of munitions that are not consistent with the CSM or what was observed during the site inspection. Therefore, the appropriate munitions are listed below:

Area of Concern	Munitions	Munitions Constituents
Possible Small Arms Range	Small Arms	Lead

5.2.3 Previous MEC Finds

- No MEC was reported or detected during the site inspection.

5.2.4 Previous MC Sample Results

- No MC was sampled.

5.2.5 Current and Future Land Use

- Land is currently part of the Jefferson County Airport. This should continue into the future.

5.2.6 Ecological Receptors

- This FUDS does qualify as an IEP because the habitat is known to be used by state and/or federal designated or proposed designated endangered or threatened species.

5.3 MEC Evaluation

- Interviewee indicated a small arms range was located near the former landing field.
- No documentation is available to substantiate this remark.
- No historical evidence of MEC.
- The site is currently privately owned and is operated as an airport.
- There is restricted access to the site.
- The population density is less than 10 people per square mile.

5.3.1 MEC Evaluation/Investigation Needed

- Visual field reconnaissance of the airport area will be conducted by a qualified UXO technician.

5.4 MC Evaluation

- Lead from small arms.
- Figure 9 illustrates the CSM for the Possible Small Arms Range and potential pathways of MC contamination.
- The site is currently privately owned and is used as an airport.
- There is restricted access to the site.

5.4.1 Overview of Pathways

Affected media and potential pathways for MC include:

- Soil: Soil is the primary medium of concern due to the presence of small arms debris and possibly MC in the soil resulting from the ammunition. The soil also serves as a secondary source of air contamination.
- Sediment: Sediment is not a potentially affected media for the Possible Small Arms Range.
- Surface Water: Surface water is not a potentially affected media for the Possible Small Arms Range.
- Groundwater: Groundwater is a potentially affected media for the Possible Small Arms Range.
- Air: Air is a possible completed pathway through inhalation of contaminated soil particles. The prevailing wind direction is from the southeast. Blowing dust from the target could mobilize soil particles. The pathway is considered to be complete.
- An analysis of exposure pathways and receptors for MEC is provided in Table 3.

5.4.2 Terrestrial Pathway

5.4.2.1 Sources of MC

- MC from small arms could include lead from bullets and propellants (black powder, nitrocellulose, and nitroglycerin).

5.4.2.2 Migration Pathway

- Wildlife and livestock in the area potentially may be exposed to MC through the soil pathway.
- Humans may come in contact with MC contamination through intrusive and non-intrusive work in areas where small arms debris may be present.

5.4.2.3 Land Use and Access

- Current land use is for an airport, it is assumed this use will remain the same in the future.
- The land is privately owned
- Access to the site is restricted.

5.4.2.4 Human Receptors

- The most likely current and future human receptors at the site would be workers.

5.4.2.5 Ecological Assessment

- Site has been determined to be an IEP based on potential for T&E to use the property.
- The pathway for ecological receptors is complete.

5.4.3 Sediment Pathway

- Sediment is not a pathway of concern at the Possible Small Arms Range.

5.4.4 Surface Water Pathway

- Surface water is not a pathway of concern at the Possible Small Arms Range.

5.4.5 Groundwater Pathway

- Groundwater is a potential pathway of concern at the Possible Small Arms Range.

5.4.6 Air Pathway

- Air is a possible completed pathway through inhalation of contaminated soil particles. The prevailing wind direction is from the southeast. Exposure to the air pathway is considered in the human health screening values and is not assessed further here.

6.0 MC Evaluation/Investigation Needed

- Three surface soil (beach) samples will be collected from the Demo Range. The sample will be analyzed for select metals (chromium, copper, iron, lead, manganese, and nickel) and explosives (including nitroglycerin and pentaerythritol tetranitrate [PETN]).
- One surface soil sample will be collected from the Burn Pit, if it can be located. The sample will be analyzed for lead only.
- Ten surface soil samples will be collected at the Possible Small Arms Range. The samples will be analyzed for lead only.
- Three background surface soil samples and three background beach samples will be collected. The samples will be analyzed for target analyte list (TAL) metals (aluminum, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, silver, vanadium, and zinc).
- No sediment, surface water, or groundwater samples will be collected from the Fort Townsend FUDS.
- No air samples will be collected. Analytical results from soil samples can be used in the evaluation of the air pathway.

6.1 CSM Summary/Data Gaps

Results of the current status of data requirements with respect to MEC and MC for the former Fort Townsend are summarized below.

Pathway	Presence of MEC	Presence of MC	Proposed Inspection Activities
Soil	Small arms debris	Unknown	Surface soil samples will be collected.
Beach Sand and Gravel	Small arms debris, munitions debris, or explosives	Unknown	Beach sand samples will be collected.
Sediment	Not applicable, incomplete pathway	Incomplete pathway	Sediment samples will not be collected
Surface water	Not applicable, incomplete pathway	Incomplete pathway	Surface water samples will not be collected.
Groundwater	Not applicable	Not applicable	Groundwater samples will not be collected.
Air	Not applicable	Not applicable	None

7.0 Proposed Field Investigation

The proposed field investigation and sampling to be conducted at the former Fort Townsend is detailed below and summarized in Table 4. The investigation approach and sampling locations will be defined in more detail in a SSWP that will be submitted to Washington Department of Ecology and other stakeholders for review. The SSWP will reference technical details including sampling and analytical methods that are described in the *Type I Work Plan, Site Inspections at Multiple Sites* prepared by Shaw and submitted to the USACE as final in February 2006.

Reconnaissance

A visual field reconnaissance survey by a trained UXO technician using a hand-held magnetometer will be performed in the areas surrounding the Demo Range, Burn Pit, and Possible Small Arms Range to assess the presence or absence of MEC and to document the current site conditions. 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 *Type I Work Plan, Site Inspections at Multiple Sites* (Shaw, 2006) and SSWP. Digital photographs will be taken to document significant features.

Visual reconnaissance surveys will also be performed to aid in sample location selection and to allow the sampler to work safely.

Soils

Three surface soil (beach) samples will be collected from the Demo Range. If no MEC or munitions debris is located, beach samples will be collected from the reported detonation pits (if they can be located). The samples would be analyzed for select metals (chromium, copper, iron, lead, manganese, and nickel) and explosives (including nitroglycerin and PETN).

One surface soil sample will be collected from the Burn Pit, if it can be located. The sample would be analyzed for lead only.

Ten surface soil samples will be collected at the Possible Small Arms Range. If no MEC or munitions debris is found during visual reconnaissance, samples will be collected from the reported location of the small arms range. All samples will be analyzed for lead only.

Surface soil and beach samples will be collected at a depth of approximately 0 to 6 inches below ground surface. Surface soil and beach samples will be composite samples (7-point, wheel pattern with a 2-foot radius). No subsurface samples are planned.

Sediment, Groundwater, and Surface Water

No sediment, groundwater, or surface water sampling is planned.

Analyses

Soil samples will be analyzed for select metals (chromium, copper, iron, lead, manganese, and nickel) by USEPA SW-846 Method 6020A. Soil samples will also be analyzed for explosives by USEPA SW-846 Method 8330A and for nitroglycerine and PETN by Method 8330A (Modified).

Background Sampling

Three background beach samples and three background surface soil samples will be collected. The composite soil sample locations will be determined in the field in areas that do not appear to have been impacted by past site operations. The background samples will be analyzed for TAL metals (aluminum, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, silver, vanadium, and zinc).

Since the body of background data is limited, the site-to-background comparison will be conducted according to guidance for SI activities and HRS scoring (EPA, 1992). Background concentrations for analytes are taken to be the maximum values observed in the limited background data set (EPA, 1995). A comparison is then made to determine if a hazardous substance in the media is "significantly above the background level" according to the HRS criteria (40 CFR Appendix A to Part 300, Table 2-3):

- If the sample measurement is less than or equal to the sample quantitation limit, no observed release is established.
- If the sample measurement is greater than or equal to the sample quantitation limit, then:
  - If the background concentration is not detected, an observed release is established when the sample equals or exceeds the sample quantitation limit.
  - If the background concentration equals or exceeds the detection limit, an observed release is established when the sample is three times or more above the background concentration.

Background threshold levels, for comparison to site data per the above HRS criteria, are three times the maximum detected background concentration. For analytes not detected in background samples, the background threshold is the sample quantitation limit.

8.0 Technical Project Planning and Development of Data Quality Objectives

- The USACE TPP process is a four-phase process:
  - Identify the current project
  - Determine data needs
  - Develop data collection options
  - 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.

TPP Phases

Phase I: Identify the Current Project

1. Team members identified to date include: USACE – representatives from the Omaha Design Center and the Seattle District, Shaw Environmental, Inc. (Shaw) as a USACE contractor, Washington Department of Ecology, and the property owners (State Parks and Port of Port Townsend).

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

   Yes. EPA Region 10 was notified of the meeting but did not attend. The Washington Department of Ecology will coordinate efforts with EPA Region 10. The USACE will contact applicable tribal interests.

2. The area of concern (AOC) identified is:
   - Demo Range
   - Burn Pit
   - Possible Small Arms Range

   Question: Are there any other AOCs to be identified?

   No.

3. Based on information available about the site and shared through discussions with the USACE, are there concerns about this area that have been expressed by the Washington Department of Ecology or USEPA, as well as by landowners.

   Question: Are there additional concerns or issues from landowners or other stakeholders regarding the former Fort Townsend site?

   No.

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?

No.

Phase II: Determine Data Needs

4. Existing site information includes an Archives Search Report (ASR) and INPR Supplement both prepared by the USACE in 2005 and 2004, respectively.

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

   No.

5. The site-specific approach for this Site Inspection (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?

   No.

   Based on site use, soil is the primary affected medium at the former Fort Townsend. Air is also a potential pathway if soil particles become airborne. Considering current and future land use, primary receptors of any contaminants that may be present would most likely be workers, recreational users, and animals using the area.

   Question: Do team members concur with the CSM?

   Yes.

6. 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?**

   No.

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

   A site walk was conducted as part of the TPP Meeting. Some of the locations of MEC findings need to be determined.

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

   No.

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

   No.

Phase III: Develop Data Collection Options

7. Proposed approach:
    1. Conduct surface reconnaissance with magnetometer focused within the Demo Range, Burn Pit, and Possible Small Arms Range areas.
    2. Find suitable surface soil and beach background sample locations (three total of each) and sample.
    3. Collect composite surface soil samples and analyze for select metals (chromium, copper, iron, lead, manganese, and nickel) and explosives.

    Question: Based on the desired decision endpoints and information known to date, what additional information is needed to reach a determination of No Department of Defense Action Indicated (NDAI) or further action?

    None identified.

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

    Yes.

    Question: Are the stakeholders in agreement with the proposed approach for collecting background data?

    Yes.

Phase IV: Finalize Data Collection Program

8. **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.

    Question: What background data will be used for evaluation?

    Background data will be collected as part of the investigation. The Washington Department of Ecology recommended evaluating the State of Washington background soils database and samples collected at the cliff area of Fort Flagler.

    Are background data sets available from previous site studies?

    The Washington Department of Ecology recommended evaluating the results of samples collected at the cliff area of Fort Flagler.

    Are background data sets available from statewide studies?

    The Washington Department of Ecology recommended evaluating the State of Washington background soils database.

    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?

    Surface soil and beach samples will be collected. The background sampling approach will be presented in the draft SI work plan.

9. **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). What concentrations of potential contaminants of concern (metals and explosives) lead to decision end-points for human health?

   Note: Washington State standards are provided in Table 5.

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

   Yes.

10. **Ecological screening level risk assessment.**
    The USACE has defined a process for conducting screening level ecological risk assessment (SLERA). 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 SLERA 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).

    Does the site qualify as an IEP?

    Yes.

    Is the site managed for ecological purposes?

    No.

    If the site is an IEP or is managed for ecological purposes, what concentrations of potential contaminants of concern (metals and explosives) lead to decision end-points for ecological risk?

    Note: Washington State standards are provided in Tables 6 and 7.

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

    Yes.

11. **Other sampling issues.**

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

    The sampling and analysis methodologies will be discussed in the draft SI work plan. It will be based on existing knowledge of Fort Townsend and any additional information gleaned from the visual reconnaissance activities to be performed.

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

    No.

9.0 Data Quality Objectives

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

- Below risk-based screening levels = NDAI;
- Above risk-based screening levels and background = RI/FS.

The following expanded project objectives have been developed.

Objective 1: Determine if the site requires additional investigation or can be recommended for NDAI based on the presence or absence of munitions and explosives of concern (MEC).

DQO #1 – Utilizing trained UXO personnel and handheld magnetometers, a visual search will be conducted searching for physical evidence to indicate the presence of MEC (e.g. MEC on the surface, munitions debris, craters, soil discoloration indicative of explosives. The visual search will consist of areas within the Demo Range, Burn Pit, and Possible Small Arms Range. The following decision rules will apply:

- The following reconnaissance results would support a recommendation for further action with respect to MEC:
    - Direct evidence is found of the presence of MEC (from historical records or SI activities) or evidence of potential MEC that is inconsistent with the bombing rocket range CSM (e.g. use of munitions containing high explosives).
    - Direct evidence of MEC is not found, but abundant munitions debris is identified suggesting a potential for the presence of MEC.
- The following reconnaissance results would support a recommendation for NDAI with respect to MEC:
    - Direct evidence of MEC is not found; small arms or munitions debris is isolated and consistent with the Demo Range, Burn Pit, or Possible Small Arms Range CSM.
    - No evidence of MEC, munitions debris, or magnetic anomalies is identified.
- If there is indication that site users are exposed to MEC hazard, the site will be recommended for a removal action.

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

DQO #2 – Soil and sediment samples will be collected and analytical results will be compared to background. Results from previous investigations will also be included in the evaluation provided the analytical data meet data quality requirements developed for the SI. The following decision rules will apply:

- If sample results do not exceed background, the site will be recommended for NDAI relative to MC
- If sample results that exceed background are less than human health and ecological screening values, the site will be recommended for NDAI relative to MC.

- If sample results exceed both background and human health screening values, the site will be recommended for additional investigation.
- If sample results that exceed background exceed ecological screening values but not 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 Hazard Ranking System (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

- Shaw will provide proposed sampling location in order for the USACE to obtain necessary rights-of-entry.
- Shaw will prepare the draft and final TPP Memorandum and distribute for concurrence.
- Shaw will prepare the draft SSWP for review and comment, and publish the final SSWP.
- Shaw will conduct field work.
- Shaw will prepare the draft final SI Report and submit for stakeholder review.
- USACE/Shaw will schedule a second TPP Meeting to review comments on the draft final report.

10.0 References

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Figures

Legend

Fort Townsend FUDS Property

NOTES:
1) FUDS property was derived from the Fort Townsend INPR Supplement.
2) Topographic maps (Clallam, Island, Jefferson, and Kitsap Counties) obtained from the U.S. Department of Agriculture, Service Center Agencies, 1999.

N

0 1 2 4 Miles

REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

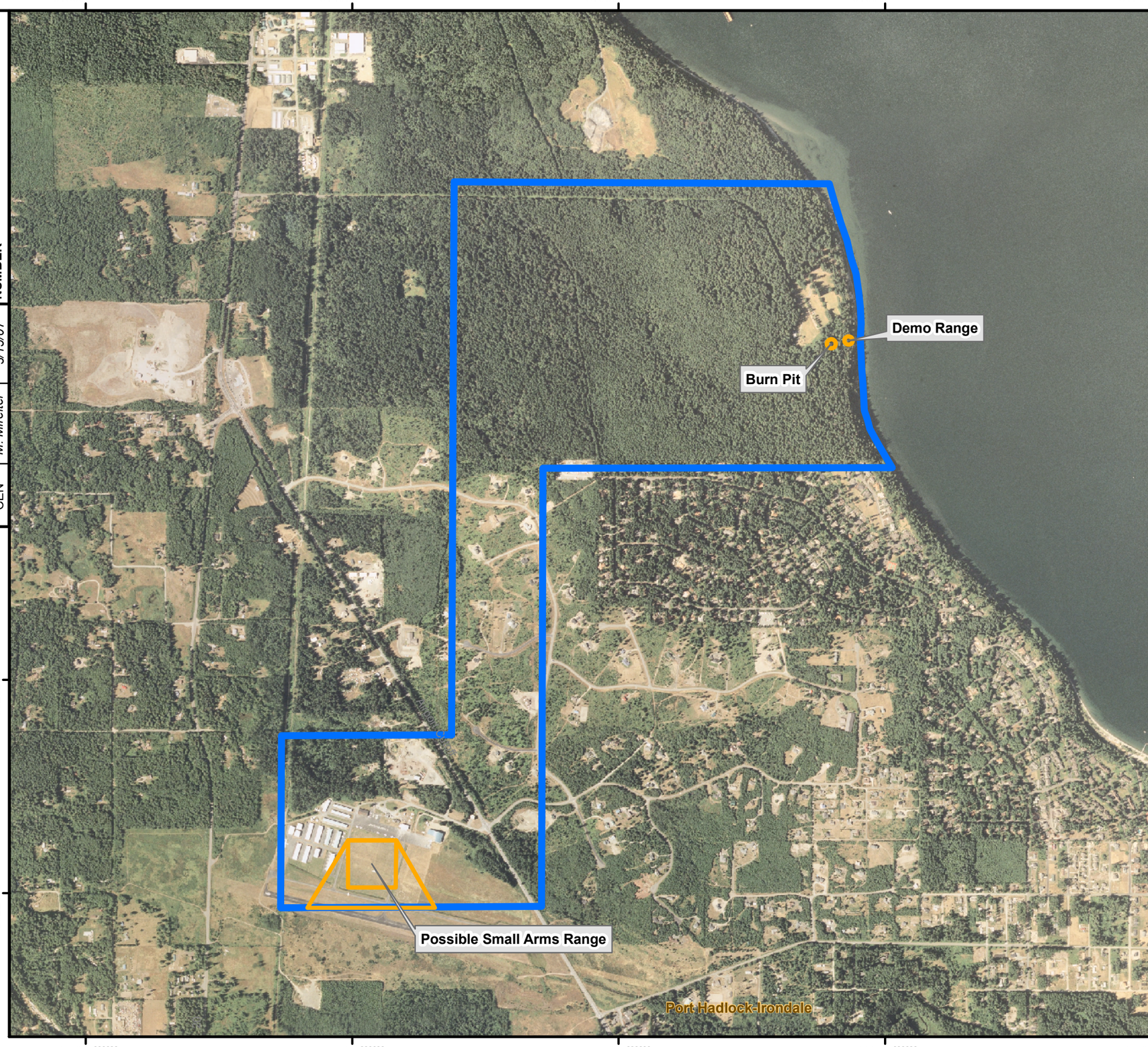
FIGURE 1

SITE LOCATION

FORT TOWNSEND

Shaw Environmental, Inc.

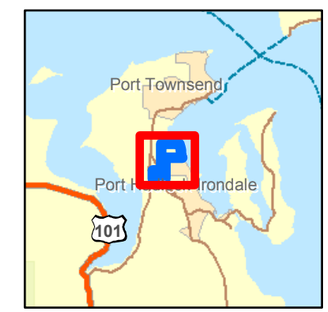
DRAWING NUMBER	DRAWN BY		OFFICE
FtTownsend_001_Fig01_SiteLocation_TPP	M. Mireiter	3/14/07	CEN



Legend

- Fort Townsend FUDS Property
- Ranges Identified in the MMRP Range Inventory

NOTES:
1) FUDS property and range boundaries were derived from the Fort Townsend INPR Supplement.
2) Aerial photograph (Jefferson County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photograph is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.



N

0 625 1,250 2,500 Feet

REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

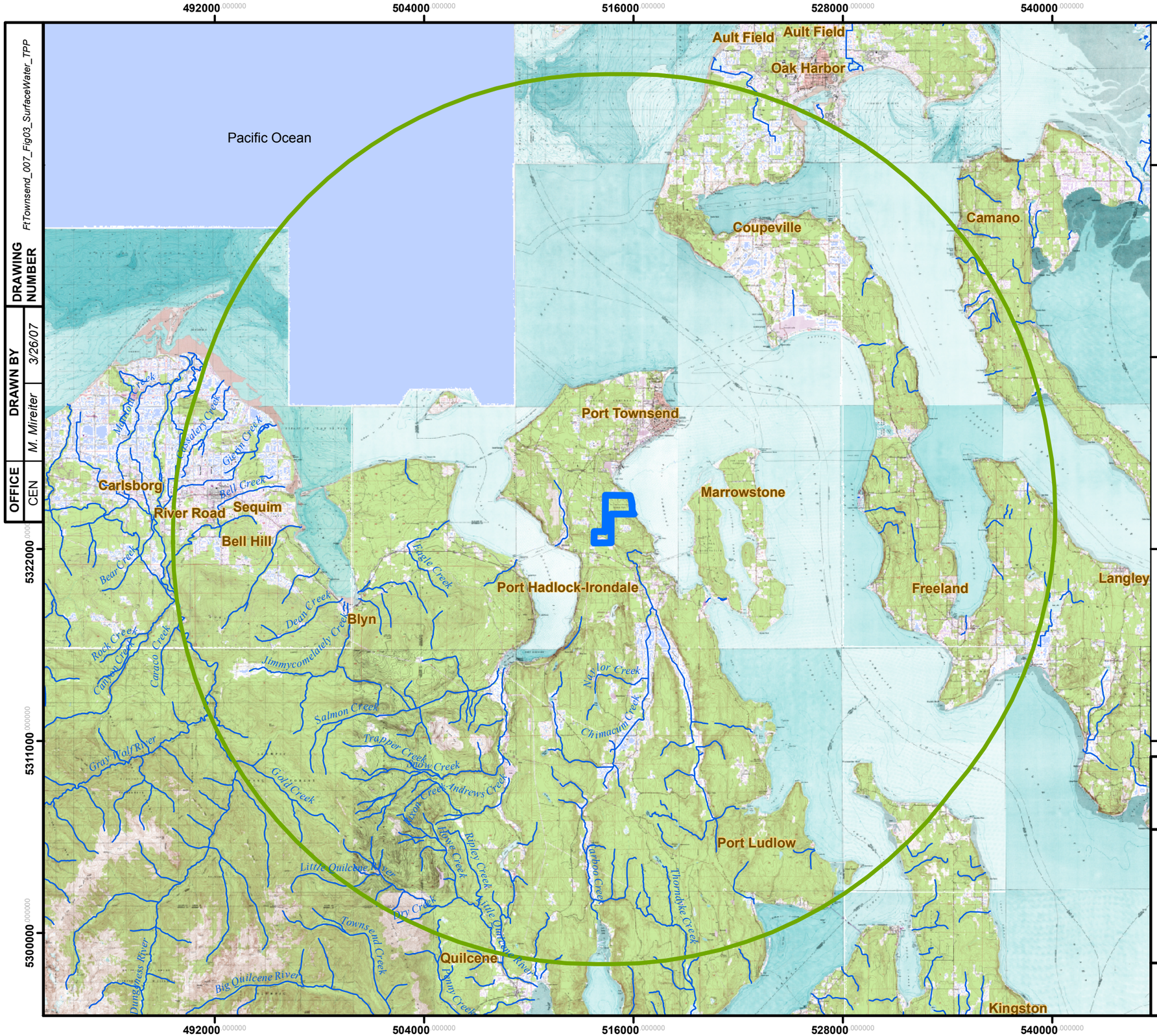
FIGURE 2

SITE LAYOUT

FORT TOWNSEND

Shaw Environmental, Inc.

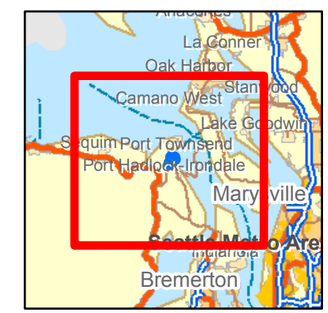
OFFICE	DRAWN BY		DRAWING NUMBER
CEN	M. Mireiter	3/15/07	FtTownsend_002_Fig02_SiteLayout_TPP



Legend

- Fort Townsend FUDS Property
- 15-Mile Radius From Fort Townsend FUDS Property

NOTES:
1) FUDS property was derived from the Fort Townsend INPR Supplement.
2) Topographic maps (Jefferson, Island, Clallam, and Kitsap Counties) obtained from the U.S. Department of Agriculture, Service Center Agencies, 1999.



N

0 1.75 3.5 7 Miles

REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

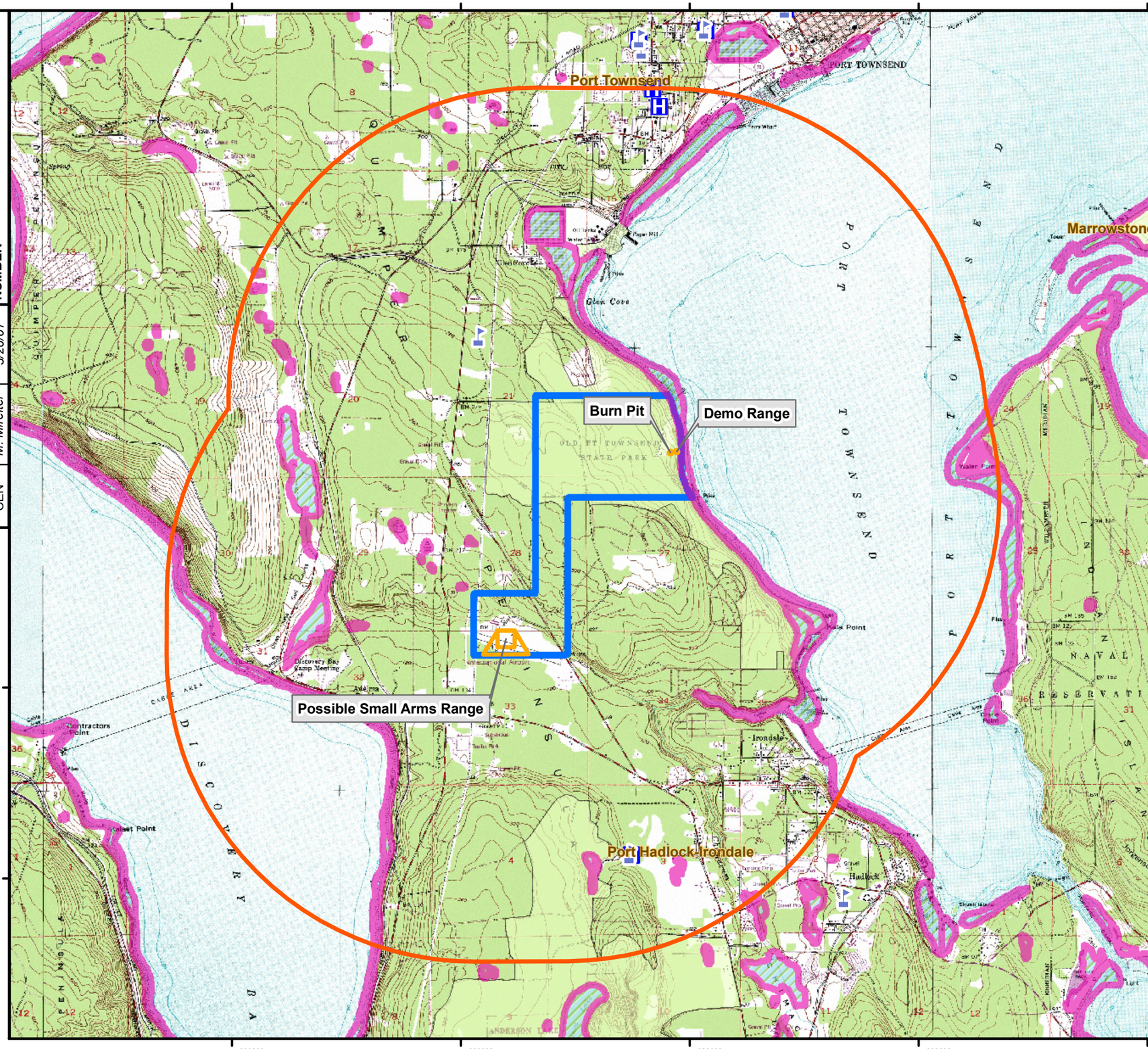
FIGURE 3

SURFACE WATER DRAINAGES

FORT TOWNSEND

Shaw Environmental, Inc.

DRAWING NUMBER	DRAWN BY		OFFICE
FtTownsend_007_Fig03_SurfaceWater_TPP	M. Mireiter	3/26/07	CEN

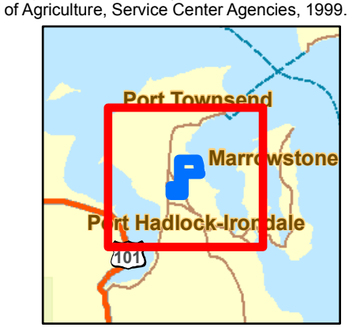


Legend

- Fort Townsend FUDS Property
- 2-Mile Radius From Fort Townsend FUDS Property
- Ranges Identified in the MMRP Range Inventory
- Wetland Area
- Park
- School
- Hospital

NOTES:

1) FUDS boundary and range boundaries were derived from the Fort Townsend INPR Supplement.
2) Wetlands data obtained from the U.S. Fish and Wildlife Service, 200605, NWIDBA.CONUS_wet_poly: Classification of Wetlands and Deepwater Habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC. FWS/OBS-79/31., U.S. Fish and Wildlife Service, Branch of Habitat Assessment, Washington, D.C.
3) Topographic map (Jefferson County) obtained from the U.S. Department of Agriculture, Service Center Agencies, 1999.



N

0 1,750 3,500 7,000 Feet

REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

U.S. ARMY CORPS OF ENGINEERS
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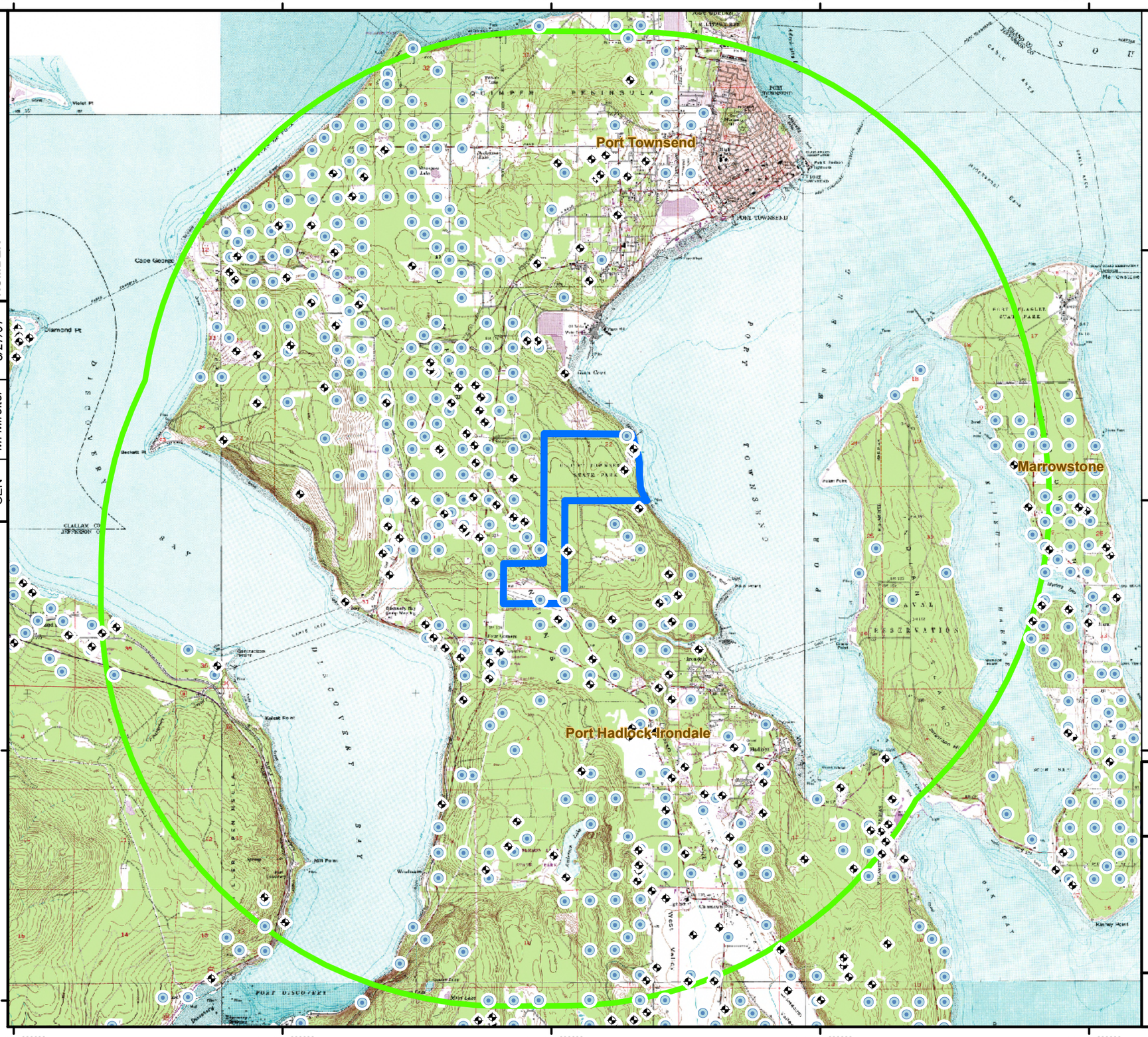
FIGURE 4

SENSITIVE RECEPTOR LOCATIONS

FORT TOWNSEND

Shaw Environmental, Inc.

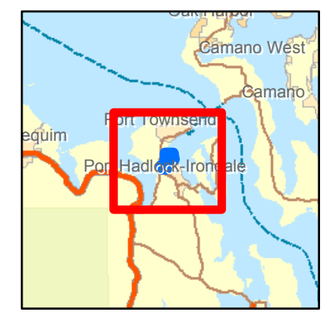
DRAWING NUMBER	DRAWN BY		OFFICE
FtTownsend_006_Fig04_SensRec_TPP	M. Mireiter	3/26/07	CEN



Legend

- Fort Townsend FUDS Property
- 4-Mile Radius From Fort Townsend FUDS Property
- Groundwater Supply Well
- USGS Monitoring Well

NOTES:
1) FUDS property was derived from the Fort Townsend INPR Supplement.
2) Groundwater well information obtained from the U.S. Geological Survey and the State of Washington, Department of Ecology.
3) Topographic map (Jefferson County) obtained from the U.S. Department of Agriculture, Service Center Agencies, 1999.



N

0 0.5 1 2 Miles

REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

U.S. ARMY CORPS OF ENGINEERS
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FIGURE 5

GROUNDWATER WELLS WITHIN 4-MILE RADIUS

FORT TOWNSEND

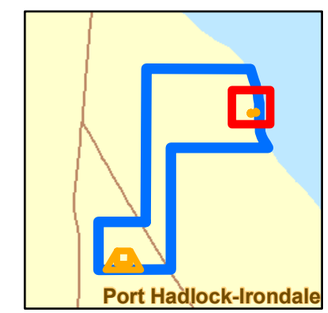
Shaw Environmental, Inc.

DRAWING NUMBER	DRAWN BY		OFFICE
FtTownsend_005_Fig05_GWWells_TPP	M. Mireiter	3/27/07	CEN

Legend

- Fort Townsend FUDS Property
- Ranges Identified in the MMRP Range Inventory
- Parcel Ownership Boundary
- 1 Parcel Designation Number
- USGS Monitoring Well

NOTES:
1) FUDS property and range boundaries were derived from the Fort Townsend INPR Supplement.
2) Parcel boundaries and ownership information obtained from the State of Washington.
3) Groundwater well information obtained from the U.S. Geological Survey.
4) Aerial photograph (Jefferson County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photograph is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.



N

0 75 150 300 Feet

REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

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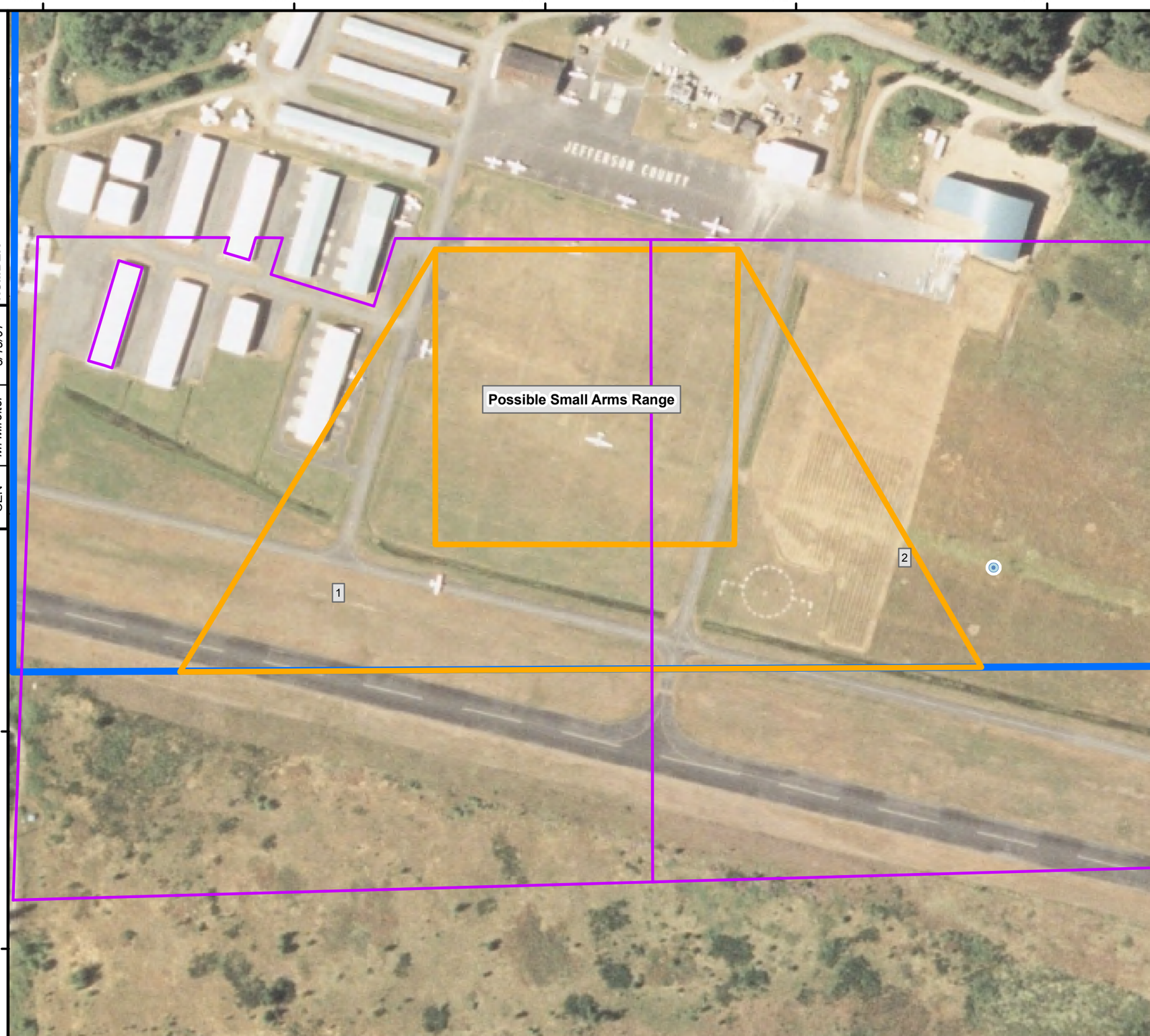
FIGURE 6

DEMO RANGE AND BURN PIT

FORT TOWNSEND

Shaw Environmental, Inc.

OFFICE	DRAWN BY		DRAWING NUMBER
CEN	M. Mireiter	3/15/07	FtTownsend_003_Fig06_DemoRng_BPit_TPP

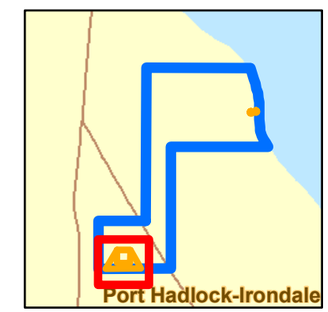


Legend

- Fort Townsend FUDS Property
- Ranges Identified in the MMRP Range Inventory
- Parcel Ownership Boundary
- 1 Parcel Designation Number
- Groundwater Supply Well

NOTES:
1) FUDS property and range boundaries were derived from the Fort Townsend INPR Supplement.
2) Parcel boundaries and ownership information obtained from the State of Washington.
3) Groundwater well information obtained from the State of Washington, Department of Ecology.
4) Aerial photograph (Jefferson County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photograph is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.

N



0 100 200 400 Feet

REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

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FIGURE 7

POSSIBLE SMALL ARMS RANGE

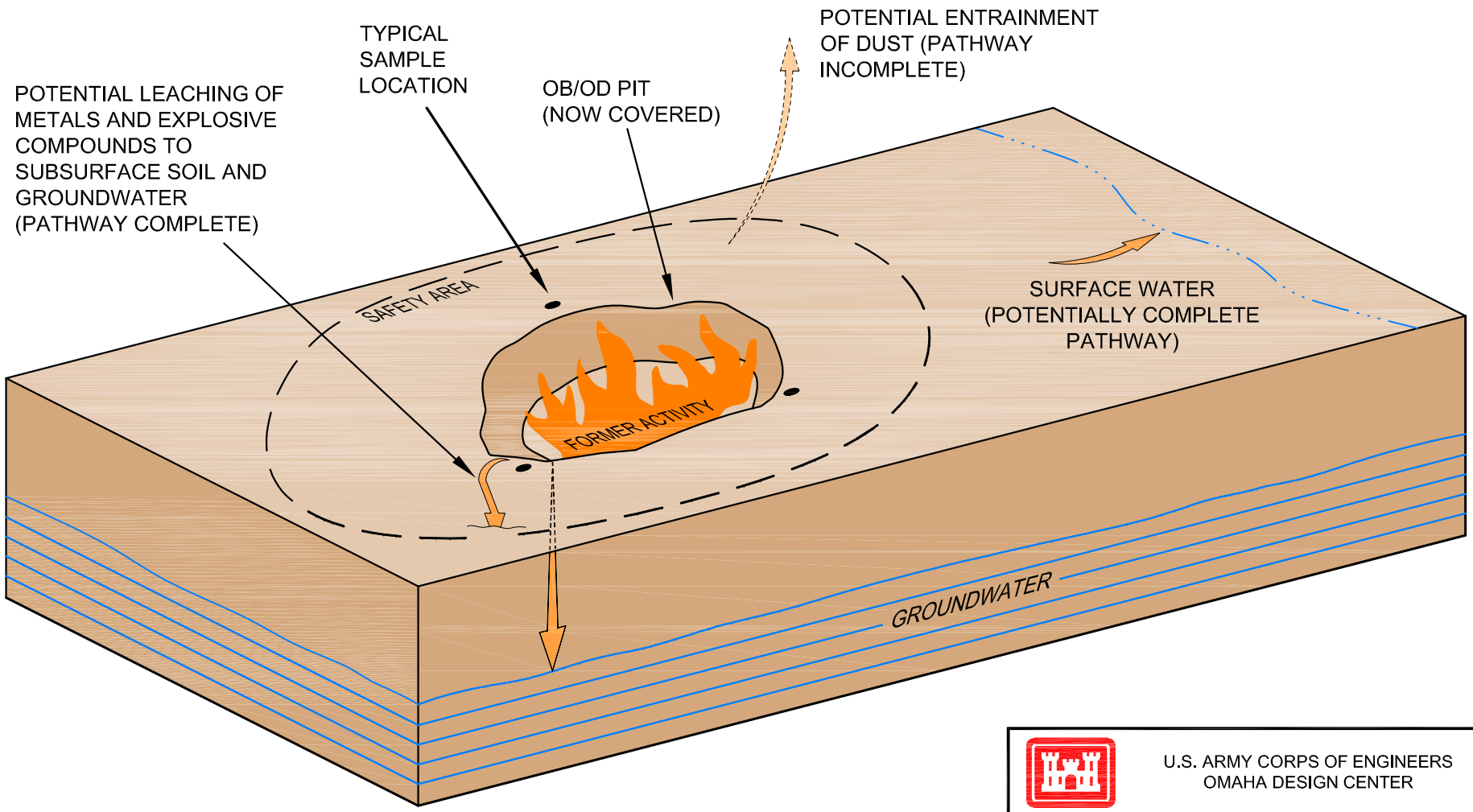
FORT TOWNSEND

Shaw Environmental, Inc.

OFFICE	DRAWN BY		DRAWING NUMBER
CEN	M. Mireiter	3/15/07	FtTownsend_004_Fig07_SmallArmsRng_TPP

XREF Files: IMAGE Files:
File: N:\cad\DWG\116188-FUDS\116188SJ-a86.dwg Layout: Layout User: Karen.Black Jun 28, 2007 - 8:53am

OFFICE	DRAWN BY		DRAWING NUMBER	116188SJ-A86
SJ	K. Black	06/28/07		



RECEPTORS:

- Landowners
- Biota (wildlife)

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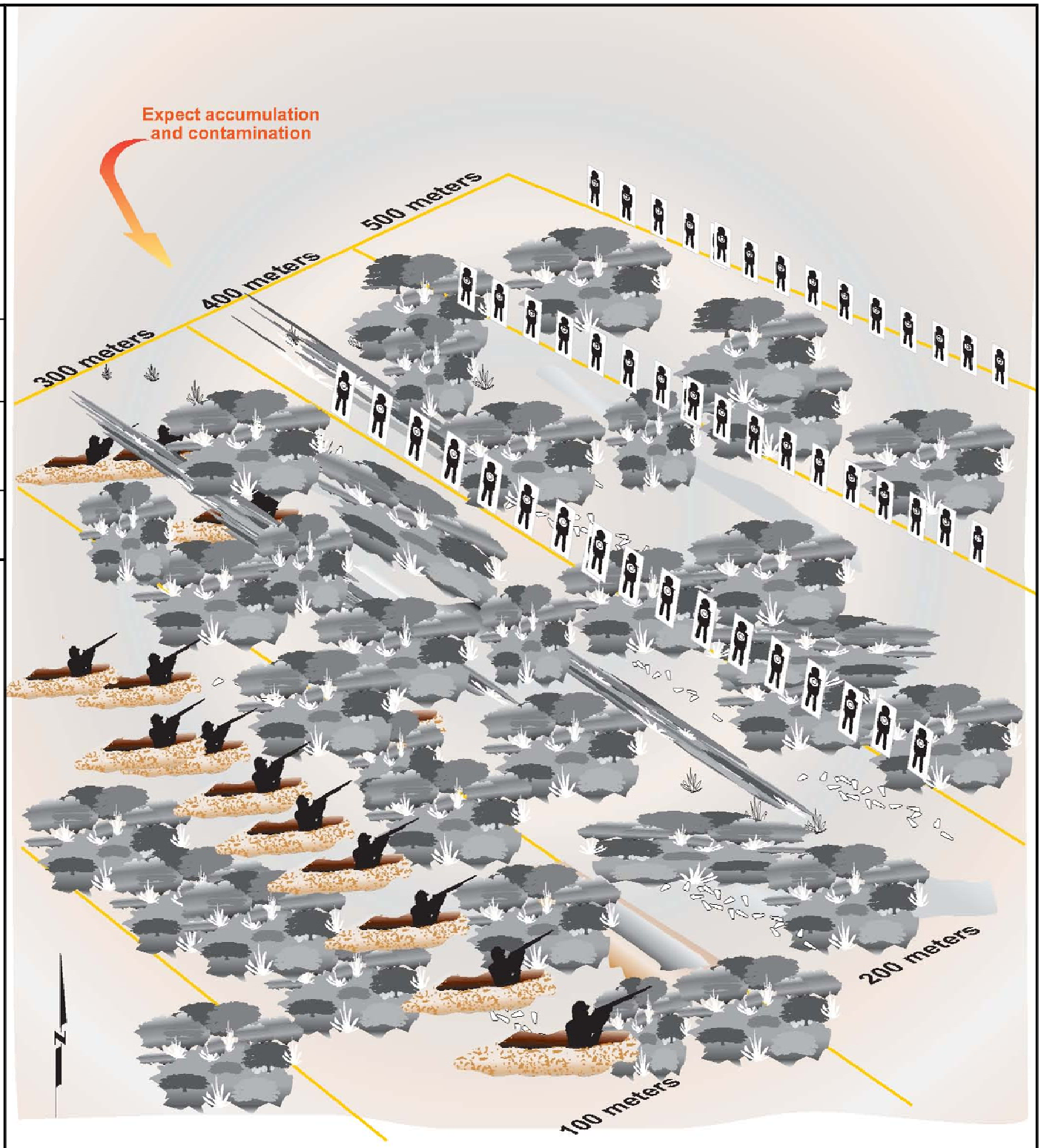
FIGURE 8

CONCEPTUAL SITE MODEL
OPEN BURNING/OPEN DETONATION PIT

FORT TOWNSEND

Shaw® Shaw Environmental, Inc.

OFFICE	DRAWN BY		DRAWING NUMBER
SJ	K. Black	06/28/07	116188SJ-A85



U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

FIGURE 9

CONCEPTUAL SITE MODEL
SMALL ARMS RANGE
FORT TOWNSEND

Shaw® Shaw Environmental, Inc.

Tables

Table 1
Army Checklist for Important Ecological Places [a]
Fort Townsend

		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	☐ / ☒	
2	Critical habitat for Federal designated endangered or threatened species	☐ / ☒	
3	Marine Sanctuary	☐ / ☒	
4	National Park	☐ / ☒	
5	Designated Federal Wilderness Area	☐ / ☒	
6	Areas identified under the Coastal Zone Management Act	☒ / ☐	Site shoreline on Puget Sound; located in one of the 15 counties identified under the CZMA.
7	Sensitive Areas identified under the National Estuary Program or Near Coastal Waters Program	☐ / ☒	
8	Critical areas identified under the Clean Lakes Program	☐ / ☒	
9	National Monument	☐ / ☒	
10	National Seashore Recreational Area	☐ / ☒	
11	National Lakeshore Recreational Area	☐ / ☒	
12	Habitat known to be used by Federal designated or proposed endangered or threatened species	☒ / ☐	Occasional bald eagle site use (ASR Appendix H-2).
13	National preserve	☐ / ☒	
14	National or State Wildlife Refuge	☐ / ☒	
15	Unit of Coastal Barrier Resources System	☐ / ☒	
16	Coastal Barrier (undeveloped)	☐ / ☒	
17	Federal land designated for protection of natural ecosystems	☐ / ☒	
18	Administratively Proposed Federal Wilderness Area	☐ / ☒	
19	Spawning areas critical for the maintenance of fish/shellfish species within river, lake, or coastal tidal waters	☐ / ☒	
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	☐ / ☒	
21	Terrestrial areas utilized for breeding by large or dense aggregations of animals	☐ / ☒	

Table 1 (Cont.)

		Yes / No	Comments
22	National river reach designated as Recreational	☐ / ☒	
23	Habitat known to be used by state designated endangered or threatened species	☒ / ☐	Occasional bald eagle site use (ASR Appendix H-2).
24	Habitat known to be used by species under review as to its Federal endangered or threatened status	☐ / ☒	
25	Coastal Barrier (partially developed)	☐ / ☒	
26	Federally designated Scenic or Wild River	☐ / ☒	
27	State land designated for wildlife or game management	☒ / ☐	Portion of site is State Park, and Washington State Parks and Recreation Commission is assumed to manage state park lands for wildlife and/or game species.
28	State-designated Scenic or Wild River	☐ / ☒	
29	State-designated Natural Areas	☐ / ☒	
30	Particular areas, relatively small in size, important to maintenance of unique biotic communities	☐ / ☒	
31	State-designated areas for protection or maintenance of aquatic life	☒ / ☐	Portion of site is State Park, and Washington State Parks and Recreation Commission has statutory responsibility to conserve Washington's seashore.
32	Wetlands	☐ / ☒	
33	Fragile landscapes, land sensitive to degradation if vegetative habitat or cover diminishes	☐ / ☒	

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 2
Munitions Information
Fort Townsend

Range Areas	Munitions ID	Munitions	Associated MC	Comments
Demo Range	Demolition Materials (CTT37)	Explosives, trinitrotoluene (TNT)	TNT	
	Demolition Materials (CTT37)	Explosives, Detonating Cord	PETN, black powder	
	Blasting Caps (CTT39)	Blasting Caps, Electric and Nonelectric, M6 and M7	Aluminum, lead styphnate, lead azide, RDX, smokeless powder, potassium chlorate, lead salt of dinitro cresol	
	Torpedoes/Sea Mines (CTT47)	Torpedo, General, Navy	Potassium chlorate, antimony sulfide, mercury fulminate, lead azide, tetryl, picric acid, trinitroanisol, ammonium, perchlorate, silicon carbide, HND, aluminum powder	
	Other (CTT53)	Foreign and domestic explosives, including torpedoes, mines, Japanese balloon bombs, dynamite, grenades, and depth charges [1] 1800s era rifle and pistol (45-70) brass [2]		[1] Interview with Doug Bassett regarding detonation pits on beach (pg 8, a) 6) ASR). Also in INPR Supplement. [2] There were no OE, OE related materials, or significant magnetic anomalies noted at the "clean-up" shots area (observation from 2003 SI pg 11 ASR). Found along the trails that run along the top of the cliff (pg 11 ASR).
Burn Pit	Small Arms (CTT01)	Small Arms, General	Black Powder Filler (Table 7-1 pg 12 ASR) and lead	Possible ordnance items used at Fort Townsend. Common models that existed

Table 2 (Cont.)
Munitions Information
Fort Townsend

Range Areas	Munitions ID	Munitions	Associated MC	Comments
				used during WW II include 45-70 and 30-06 (pg 12 ASR). Black Powder is made up of 75% potassium nitrate (salt peter, niter), 10% sulfur, and 15% charcoal. Found 1875 to 1885 era charred and burst small arms brass, melted glass, and sporadic pieces of lead slag during 2003 Site Inspection (Appendix J, ASR).
Possible Small Arms Range (Used 1930-1947? Near present day landing field. No documentation verifying existence) pg 7 ASR	Small Arms (CTT01)	Small Arms, General	Black Powder Filler (Table 7-1 pg 12 ASR) and lead	Was not listed in INPR Supplement.

Note: Information provided in this table is derived from the ASR, INPR Supplement, and munitions data sheets.

Table 3
MEC and MC Exposure Pathway Analysis

Range Area & Type	MMRP Concern	Potential Contaminant of Concern (PCOCs)	Affected Media (Potential Contaminant Sources) (Fate and Transport)	Exposure Routes and Potential Receptors			Data Gaps	Activities to Address Data Gaps (i.e., Sampling)
				Site Workers/ Contractor Personnel	Residents/ General Public	Ecological (Biota)		
Demo Range	MEC	MEC in the form of torpedoes, mines, Japanese balloon bombs, dynamite, grenades, depth charges, and small range ammunition may exist on the beach surface.	**Surface Soil** • MEC (unexploded munitions) are a hazard. • MEC (unexploded munitions) reported to be detonated in detonation pits on beach.	• Potentially complete pathway. Exposure routes: • Vehicle and foot traffic	• Potentially complete pathway. Exposure routes: • Vehicle and foot traffic	• Potentially complete pathway. Exposure routes: • Foot traffic	• MEC has not been found.	• A field reconnaissance survey by a trained unexploded ordnance (UXO) technician on beach area to assess the presence or absence of munitions and explosives of concern (MEC) and to document the current site conditions.
	MC	MC in the form of metals from small arms and munitions debris, MC from explosives in detonation pit. MC from propellants.	**Surface Soil** • Potentially affected media.	• Potentially complete pathway. Exposure routes: • Inhalation • Ingestion • Dermal contact	• Potentially complete pathway. Exposure routes: • Inhalation • Ingestion • Dermal contact	• Potentially complete pathway. Exposure routes: • Inhalation • Ingestion • Dermal contact	• Metals and explosives data needed.	• Three beach samples will be collected and analyzed for metals (chromium, copper, iron, lead, manganese, and nickel) and explosives (including nitroglycerin and PETN).
			Sediment/Surface Water • Not an affected media.	• Incomplete pathway.	• Incomplete pathway.	• Incomplete pathway.	• Not applicable.	• No surface water samples or sediment samples will be collected.
			Groundwater • Not an affected media under current land use.	• Incomplete pathway.	• Incomplete pathway.	• Incomplete pathway.	• Not applicable.	• No groundwater samples will be collected.
			Air • Potentially affected media due to blowing soil.	• Potentially complete pathway. Exposure routes: • Inhalation	• Potentially complete pathway. Exposure routes: • Inhalation	• Potentially complete pathway. Exposure routes: • Inhalation	• Not applicable.	• Will use soil analytical data in risk screening.
Burn Pit	MEC	MEC in the form of small arms ammunition.	**Surface Soil** • MEC (ammunition) is a hazard. • MEC (small arms brass) reported to be in burn pit.	• Potentially complete pathway. Exposure routes: • Vehicle and foot traffic	• Potentially complete pathway. Exposure routes: • Vehicle and foot traffic	• Potentially complete pathway. Exposure routes: • Foot traffic	• MEC has not been found.	• A field reconnaissance survey by a trained UXO technician of the burn pit to assess the presence or absence of MEC and to document the current site conditions.
	MC	MC in the form of metals from small arms and munitions debris.	**Surface Soil** • Potentially affected media	• Potentially complete pathway. Exposure routes: • Inhalation • Ingestion • Dermal contact	• Potentially complete pathway. Exposure routes: • Inhalation • Ingestion • Dermal contact	• Potentially complete pathway. Exposure routes: • Inhalation • Ingestion • Dermal contact	• No data available.	• One surface soil sample will be collected and analyzed for lead only.
			Sediment/Surface Water • Not an affected media.	• Incomplete pathway.	• Incomplete pathway.	• Incomplete pathway.	• Not applicable.	• No surface water samples or sediment samples will be collected.
			Groundwater • May be an affected media.	• Potentially complete pathway.	• Potentially complete pathway.	• Potentially complete pathway.	• Not applicable.	• No groundwater samples will be collected.
			Air • Potentially affected media due to blowing soil.	• Potentially complete pathway. Exposure routes: • Inhalation	• Potentially complete pathway. Exposure routes: • Inhalation	• Potentially complete pathway. Exposure routes: • Inhalation	• Not applicable.	• Will use soil analytical data in risk screening.

Table 3 (Cont.)

Range Area & Type	MMRP Concern	Potential Contaminant of Concern (PCOCs)	Affected Media (Potential Contaminant Sources) (Fate and Transport)	Exposure Routes and Potential Receptors			Data Gaps	Activities to Address Data Gaps (i.e., Sampling)
				Site Workers/ Contractor Personnel	Residents/ General Public	Ecological (Biota)		
Possible Small Arms Range	**MEC**	MEC in the form of small arms ammunition.	**Surface Soil** • MEC (ammunition) is a hazard.	• Potentially complete pathway. Exposure routes: • Vehicle and foot traffic	• Potentially complete pathway. Exposure routes: • Vehicle and foot traffic	• Potentially complete pathway. Exposure routes: • Foot traffic	• MEC has not been found. • Location of range has not been documented.	• A field reconnaissance survey by a trained UXO technician of the possible small arms range to assess the presence or absence of MEC and to document the current site conditions.
	MC	MC in the form of metals from small arms and munitions debris.	**Surface Soil** • Potentially affected media.	• Potentially complete pathway. Exposure routes: • Inhalation • Ingestion • Dermal contact	• Potentially complete pathway. Exposure routes: • Inhalation • Ingestion • Dermal contact	• Potentially complete pathway. Exposure routes: • Inhalation • Ingestion • Dermal contact	• No data available.	• Ten surface soil samples will be collected and analyzed for lead only.
			Sediment/Surface Water • Not an affected media.	• Incomplete pathway.	• Incomplete pathway.	• Incomplete pathway.	• Not applicable.	• No surface water samples or sediment samples will be collected.
			Groundwater • May be an affected media.	• Potentially complete pathway.	• Potentially complete pathway.	• Potentially complete pathway.	• Not applicable.	• No groundwater samples will be collected.
			Air • Potentially affected media due to blowing soil.	• Potentially complete pathway. Exposure routes: • Inhalation	• Potentially complete pathway. Exposure routes: • Inhalation	• Potentially complete pathway. Exposure routes: • Inhalation	• Not applicable.	• Will use soil analytical data in risk screening.

Table 4
Proposed Sampling Approach
Fort Townsend

Area of Concern	Media	Samples	Lead	Select Metals	TAL Metals	Explosives	PETN	Nitroglycerin
Demo Range	Beach	3	0	3	0	3	3	3
	Sediment	0	0	0	0	0	0	0
	Surface Water	0	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0	0
Burn Pit	Soil	1	1	0	0	0	0	0
	Sediment	0	0	0	0	0	0	0
	Surface Water	0	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0	0
Possible Small Arms Range	Soil	10	10	0	0	0	0	0
	Sediment	0	0	0	0	0	0	0
	Surface Water	0	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0	0
Background	Beach	3	0	0	3	0	0	0
	Soil	3	0	0	3	0	0	0
	Sediment	0	0	0	0	0	0	0
	Surface Water	0	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0	0
		Totals	11	3	6	3	3	3

QC Required Samples	Media	Samples	Lead	Select Metals	TAL Metals	Explosives	PETN	Nitroglycerin
Duplicate	Soil	1	1	0	0	0	0	0
	Beach	1	0	1	1	1	1	1
	Sediment	0	0	0	0	0	0	0
	Surface Water	0	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0	0
		Totals	1	1	1	1	1	1
MS/MSD	Soil	1	1	0	0	0	0	0
	Beach	1	0	1	1	1	1	1
	Sediment	0	0	0	0	0	0	0
	Surface Water	0	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0	0
		Totals	1	1	1	1	1	1

Notes:

1) In addition to the QC samples shown above, temperature blanks will be submitted with samples, one blank per cooler.

2) Metals by SW-846 6020A. Explosives by SW-846 8330A. PETN and Nitroglycerin by SW-845 8330A (Modified).

3) Select metals include: chromium, copper, iron, lead, manganese, and nickel.

4) Target Analyte List metals include: aluminum, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, silver, vanadium, and zinc.

MS/MSD - matrix spike/matrix spike duplicate
PETN - pentaerythritol tetranitrate
QC - quality control
TAL - Target Analyte List

Table 5
Human Health Soil and Sediment Screening Criteria
Fort Townsend

Analyte	USEPA Region 9[a]		Washington Department of Ecology - Soil Cleanup Levels[b]					Final Screening Value[h] (mg/kg)
	Residential PRGs (mg/kg)	Industrial PRGs (mg/kg)	Method B Level - Unrestricted[c] (mg/kg)	Leaching - Phase 3 Model - Unrestricted[d] (mg/kg)	Method B Level - Industrial[e] (mg/kg)	Leaching - Phase 3 Model - Industrial[f] (mg/kg)	Natural Background Level[g] (mg/kg)	
Explosives								
Hexahydro-1,3,5-trinitro-1,3,5-triazine	4.4	16	NVA	NVA	NVA	NVA	NA	4.4
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	3,100	31,000	NVA	NVA	NVA	NVA	NA	3,100
2,4,6-Trinitrotoluene	16	57	NVA	NVA	NVA	NVA	NA	16
1,3,5-Trinitrobenzene	1,800	18,000	NVA	NVA	NVA	NVA	NA	1,800
1,3-Dinitrobenzene	6.1	62	NVA	NVA	NVA	NVA	NA	6.1
2,4-Dinitrotoluene[i]	0.72	2.5	NVA	NVA	NVA	NVA	NA	0.72
2,6-Dinitrotoluene[i]	0.72	2.5	NVA	NVA	NVA	NVA	NA	0.72
2-Amino-4,6-dinitrotoluene	12	120	NVA	NVA	NVA	NVA	NA	12
2-Nitrotoluene	0.88	2.2	NVA	NVA	NVA	NVA	NA	0.88
3-Nitrotoluene	730	1,000	NVA	NVA	NVA	NVA	NA	730
4-Amino-2,6-dinitrotoluene	12	120	NVA	NVA	NVA	NVA	NA	12
4-Nitrotoluene	12	30	NVA	NVA	NVA	NVA	NA	12
Nitrobenzene	20	100	NVA	NVA	NVA	NVA	NA	20
Nitroglycerin	35	120	NVA	NVA	NVA	NVA	NA	35
Methyl-2,4,6-trinitrophenylnitramine	610	6,200	NVA	NVA	NVA	NVA	NA	610
Pentaeryltritol tetranitrate	NVA	NVA	NVA	NVA	NVA	NVA	NA	0.5 [j]
Metals								
Aluminum	76,000	100,000	NVA	NVA	NVA	NVA	32,600	76,000
Arsenic	0.39	1.8	0.62	2.92	38.84	2.92	7	0.39
Barium	16,000	100,000	NVA	NVA	NVA	NVA	NVA	16,000
Cadmium	39	560	74	0.69	1,460	0.69	1	1[k]
Chromium (Total)	210	500	NVA	NVA	NVA	NVA	48	210
Chromium (VI)	30	64	128	19	1,226	19	NVA	19
Cobalt	900	2,100	NVA	NVA	NVA	NVA	NVA	900
Copper	2,900	42,000	NVA	NVA	NVA	NVA	36	2,900
Iron	55,000	100,000	NVA	NVA	NVA	NVA	58,700	55,000
Lead	400	800	NVA	3,000	NVA	3,000	24	400
Manganese	3,200	35,000	NVA	NVA	NVA	NVA	1,200	3,200

Table 5
Human Health Soil and Sediment Screening Criteria
Fort Townsend

Analyte	USEPA Region 9[a]		Washington Department of Ecology - Soil Cleanup Levels[b]					Final Screening Value[h] (mg/kg)
	Residential PRGs (mg/kg)	Industrial PRGs (mg/kg)	Method B Level - Unrestricted[c] (mg/kg)	Leaching - Phase 3 Model - Unrestricted[d] (mg/kg)	Method B Level - Industrial[e] (mg/kg)	Leaching - Phase 3 Model - Industrial[f] (mg/kg)	Natural Background Level[g] (mg/kg)	
Mercury (Inorganic)	23	340	18	2.09	252	2.09	0.07	23
Nickel	1,600	23,000	NVA	NVA	NVA	NVA	48	1,600
Silver	390	5,700	NVA	NVA	NVA	NVA	NVA	390
Vanadium	390	5,700	NVA	NVA	NVA	NVA	NVA	390
Zinc	23,000	100,000	NVA	NVA	NVA	NVA	85	23,000

Acronyms and Abbreviations:

CLARC = Cleanup Level and Risk Calculation
WAC = Washinton Administrative Code
NVA = no value available
mg/kg = milligrams per kilogram.
NVA = no value available
C = Value for carcinogen
N = Value for noncarcinogen
NA = not applicable, compound considered not present in natural soils
USEPA = U.S. Environmental Protection Agency

Notes:

[a] Region 9 Preliminary Remediation Goals (PRG) table; October 2004. Values are based on residential and industrial exposure to single chemicals.
[b] Cleanup levels are established under the Model Toxics Control Act (MCTA) Cleanup Regulation. Chapter 173-340 WAC.
[c] 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 undated on November 23, 2004.
[d] 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.
[e] 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 Injestion 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.
[f] 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.
[g] Values from "Natural Background Soil Metals Concentrations in Washington State", Publication #94-115, October 1994. Based on data for Puget Sound.
[h] 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
[i] Carcinogenic DNT mixture values used if more conservative than noncarcinogenic isomer-specific values.
[j] Value is laboratory practical quantitation limit.
[k] Soil cleanup levels for individual substances must not be set below the practical quantitation limit (PQL) or natural background concentration, whichever is higher. From "Focus on Developing Soil Cleanup Standards Under the Model Toxics Control Act" (Washington Department of Ecology, Toxic Cleanup Program, April 2005).

Table 6
Ecological Soil Screening Criteria and Selected Values for Potential Contaminants of Concern
Fort Townsend

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
PETN	NVA	NVA	NVA		NVA		NVA		8600	LANL		8600
RDX	NVA	NVA	NVA		NVA		NVA		7.5	LANL		7.5
Tetryl	NVA	NVA	NVA		NVA		NVA		0.99	LANL		0.99
Metals												
Aluminum	50	NVA	50	EPA-R4	NVA		50	EPA-R4	5.5	LANL		50
Arsenic	7	5.7	18	SSL	18	SSL	18	SSL	6.8	LANL	Yes	7
Barium	102	1.04	330	SSL	330	SSL	330	SSL	110	LANL		102
Cadmium	4	0.00222	0.36	SSL	0.36	SSL	0.36	SSL	0.27	LANL	Yes	4
Chromium (total)	42	0.4	26	SSL	26	SSL	26	SSL	2.3	LANL	Yes	42
Cobalt	20	0.14	13	SSL	13	SSL	13	SSL	13	LANL		20
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
Manganese	1100	NVA	220	SSL	220	SSL	220	SSL	50	LANL		1100
Mercury	0.1	0.1	0.00051	ORNL	0.00051	ORNL	0.00051	ORNL	0.013	LANL	Yes	0.1
Nickel	30	13.6	28	SSL	28	SSL	28	SSL	20	LANL	Yes	30
Silver	2	4.04	4.2	SSL	4.2	SSL	4.2	SSL	0.05	LANL	Yes	2
Vanadium	2	1.59	7.8	SSL	7.8	SSL	7.8	SSL	0.025	LANL		2
Zinc	86	6.62	8.5	ORNL	8.5	ORNL	8.5	ORNL	10	LANL	Yes	86

Acronyms and Abbreviations:
EPA-R4 = USEPA Region 4
Dutch = Dutch Intervention Values
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.)
PETN - pentaerythritol tetranitrate
RDX - Hexahydro-1,3,5-trinitro-1,3,5-triazine
SSL = USEPA Eco Soil Screening Levels
USEPA = U. S. Environmental Protection Agency

Table 6
Ecological Soil Screening Criteria and Selected Values for Potential Contaminants of Concern
Fort Townsend

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 Efroymson 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 Efroymson 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: B*ioaccumulation 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, 2005, *Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs)* , Office of Solid Waste and Emergency Response, Website version last updated March 15, 2005: 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.

Efroymson, 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. R*isk-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 7
Ecological Sediment Screening Criteria and Selected Values for Potential Contaminants of Concern
Fort Townsend

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
PETN	NVA	NVA	NVA		NVA		NVA		1.20E+05	LANL		1.20E+05
RDX	NVA	NVA	NVA		NVA		NVA		1.30E-01	TAL		1.30E-01
Tetryl	NVA	NVA	NVA		NVA		NVA		1.00E+02	LANL		1.00E+02
Metals/Inorganics												
Aluminum	NVA	NVA	NVA		NVA		NVA		2.80E+02	LANL		2.80E+02
Arsenic	4.00E+01	9.79E+00	9.79E+00	MAC	9.79E+00	MAC	9.79E+00	MAC	1.20E+01	LANL	Yes	4.00E+01
Barium	NVA	NVA	NVA		NVA		NVA		4.80E+01	LANL		4.80E+01
Cadmium	5.10E+00	9.90E-01	9.90E-01	MAC	9.90E-01	MAC	9.90E-01	MAC	3.30E-01	LANL	Yes	5.10E+00
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
Cobalt	NVA	5.00E+01	NVA		NVA		NVA		2.30E+02	LANL		2.30E+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+01	LANL		2.00E+01
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
Manganese	1.80E+03	NVA	NVA		NVA		NVA		7.20E+02	LANL		1.80E+03
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
Silver	4.50E+00	5.00E-01	1.80E+00	EPRG	1.80E+00	EPRG	1.80E+00	EPRG	1.00E+00	LANL	Yes	4.50E+00
Vanadium	NVA	NVA	NVA		NVA		NVA		3.00E+01	LANL		3.00E+01
Zinc	4.10E+02	1.21E+02	1.21E+02	MAC	1.21E+02	MAC	1.21E+02	MAC	3.70E+01	LANL	Yes	4.10E+02

Table 7
Ecological Sediment Screening Criteria and Selected Values for Potential Contaminants of Concern
Fort Townsend

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
PETN - pentaerythritol tetranitrate
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 Efroymson 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 Efroymson 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:
Efroymson, R.A., et al., 1997, P*reliminary 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

Site: Fort Townsend

Project: Fort Townsend FUDS

	Site Information Needed	Suggested Means to Obtain Site Information	Potential Source(s) of Site Information	Responsible for Obtaining	Deadline for Obtaining Site Information
1	Schedule for Sampling	Consultation	Washington State Department of Parks	Shaw	Prior to field work
2	Point of Contact for Community	Not Applicable	USACE	USACE	Prior to field work
3	Access Agreements	Correspondence, call, or visit stakeholders	Letters/conversations with stakeholders	USACE	Prior to field work
4	Areas of Cultural Significance within AOC	SHPO	Phone SHPO	Shaw	For inclusion in final TPP Memorandum

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

Installation: Fort Townsend
AOC: Demolition Range, Possible Small Arms Range, and Burn Pit
RMIS Range ID: F10WA032201

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	Wide range of explosives, foreign and domestic, including torpedoes, mines, TNT, dynamite, Japanese balloon bombs, grenades, and depth charges. Small arms.
	2	Source of Hazard			x	Former demolition range (detonation pit), burn pit, and possible small arms range
	3	Location of Munitions	x			Historical evidence indicates excess munitions destroyed in detonation pits (demolition range) and confirmed presence of small arms debris in burn pit. Possible small arms range at present day Jefferson County Airport may be difficult to locate because of earthwork to upgrade airport runway area.
	4	Ease of Access			x	State park with access to public
	5	Status of Property			x	Non-DoD control
	6	Population Density			x	< 100 persons per square mile
	7	Population Near Hazard			x	0 inhabited structures w/in 2 miles
	8	Activities/Structures			x	Agricultural - irrigated crops and livestock grazing
	9	Ecological and/or Cultural Resources			x	Ecological resources present
	10	**EHE Module Score**				
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	No barrier
	15	Status of Property			x	Non-DoD control
	16	Population Density			x	< 100 persons per square mile
	17	Population Near Hazard			x	0 inhabited structures w/in 2 miles
	18	Activities/Structures			x	Agricultural - livestock grazing
	19	Ecological and/or Cultural Resources			x	Ecological resources present
	20	**CHE Module Score**				
Health Hazard Evaluation (HHE)	21	HHE Factor Levels	x	Contaminant hazard evaluation pending analytical results		
	22	HHE Three-Letter Combination Levels	x	Contaminant hazard evaluation pending analytical results		
	23	HHE Module Ratings	x	Contaminant hazard evaluation pending analytical results		
	24	HHE Module Rating	x	Contaminant hazard evaluation pending analytical results		
MRS Priority	**25**	**MRS Priority (Based on Highest Hazard Evaluation Module Rating)**	**x**	**Evaluation pending filling of data gaps**		

To be completed by USACE once all data gaps are filled.

Fort Townsend HRS Data Gaps

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

1. Determine the latitude / longitude of the site boundary.
2. Confirm the area of the site, v. the area of all source(s).

Item	Number	Comment – Missing Data Element
1	1.8	Source scale (i.e., 1:24,000, etc.)
2	1.12	Site Permits
3	1.16	Site with unknown source
4	2.4	Confirm if there are other NPL sites within 1-mile of the site.
5	3.3	Waste treatment, storage, and disposal activities.
6	3.4	Source(s):
7	5.1	Workers on site
8	5.2	Distance to population
9	5.3	Population within 1 mile, within 4 miles
10	6	Water use (GW within 4 miles, SW within 15 miles)
11	6.1	Total drinking water population served
12	6.2	Type of drinking water supply system (GW or SW?)
13	6.3	Other water uses of GW within 4-miles
14	6.4	Aquifer depth
15	6.5	Surface Water uses
16	8	Response Actions
17	8.1	Types of action(s) that have occurred at or near the site?
18	8.2	Who did the action? (EPA, Private parties, other, etc.?)