

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

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**Technical Project Planning  
Meeting Package  
Former Fort Townsend  
FUDS ID F10WA032201**

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

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

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## TABLE OF CONTENTS

<b>ABBREVIATIONS AND ACRONYMS</b> .....	<b>ii</b>
<b>1.0 ADMINISTRATIVE INFORMATION</b> .....	<b>1</b>
<b>2.0 SITE INSPECTION OBJECTIVES</b> .....	<b>2</b>
2.1 Goal.....	2
2.2 Objectives .....	2
2.3 Roles & Responsibilities.....	2
2.4 Site Inspection Process .....	3
2.5 Technical Project Planning Process .....	3
<b>3.0 BACKGROUND INFORMATION</b> .....	<b>4</b>
3.1 Site Name and Location.....	4
3.2 Range Inventory.....	4
3.3 Property History.....	5
3.3.1 Historical Military Use .....	5
3.3.2 Munitions Information.....	5
3.3.3 Ownership History .....	6
Physical Setting.....	6
3.3.4 Topography and Vegetation.....	6
3.3.5 Surface Water.....	6
3.3.6 Sensitive Environments .....	7
3.3.7 Climate.....	7
Geologic and Hydrogeologic Setting.....	7
3.3.8 Bedrock Geology .....	7
3.3.9 Overburden Soils .....	7
• Soil at the site consists of coastal beaches, Whidbey gravelly sandy loam and Dick loamy sand. ....	7
3.3.10 Hydrogeology .....	7
3.4 Population and Land Use.....	7
3.4.1 Nearby Population .....	7
3.4.2 Land Use.....	8
3.4.3 Area Water Supply.....	8
3.5 Previous Investigations for MC and MEC.....	8
<b>4.0 CONCEPTUAL SITE MODEL – DEMO RANGE</b> .....	<b>9</b>
4.1 Overview.....	9
4.2 Background.....	9
4.2.1 History of use.....	9
4.2.2 Munitions and Associated MC.....	10
4.2.3 Previous MEC Finds.....	10
4.2.4 Previous MC Sample Results .....	10
4.2.5 Current and Future Land Use.....	10
4.2.6 Ecological Receptors .....	11
4.3 MEC Evaluation.....	11

4.3.1	MEC Evaluation/Investigation Needed .....	11
4.4	MC Evaluation.....	11
4.4.1	Overview of Pathways .....	11
4.4.2	Terrestrial Pathway .....	12
4.4.3	Sediment Pathway.....	13
•	Sediment is not a pathway of concern for the Demo Range.....	13
4.4.4	Surface Water Pathway.....	13
4.4.5	Groundwater Pathway.....	13
4.4.6	Air Pathway .....	13
<b>5.0</b>	<b>CONCEPTUAL SITE MODEL – BURN PIT .....</b>	<b>14</b>
5.1	Overview.....	14
5.2	Background.....	14
5.2.1	History of use.....	14
5.2.2	Munitions and Associated MC.....	15
5.2.3	Previous MEC Finds .....	15
5.2.4	Previous MC Sample Results .....	15
5.2.5	Current and Future Land Use.....	15
5.2.6	Ecological Receptors .....	15
5.3	MEC Evaluation.....	15
5.3.1	MEC Evaluation/Investigation Needed .....	15
5.4	MC Evaluation.....	15
5.4.1	Overview of Pathways .....	15
5.4.2	Terrestrial Pathway .....	16
5.4.3	Sediment Pathway.....	17
5.4.4	Surface Water.....	17
5.4.5	Groundwater Pathway.....	17
5.4.6	Air Pathway .....	17
<b>6.0</b>	<b>CONCEPTUAL SITE MODEL – POSSIBLE SMALL ARMS RANGE .....</b>	<b>18</b>
6.1	Overview.....	18
6.2	Background.....	18
6.2.1	History of use.....	18
6.2.2	Munitions and Associated MC.....	19
6.2.3	Previous MEC Finds .....	19
6.2.4	Previous MC Sample Results .....	19
6.2.5	Current and Future Land Use.....	19
6.2.6	Ecological Receptors .....	19
6.3	MEC Evaluation.....	19
6.3.1	MEC Evaluation/Investigation Needed .....	19
6.4	MC Evaluation.....	19
6.4.1	Overview of Pathways .....	20
6.4.2	Terrestrial Pathway .....	20
6.4.3	Sediment Pathway.....	21
6.4.4	Surface Water Pathway.....	21
6.4.5	Groundwater Pathway.....	21
6.4.6	Air Pathway .....	21

<b>7.0</b>	<b>MC EVALUATION/INVESTIGATION NEEDED .....</b>	<b>22</b>
7.1	CSM Summary/Data Gaps.....	22
<b>8.0</b>	<b>PROPOSED SAMPLING SCHEME.....</b>	<b>23</b>
8.1	Proposed Field Investigation.....	23
8.2	Reconnaissance.....	23
8.3	Soils.....	23
8.4	Sediment, Groundwater, and Surface Water.....	23
8.5	Analyses.....	24
8.6	Background Sampling.....	24
<b>9.0</b>	<b>TPP MEETING NOTES AND DATA QUALITY OBJECTIVES .....</b>	<b>25</b>
9.1	Technical Project Planning and Development of Data Quality Objectives.....	25
9.2	TPP Phases.....	25
<b>10.0</b>	<b>DATA QUALITY OBJECTIVES .....</b>	<b>29</b>
10.1	Next Steps.....	30
<b>11.0</b>	<b>REFERENCES.....</b>	<b>31</b>
	<b>FIGURES.....</b>	<b>32</b>
	<b>TABLES.....</b>	<b>33</b>
	<b>DRAFT WORKSHEETS.....</b>	<b>34</b>

## ABBREVIATIONS AND ACRONYMS

°F	degrees Fahrenheit
AOC	area of concern
ASR	Archives Search Report
bgs	below ground surface
CSM	Conceptual Site Model
DQO	Data Quality Objective
FS	Feasibility Study
FUDS	Formerly Used Defense Site
HRS	Hazard Ranking System
INPR	Inventory Project Report
lb	pound
MC	munitions constituents
MEC	munitions and explosives of concern
mm	millimeter
MRSPP	Munitions Response Site Prioritization Protocol
NBEC	nitrogen-based explosive compound
NDAI	No Department of Defense Action Indicated
PA/SI	Preliminary Assessment/Site Inspection
PETN	pentaerythritol tetranitrate
Shaw	Shaw Environmental, Inc.
SI	Site Inspection
SQL	sample quantitation limit
SSWP	Site-Specific Work Plan
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
WDOE	Washington Department of Ecology

### **List of Figures**

Figure 1	Site Location
Figure 2	Groundwater Wells Within 4-Mile Radius
Figure 3	Site Layout
Figure 4	Demo Range and Burn Pit
Figure 5	Conceptual Site Model Open Burning/Open Detonation Pit
Figure 6	Conceptual Site Model Small Arms Range

### **List of Tables**

Table 1	Army Checklist for Important Ecological Places
Table 2	Munitions Information
Table 3	MEC and MC Exposure Pathway Analysis
Table 4	Proposed Sampling Approach
Table 5	Human Health Screening Criteria for Soil/Sediment at Washington Sites
Table 6	Human Health Screening Criteria for Groundwater at Washington Sites
Table 7	Human Health Screening Criteria for Surface Water at Washington Sites

### **Draft Worksheets**

Site Information Worksheet  
MRSPP Data Gaps  
HRS Data Gaps

**Site:** Former 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 the Washington Department of Ecology Office, Lacey, Washington**
  - **Introductions**
  - **Review Site Inspection Objectives**
    - **Goals, Objectives, and Roles & Responsibilities**
    - **Site Inspection Process**
    - **Technical Project Planning (TPP) Process**
    - **Review of Background Information**
  - **Technical Project Planning Discussion**
- **Public Meeting (evening) at Fort Wordon State Park**





## 1.0 Administrative Information

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

The TPP Meeting for the former Fort Townsend will be conducted on May 1, 2007, at the Washington Department of Ecology office located in Lacey, Washington. Representatives from the U.S. Army Corps of Engineers (USACE) – Omaha Design Center and Seattle District, the Washington Department of Ecology (WDOE), Washington State Parks Department (State Parks), and Shaw Environmental, Inc. (Shaw) will be in attendance. A site tour will not be conducted as part of this meeting. By agreement with the USACE, the public and landowners (other than State Parks) will not be present at this meeting. A separate public meeting will be held in the evening on the same day at Fort Warden State Park.

The TPP Memorandum documents discussions for 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.**

## 2.0 *Site Inspection Objectives*

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### 2.1 *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.

### 2.2 *Objectives*

- Determine if the site requires further response action under CERCLA 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 (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 Time-Critical Removal Action or Non-Time Critical 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.

### 2.3 *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.

## 2.4 *Site Inspection Process*

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

## 2.5 *Technical Project Planning Process*

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

\* Second TPP Meeting to be determined by team members during the first TPP Meeting.

### 3.0 Background Information

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

#### 3.1 Site Name and Location

The former Fort Townsend, identification number F10WA032201, is located approximately four miles south of Port Townsend, Washington in Jefferson County, Washington (Figure 1, “Site Location”).

#### 3.2 Range Inventory

The former Fort Townsend is included in the Military Munitions Response Program Inventory in the *Defense Environmental Programs Fiscal Year 2005 Annual Report to Congress* (DoD, 2005) with range information as follows:

<b>Range Name</b>	<b>Federal Facility Identification</b>	<b>Range Total Acres</b>
Fort Townsend	F10WA0322	614.75

The ASR (USACE, 2005) indicates the area of the Formerly Used Defense Site (FUDS) site is 614.75 acres and the area of the ranges 23.37 acres.

Range areas and coordinates are listed in the Inventory Project Report (INPR) Supplement (USACE, 2004) as follows:

<b>Range Name</b>	<b>Range Identification</b>	<b>Approximate Area (acres)</b>	<b>UTM Coordinates (meters)</b>
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.

### **3.3 Property History**

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

#### **3.3.1 Historical Military Use**

- Fort Townsend was originally built to protect settlers on the Olympic Peninsula from hostile northern Indians, with troops stationed there from 1857 to 1861, but were then withdrawn for service in the Civil War. Fort Townsend was acquired by the War Department on January 29, 1859 by Executive Order. 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 grainery, a sawmill, and a post traders. The southeastern portion of the Fort was used for pasture.
- A fire destroyed the barracks and the fort was under caretaker status from 1895 to 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.
- Also 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 on site.

#### **3.3.2 Munitions Information**

- The MEC used 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.

### **3.3.3 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 post Department of Defense (DoD) use were:
  - Built in 1857
  - Acquired by War Department January 29, 1859 by Executive Order
  - Property briefly turned over to DOI 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 five-year term)
  - 1945 Navy requested to use the landing field
  - War Assets Administration assumed accountability of the southwestern 245.75 acres on October 22, 1946.
  - 1947 this was conveyed to Jefferson County for an airport, which operated until 1959. In 1959, The Port of Port Townsend took over operations.
- 1958 Washington State Parks and Recreation Commission purchased the northeastern portion for Old Fort Townsend State Park.

## **Physical Setting**

### **3.3.4 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 (National Oceanic and Atmospheric Administration, “Climate of Washington”, June 1982).

### **3.3.5 Surface Water**

- There are no streams or ponds located on the former Fort Townsend.
- The only surface water located on the site is the Pacific Ocean running along the north/east edge of the site. shoreline (National Oceanic and Atmospheric Administration, “Climate of Washington,” June 1982).

### **3.3.6 Sensitive Environments**

- Only one species, the bald eagle, has been identified on or near the former Fort Townsend site (per 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.

### **3.3.7 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 (°F) near the water to 70°F or 75°F inland. In January, maximum temperatures are in the 40s and minimums in the 30s. The average annual precipitation is 18 inches per year.

## **Geologic and Hydrogeologic Setting**

### **3.3.8 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.

### **3.3.9 Overburden Soils**

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

### **3.3.10 Hydrogeology**

- There are a couple of wells on the site which indicate the water table between 100 feet and 175 feet.

## **3.4 Population and Land Use**

### **3.4.1 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 four miles south) 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.

### ***3.4.2 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.

### ***3.4.3 Area Water Supply***

- Groundwater is used for domestic drinking water, irrigation, and industrial purposes.
- Domestic wells are located within 4 miles of the site (Figure 2, “Groundwater Wells Within 4-Mile Radius”).

### ***3.5 Previous Investigations for MC and MEC***

- Figure 3, “Site Layout,” presents a layout of the former Fort Townsend. Figure 4, “Demo Range and Burn Pit” present a layout of the two 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.

## 4.0 *Conceptual Site Model – Demo Range*

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### 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*

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

#### 4.2.1 *History of use*

- According to an interview with a person stationed at the former Fort Townsend (1944 to 1946), excess munitions were disposed of in detonation pits located on the beach. Recalled participating in 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 supposedly disposed of by detonation.
- Used from 1944 to 1946.
- Located on the beach.

- 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 5, “Conceptual Site Model Open Burning/Open Detonation Pit,” illustrates the conceptual site model for the Demo Range at the former Fort Townsend.

#### 4.2.2 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	Steel (chromium, iron, copper, lead, manganese, and nickel), 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)

#### 4.2.3 Previous MEC Finds

- 1800s era rifle and pistol brass
- No other 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

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

#### 4.2.6 *Ecological Receptors*

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

#### 4.3 *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 1800s 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.

##### 4.3.1 *MEC Evaluation/Investigation Needed*

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

#### 4.4 *MC Evaluation*

- Metals from small arms and munitions debris.
- Propellants (nitrocellulose and/or nitroglycerin).
- Explosives from detonation of munitions.
- Figure 5 illustrates the conceptual site model 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.

##### 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, munitions debris, or explosives and possibly MC in the soil 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.

#### *4.4.2 Terrestrial Pathway*

##### *4.4.2.1 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, black powder, aluminum, and lead.

##### *4.4.2.2 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.

##### *4.4.2.3 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.

##### *4.4.2.4 Human Receptors*

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

##### *4.4.2.5 Ecological Assessment*

- Site has been determined to be an IEP based on potential for threatened and endangered (T&E) to use the property.
- The potential T&E species are listed in Section 3.3.6.
- The pathway for ecological receptors is complete.

#### *4.4.3 Sediment Pathway*

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

#### *4.4.4 Surface Water Pathway*

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

#### *4.4.5 Groundwater Pathway*

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

#### *4.4.6 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.

## 5.0 *Conceptual Site Model – Burn Pit*

---

### 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*

- 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.

#### 5.2.1 *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 1800s), 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 5, “Conceptual Site Model Open Burning/Open Detonation Pit,” illustrates the conceptual site model for the Burn Pit at the former Fort Townsend.

### 5.2.2 Munitions and Associated MC

Area of Concern	Munitions	Munitions Constituents
Burn Pit	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

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

### 5.2.6 Ecological Receptors

- This FUDS does qualify as an IEPS 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

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

### 5.3.1 MEC Evaluation/Investigation Needed

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

## 5.4 MC Evaluation

- Lead. Only small arms were found at this site.
- Figure 5 illustrates the conceptual site model 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.

### 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 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.

## *5.4.2 Terrestrial Pathway*

### *5.4.2.1 Sources of MC*

- MC from small arms could include lead.

### *5.4.2.2 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.

### *5.4.2.3 Land Use and Access*

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

### *5.4.2.4 Human Receptors*

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

### *5.4.2.5 Ecological Assessment*

- Site has been determined to be an IEP based on potential for threatened and endangered (T&E) to use the property.
- The potential T&E species are listed in Section 3.3.6.
- The pathway for ecological receptors is complete.

#### *5.4.3 Sediment Pathway*

- Sediment is not a pathway of concern.

#### *5.4.4 Surface Water*

- Surface water is not a pathway of concern.

#### *5.4.5 Groundwater Pathway*

- Groundwater is not a pathway of concern.

#### *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 *Conceptual Site Model – Possible Small Arms Range*

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### 6.1 *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.

### 6.2 *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.

#### 6.2.1 *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 6, “Conceptual Site Model Small Arms Range,” illustrates the conceptual site model for the Possible Small Arms Range at the former Fort Townsend.

## 6.2.2 Munitions and Associated MC

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

### 6.2.3 Previous MEC Finds

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

### 6.2.4 Previous MC Sample Results

- No MC was sampled.

### 6.2.5 Current and Future Land Use

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

### 6.2.6 Ecological Receptors

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

## 6.3 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.

### 6.3.1 MEC Evaluation/Investigation Needed

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

## 6.4 MC Evaluation

- Lead.
- Figure 6 illustrates the conceptual site model 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.

#### *6.4.1 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.

#### *6.4.2 Terrestrial Pathway*

##### *6.4.2.1 Sources of MC*

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

##### *6.4.2.2 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.

##### *6.4.2.3 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.

#### *6.4.2.4 Human Receptors*

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

#### *6.4.2.5 Ecological Assessment*

- Site has been determined to be an IEP based on potential for threatened and endangered (T&E) to use the property.
- The potential T&E species are listed in Section 3.3.6.
- The pathway for ecological receptors is complete.

#### *6.4.3 Sediment Pathway*

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

#### *6.4.4 Surface Water Pathway*

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

#### *6.4.5 Groundwater Pathway*

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

#### *6.4.6 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.

## 7.0 MC Evaluation/Investigation Needed

- One surface soil (beach) sample will be collected from the Demo Range. The sample would be analyzed for select metals (chromium, iron, copper, lead, manganese, and nickel) and explosives (including nitroglycerin and pentaerythritol tetranitrate [PETN]).
- One surface soil sample will be collected from the Burn Pit. The sample would be analyzed for lead only.
- One contingent surface soil sample will be collected at the Possible Small Arms Range if MEC is found during visual reconnaissance. The sample would be analyzed for lead only.
- Three background surface soil samples and three background beach samples will be collected. The samples would be analyzed for target analyte metals (aluminum, chromium, iron, copper, lead, manganese, and nickel).
- 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. .

### 7.1 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.
Sediment	unknown	unknown incomplete pathway	Sediment samples will not be collected
Surface water	unknown	unknown incomplete pathway	Surface water samples will not be collected.
Groundwater	unknown	unknown	Groundwater samples will not be collected.
Air	unknown	unknown	None

## **8.0 Proposed Sampling Scheme**

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### **8.1 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 Site-Specific Work Plan (SSWP) that will be submitted to Washington State 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 U.S. Army Corps of Engineers (USACE) as final in February 2006.

### **8.2 Reconnaissance**

A visual field reconnaissance survey by a trained unexploded ordnance (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 munitions and explosives of concern (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* 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.

### **8.3 Soils**

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

One surface soil sample will be collected from the Burn Pit. The sample would be analyzed for lead only.

One contingent surface soil sample will be collected at the Possible Small Arms Range, if MEC is found during visual reconnaissance. The sample would be analyzed for lead only.

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

### **8.4 Sediment, Groundwater, and Surface Water**

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

## **8.5    *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).

## **8.6    *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 Target Analyte List metals.

## 9.0 *TPP Meeting Notes and Data Quality Objectives*

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### 9.1 *Technical Project Planning and Development of Data Quality Objectives*

- The U.S. Army Corps of Engineers (USACE) Technical Project Planning (TPP) process is a four-phase process:
  - Identify the current project,
  - Determine data needs,
  - Develop data collection options, and
  - Finalize data collection program.
- The purpose of TPP is to develop data quality objectives (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.

### 9.2 *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 State Department of Ecology, and the leaseholders.

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

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?**

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 State 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?**

**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?**

### **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?**

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?**

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 Conceptual Site Model (CSM)?**

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?**
- **What is the nature of needed data?**
- **What data gaps would additional data meet for making a decision about the site?**
- **Are there any considerations/constraints that need to be addressed for collecting additional data?**

### **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 background sample locations (ten total) 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?**

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

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

#### **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?

Are background data sets available from previous site studies?

Are background data sets available from statewide studies?

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

Soil

##### **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?**

##### **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 Important Ecological Place (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?

Is the site managed for ecological purposes?

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?**

#### 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?**

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

## 10.0 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 = Remedial Investigation/Feasibility Study (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.

**10.1 Next Steps**

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

## 11.0 References

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Interstate Technical and Regulatory Council, 2003, *Characterization and Remediation of Soils at Closed Small Arms Firing Ranges*

Shaw Environmental, Inc. (Shaw), 2006, *Type I Work Plan, Site Inspections of Multiple Sites*.

U.S. Army Corps of Engineers (USACE), 2005, *Archives Search Report (ASR) for the former Fort Townsend, Port Townsend, Washington*, Project No. F10WA032201, April.

U.S. Army Corps of Engineers (USACE), 2004, *INPR Supplement, former Fort Townsend*, November.

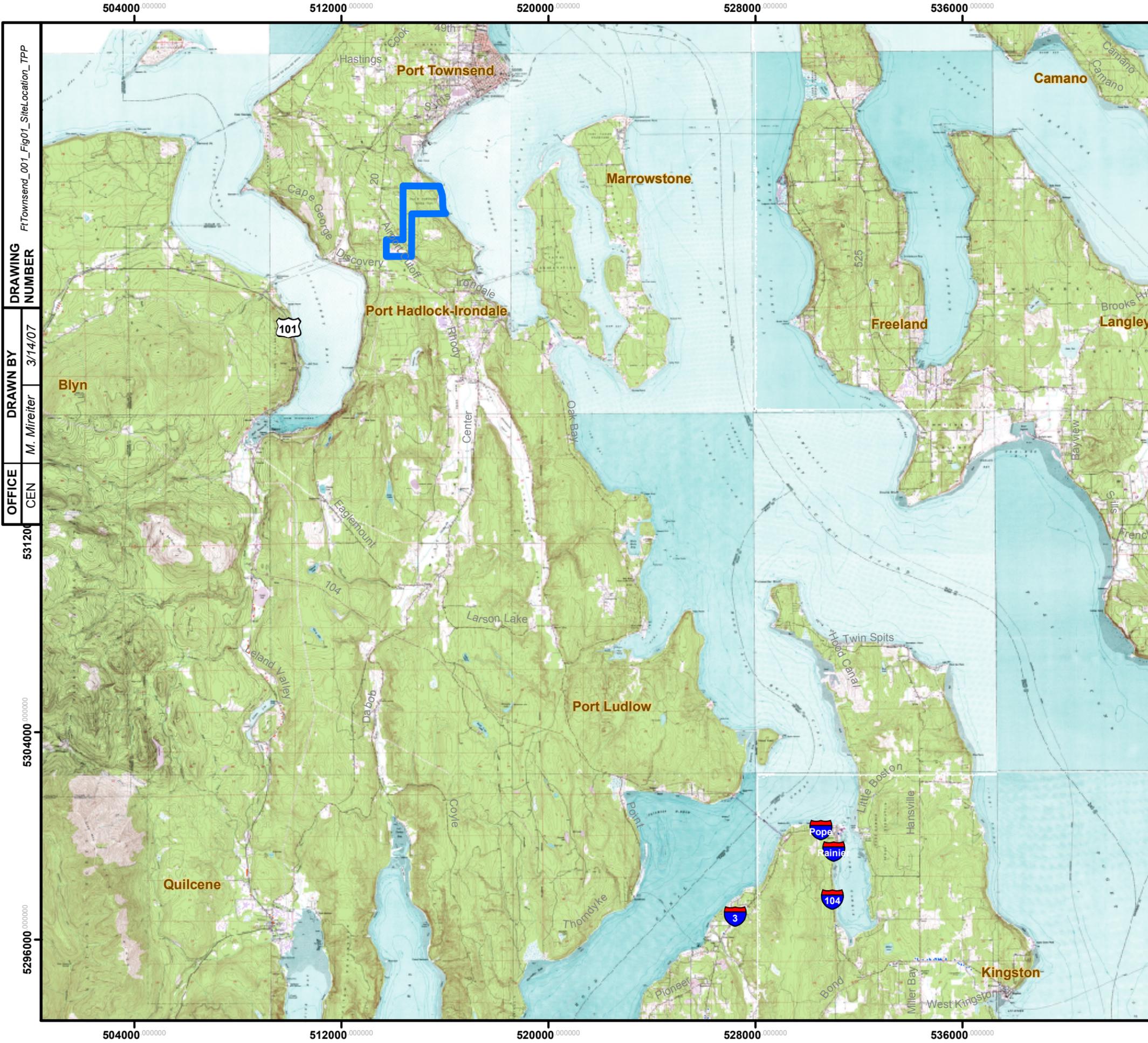
U.S. Census Bureau, Population Estimates, [www.census.gov](http://www.census.gov).

U.S. Department of Defense (DoD), 2005, *Defense Environmental Programs Fiscal Year 2005 annual Report to Congress*.

# *Figures*

*Site Inspection  
former Fort Townsend*

*Technical Project Planning Meeting  
May 1, 2007*

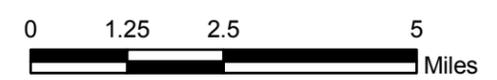


DRAWING NUMBER: FtTownsend\_001\_Fig01\_SiteLocation\_TPP  
 DRAWN BY: M. Mireiter  
 DATE: 3/14/07  
 OFFICE: CEN  
 PROJECT NUMBER: 531200

**Legend**

 Fort Townsend FUDS Boundary

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

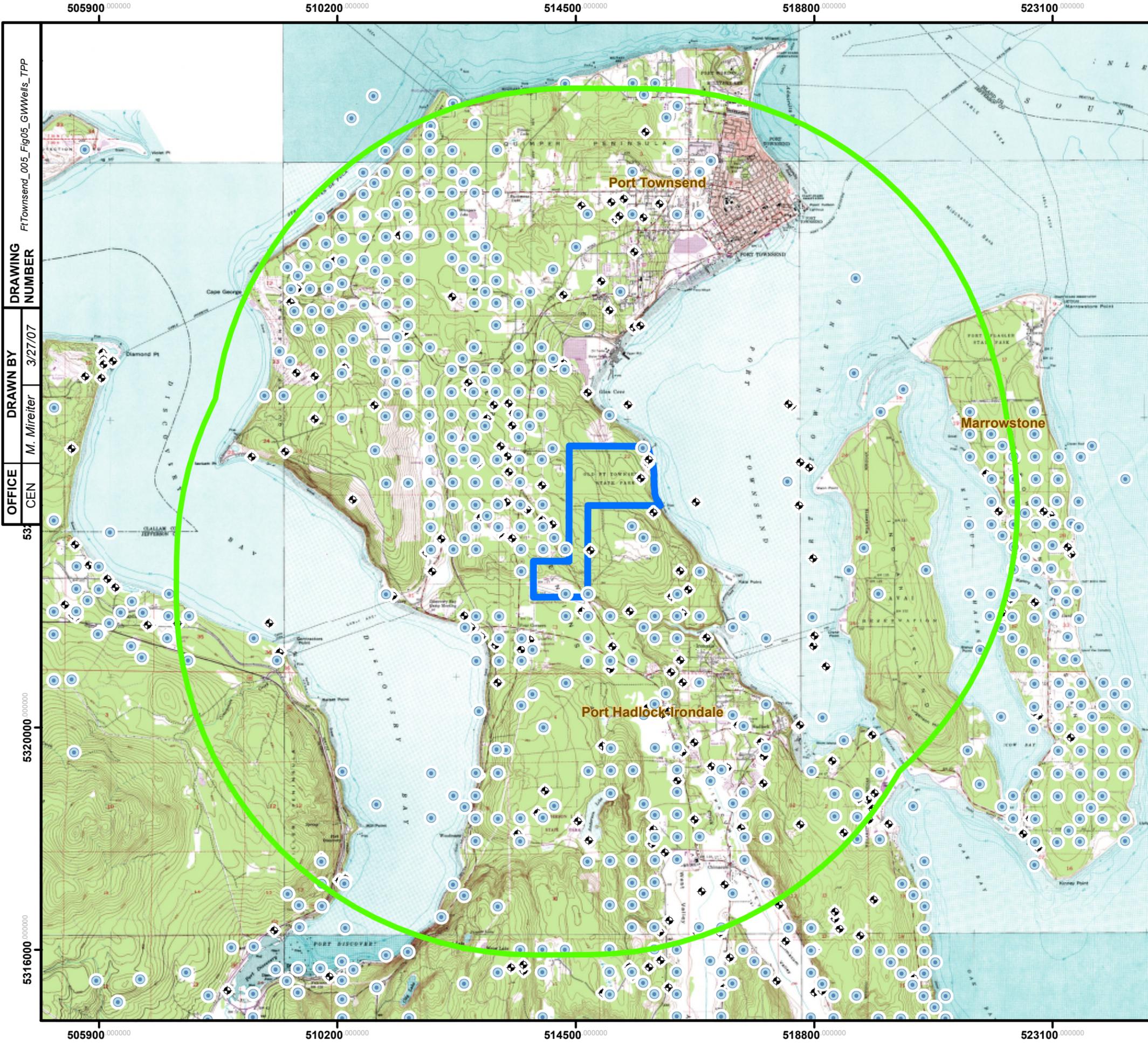


REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

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**FIGURE 1**  
**SITE LOCATION**  
 FORT TOWNSEND

 Shaw Environmental, Inc.



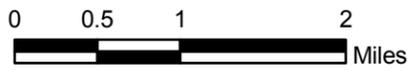
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 DRAWN BY: M. Mireiter  
 DATE: 3/27/07  
 OFFICE: CEN  
 NUMBER: 5316000

**Legend**

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

**NOTES:**

- 1) FUDS boundary was derived from the Fort Townsend ASR Supplement.
- 2) Groundwater well information obtained from the US Geological Survey and the State of Washington, Department of Ecology.
- 3) Topo map (Jefferson County) obtained from the U.S. Department of Agriculture, Service Center Agencies, 1999.

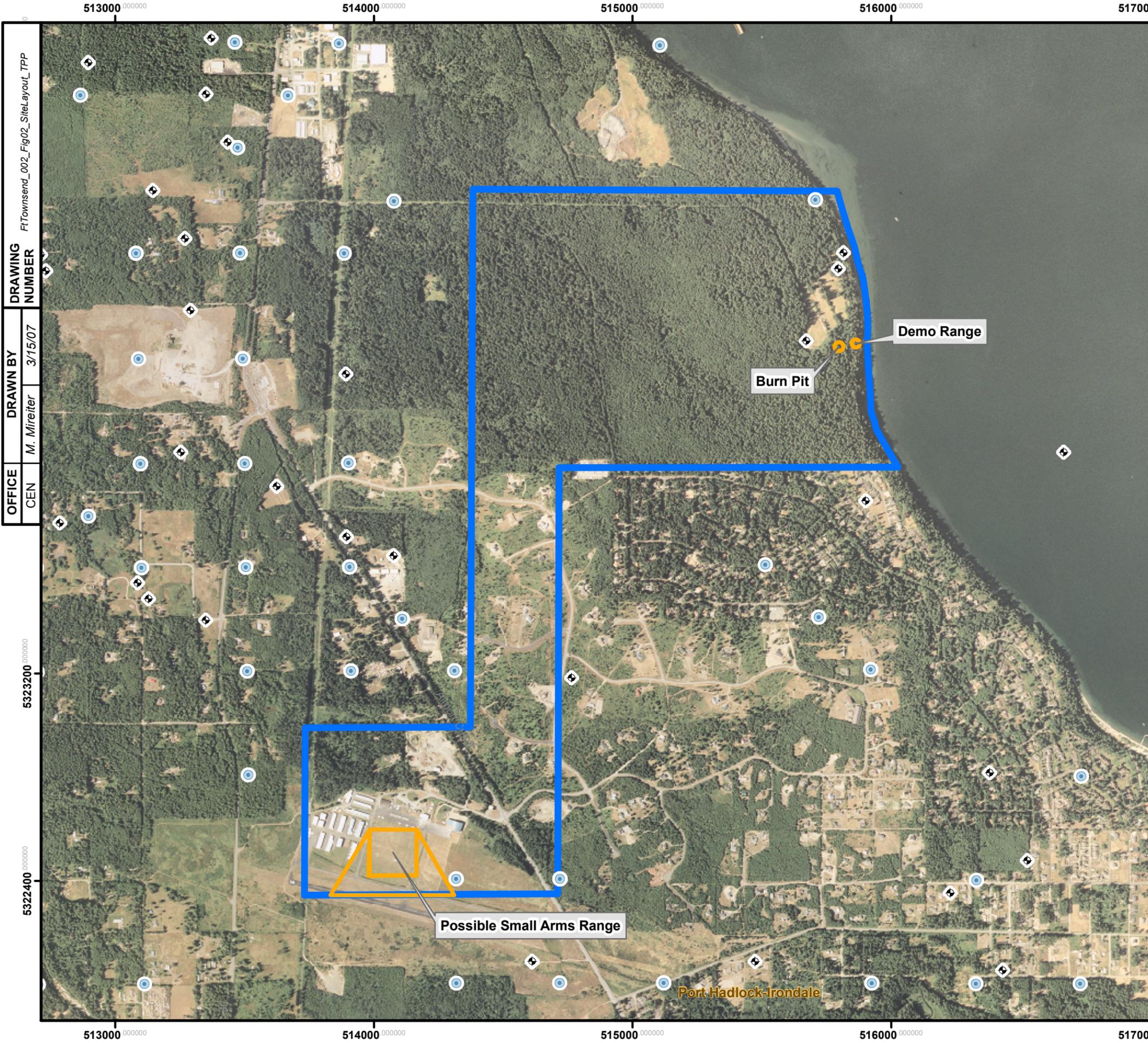
REFERENCE/PROJECTION: NAD 83 UTM Zone 10N



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**FIGURE 2**  
**GROUNDWATER WELLS**  
**WITHIN 4-MILE RADIUS**  
**FORT TOWNSEND**

Shaw Environmental, Inc.



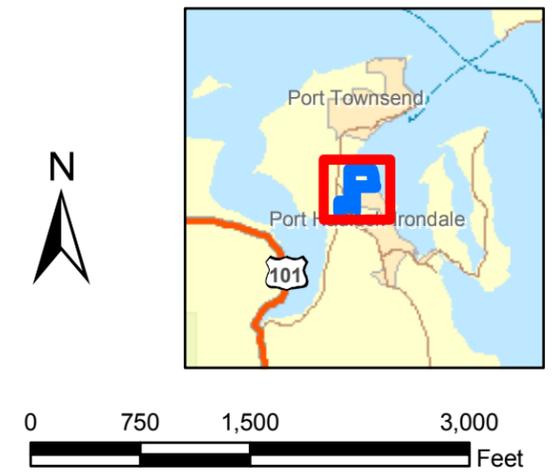
Ft Townsend\_002\_Fig02\_SiteLayout\_TPP  
 DRAWING NUMBER  
 DRAWN BY M. Mireiter 3/15/07  
 OFFICE CEN

**Legend**

- Fort Townsend FUDS Boundary
- Ranges Identified in the MMRP Range Inventory
- Groundwater Supply Well
- ◆ USGS Monitoring Well

**NOTES:**

- 1) FUDS boundary and range boundaries were derived from the Fort Townsend ASR Supplement.
- 2) Groundwater well information obtained from the US Geological Survey and the State of Washington, Department of Ecology.
- 3) Aerial photo (Jefferson County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

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**FIGURE 3**  
**SITE LAYOUT**  
 FORT TOWNSEND

Shaw Environmental, Inc.

515600 000000 515700 000000 515800 000000 515900 000000 516000 000000



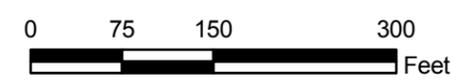
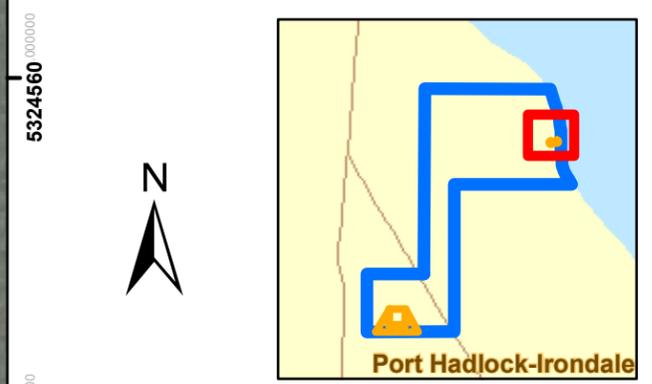
Ft Townsend\_003\_Fig03\_DemoRng\_BPit\_TPP  
**DRAWING NUMBER**  
**DRAWN BY** M. Mireiter 3/15/07  
**OFFICE** CEN

**Legend**

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

**NOTES:**

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



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

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**FIGURE 4**  
**DEMO RANGE AND BURN PIT**  
FORT TOWNSEND

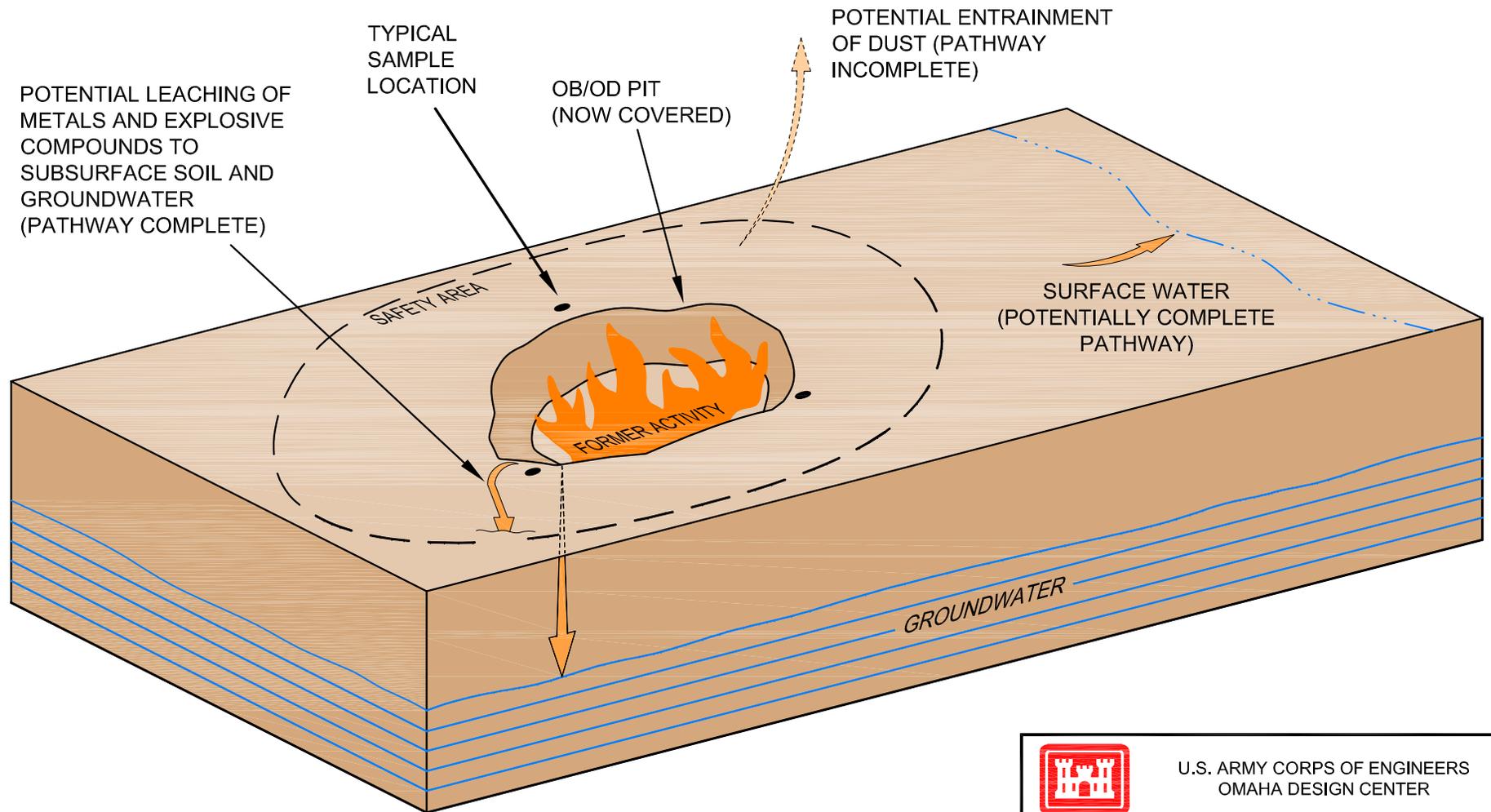
Shaw Environmental, Inc.

515600 000000 515700 000000 515800 000000 515900 000000 516000 000000

5324470 000000  
 5324650 000000  
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 5324380 000000

OFFICE	DRAWN BY	DRAWING NUMBER	116188SJ-A86
SJ	K. Black	04/26/07	



**RECEPTORS:**

- Landowners
- Biota (wildlife)

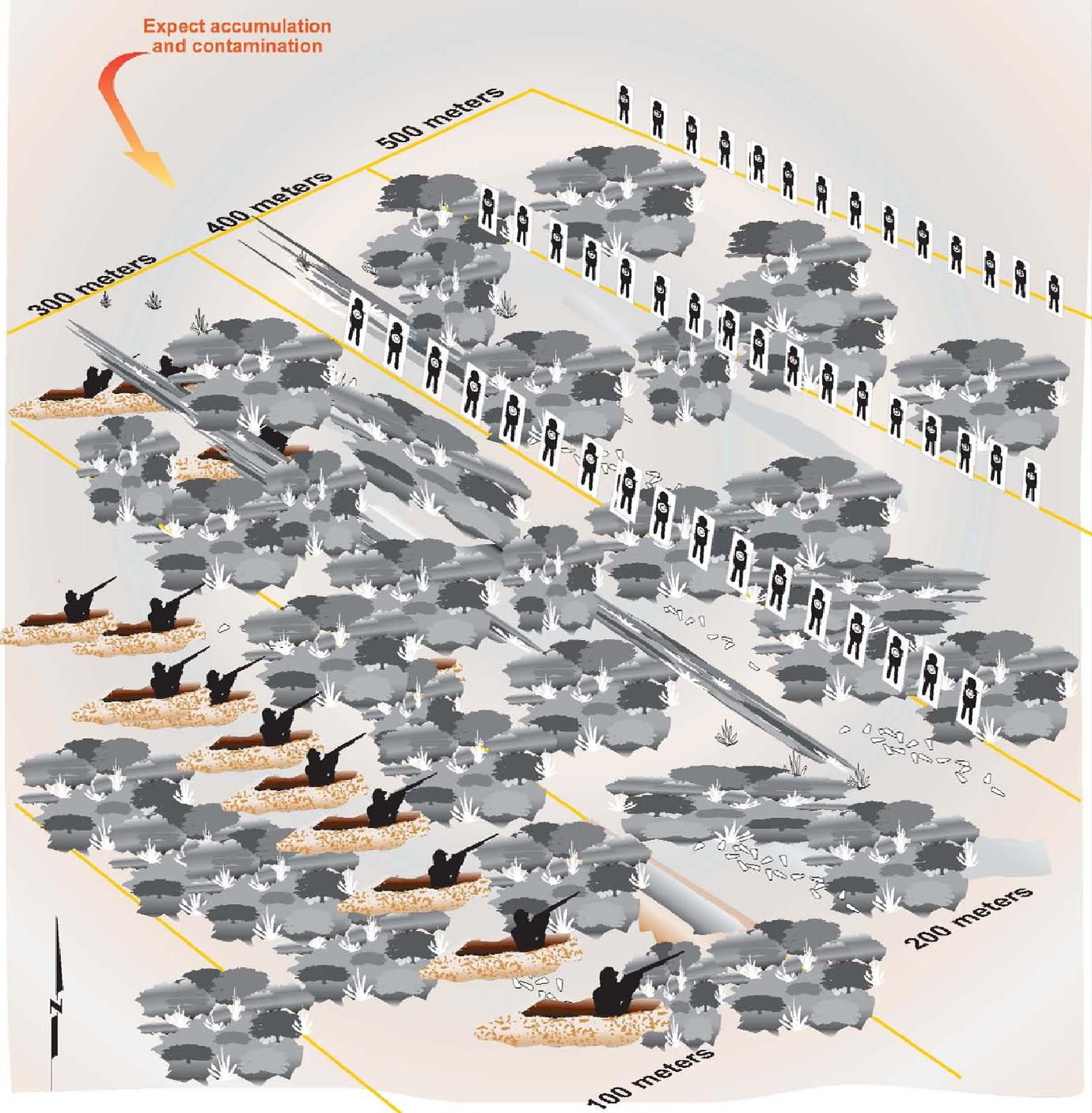


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FIGURE 5  
CONCEPTUAL SITE MODEL  
OPEN BURNING/OPEN DETONATION PIT  
FORMER FORT TOWNSEND



OFFICE	DRAWN BY	DRAWING NUMBER
SJ	K. Black	116188SJ-A85
		04/26/07



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FIGURE 6  
CONCEPTUAL SITE MODEL  
SMALL ARMS RANGE  
FORMER FORT TOWNSEND



# *Tables*

*Site Inspection  
former Fort Townsend*

*Technical Project Planning Meeting  
May 1, 2007*

**Table 1**  
**Army Checklist for Important Ecological Places <sup>a</sup>**  
**Former Fort Townsend, Port Townsend, Washington**

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

**Table 1 (Cont.)**

		Yes / No	Comments
23	Habitat known to be used by state designated endangered or threatened species	<input checked="" type="checkbox"/> / <input type="checkbox"/>	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	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
25	Coastal Barrier (partially developed)	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
26	Federally designated Scenic or Wild River	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
27	State land designated for wildlife or game management	<input checked="" type="checkbox"/> / <input type="checkbox"/>	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	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
29	State-designated Natural Areas	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
30	Particular areas, relatively small in size, important to maintenance of unique biotic communities	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
31	State-designated areas for protection or maintenance of aquatic life	<input checked="" type="checkbox"/> / <input type="checkbox"/>	Portion of Site is State Park, and Washington State Parks and Recreation Commission has statutory responsibility to conserve Washington's seashore.
32	Wetlands	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
33	Fragile landscapes, land sensitive to degradation if vegetative habitat or cover diminishes	<input type="checkbox"/> / <input checked="" type="checkbox"/>	

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

Table 2  
Munitions Information  
Former Fort Townsend, Port Townsend, Washington

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)	Torpedoe, 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 <sup>1</sup>  1800s era rifle and pistol (45-70) brass <sup>2</sup>		<sup>1</sup> Pg 8, a) 6) ASR: Interview with Doug Bassett regarding detonation pits on beach. Also in INPR Supplement.  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). <sup>2</sup> Found along the trails that run along the top of the cliff pg 11 ASR).

Table 2  
Munitions Information  
Former Fort Townsend, Port Townsend, Washington

Range Areas	Munitions ID	Munitions	Associated MC	Comments
Burn Pit	Small Arms (CTT01)	Small Arms, General	Black Powder Filler Table 7-1 pg 12 ASR) and lead.	<p>Possible ordnanace items used at Fort Townsend. Common models that existed used during WW II include 45-70 and 30-06 (pg 12 ASR)</p> <p>Black Powder is made up of 75% potassium nitrate (salt peter, niter), 10% sulfur, and 15% charcoal</p> <p>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).</p>
	Demolition Materials (CTT37)	Explosives, TNT	Black Powder	
	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)	Other		

Table 2  
Munitions Information  
Former Fort Townsend, Port Townsend, Washington

Possible Small Arms Range (Used 1930-1947? Near present day landing field. No documentation verifying existence) pg 7 ASR	Demolition Materials (CTT37)	Explosives, 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,	
	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.	<b>Surface Soil</b> <ul style="list-style-type: none"> <li>MEC (unexploded munitions) are a hazard.</li> <li>MEC (unexploded munitions) reported to be detonated in detonation pits on beach.</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Vehicle and foot traffic</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Vehicle and foot traffic</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Foot traffic</li> </ul>	<ul style="list-style-type: none"> <li>MEC has not been found.</li> </ul>	<ul style="list-style-type: none"> <li>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.</li> </ul>
	MC	MC in the form of metals from small arms and munitions debris,  MC from explosives in detonation pit.  MC from propellants.	<b>Surface Soil</b> <ul style="list-style-type: none"> <li>Potentially affected media</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: Inhalation Ingestion Dermal contact	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: Inhalation Ingestion Dermal contact	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: Inhalation Ingestion Dermal contact	<ul style="list-style-type: none"> <li>Metals and explosives data needed.</li> </ul>	<ul style="list-style-type: none"> <li>One beach sample will be collected and analyzed for metals (chromium, copper, iron, lead, manganese, and nickel) and explosives (including nitroglycerin and PETN).</li> </ul>
			<b>Sediment/Surface Water</b> <ul style="list-style-type: none"> <li>Not an affected media.</li> </ul>	<ul style="list-style-type: none"> <li>Incomplete pathway.</li> </ul>	<ul style="list-style-type: none"> <li>Incomplete pathway.</li> </ul>	<ul style="list-style-type: none"> <li>Incomplete pathway.</li> </ul>	<ul style="list-style-type: none"> <li>Not Applicable.</li> </ul>	<ul style="list-style-type: none"> <li>No surface water samples or sediment samples will be collected.</li> </ul>
			<b>Groundwater</b> <ul style="list-style-type: none"> <li>Not an affected media under current land use.</li> </ul>	<ul style="list-style-type: none"> <li>- Incomplete pathway.</li> </ul>	<ul style="list-style-type: none"> <li>Incomplete pathway.</li> </ul>	<ul style="list-style-type: none"> <li>Incomplete pathway.</li> </ul>	<ul style="list-style-type: none"> <li>Not Applicable.</li> </ul>	<ul style="list-style-type: none"> <li>No groundwater samples will be collected</li> </ul>
			<b>Air</b> <ul style="list-style-type: none"> <li>Potentially affected media due to blowing soil.</li> </ul>	Potentially complete Pathway  Exposure routes: Inhalation	Potentially complete Pathway  Exposure routes: Inhalation	Potentially complete Pathway  Exposure routes: Inhalation	<ul style="list-style-type: none"> <li>Not Applicable.</li> </ul>	Will use soil analytical data in risk screening

**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)		
Burn Pit	MEC	MEC in the form of small arms ammunition.	<b>Surface Soil</b> <ul style="list-style-type: none"> <li>MEC (ammunition) is a hazard.</li> <li>MEC (small arms brass) reported to be in burn pit.</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Vehicle and foot traffic</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Vehicle and foot traffic</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Foot traffic</li> </ul>	<ul style="list-style-type: none"> <li>MEC has not been found.</li> </ul>	<ul style="list-style-type: none"> <li>A field reconnaissance survey by a trained, unexploded ordnance (UXO) technician of the burn pit to assess the presence or absence of munitions and explosives of concern (MEC) and to document the current site conditions.</li> </ul>
	MC	MC in the form of metals from small arms and munitions debris,  MC from explosives in detonation pit.  MC from propellants.	<b>Surface Soil</b> <ul style="list-style-type: none"> <li>Potentially affected media</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: Inhalation Ingestion Dermal contact	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: Inhalation Ingestion Dermal contact	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: Inhalation Ingestion Dermal contact	<ul style="list-style-type: none"> <li>No data available..</li> </ul>	<ul style="list-style-type: none"> <li>One surface soil sample will be collected and analyzed for lead only.</li> </ul>
			<b>Sediment/Surface Water</b> <ul style="list-style-type: none"> <li>Not an affected media.</li> </ul>	<ul style="list-style-type: none"> <li>Incomplete pathway.</li> </ul>	<ul style="list-style-type: none"> <li>Incomplete pathway.</li> </ul>	<ul style="list-style-type: none"> <li>Incomplete pathway.</li> </ul>	<ul style="list-style-type: none"> <li>Not Applicable.</li> </ul>	<ul style="list-style-type: none"> <li>No surface water samples or sediment samples will be collected.</li> </ul>
			<b>Groundwater</b> <ul style="list-style-type: none"> <li>May be an affected media.</li> </ul>	<ul style="list-style-type: none"> <li>- Potentially complete pathway.</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul>	<ul style="list-style-type: none"> <li>Not Applicable.</li> </ul>	<ul style="list-style-type: none"> <li>No groundwater samples will be collected</li> </ul>
			<b>Air</b> <ul style="list-style-type: none"> <li>Potentially affected media due to blowing soil.</li> </ul>	Potentially complete Pathway  Exposure routes: Inhalation	Potentially complete Pathway  Exposure routes: Inhalation	Potentially complete Pathway  Exposure routes: Inhalation	<ul style="list-style-type: none"> <li>Not Applicable.</li> </ul>	Will use soil analytical data in risk screening

**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)		
Possible Small Arms Range	MEC	MEC in the form of small arms ammunition.	<b>Surface Soil</b> <ul style="list-style-type: none"> <li>MEC (ammunition) is a hazard.</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Vehicle and foot traffic</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Vehicle and foot traffic</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Foot traffic</li> </ul>	<ul style="list-style-type: none"> <li>MEC has not been found.</li> <li>Location of range has not been documented.</li> </ul>	<ul style="list-style-type: none"> <li>A field reconnaissance survey by a trained, unexploded ordnance (UXO) technician of the possible small arms range to assess the presence or absence of munitions and explosives of concern (MEC) and to document the current site conditions.</li> </ul>
	MC	MC in the form of metals from small arms and munitions debris.  MC from explosives in detonation pit.  MC from propellants.	<b>Surface Soil</b> <ul style="list-style-type: none"> <li>Potentially affected media</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: Inhalation Ingestion Dermal contact	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: Inhalation Ingestion Dermal contact	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: Inhalation Ingestion Dermal contact	<ul style="list-style-type: none"> <li>No data available..</li> </ul>	<ul style="list-style-type: none"> <li>One contingent surface soil sample will be collected and analyzed for lead only if the small arms range is found.</li> </ul>
			<b>Sediment/Surface Water</b> <ul style="list-style-type: none"> <li>Not an affected media.</li> </ul>	<ul style="list-style-type: none"> <li>Incomplete pathway.</li> </ul>	<ul style="list-style-type: none"> <li>Incomplete pathway.</li> </ul>	<ul style="list-style-type: none"> <li>Incomplete pathway.</li> </ul>	<ul style="list-style-type: none"> <li>Not Applicable.</li> </ul>	<ul style="list-style-type: none"> <li>No surface water samples or sediment samples will be collected.</li> </ul>
			<b>Groundwater</b> <ul style="list-style-type: none"> <li>May be an affected media.</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul>	<ul style="list-style-type: none"> <li>Not Applicable.</li> </ul>	<ul style="list-style-type: none"> <li>No groundwater samples will be collected</li> </ul>
			<b>Air</b> <ul style="list-style-type: none"> <li>Potentially affected media due to blowing soil.</li> </ul>	Potentially complete Pathway  Exposure routes: Inhalation	Potentially complete Pathway  Exposure routes: Inhalation	Potentially complete Pathway  Exposure routes: Inhalation	<ul style="list-style-type: none"> <li>Not Applicable.</li> </ul>	Will use soil analytical data in risk screening

**Table 4  
Proposed Sampling Approach  
Cold Springs Precision Bombing Range**

Area of Concern	Media	Samples					
			Select Metals	TAL Metals	Explosives	PETN	Nitroglycerin
Demo Range	Soil	1	1	0	1	1	1
	Sediment	0	0	0	0	0	0
	Surface Water	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0
Burn Pit	Soil	1	1	0	0	0	0
	Sediment	0	0	0	0	0	0
	Surface Water	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0
Possible Small Arms Range	Soil	1	1	0	0	0	0
	Sediment	0	0	0	0	0	0
	Surface Water	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0
Background	Beach	3	0	3	0	0	0
	Soil	3	0	3	0	0	0
	Sediment	0	0	0	0	0	0
	Surface Water	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0
		<b>Totals</b>	<b>3</b>	<b>6</b>	<b>1</b>	<b>1</b>	<b>1</b>
<b>QC Required Samples</b>	<b>Media</b>	<b>Samples</b>	<b>Select Metals</b>	<b>TAL Metals</b>	<b>Explosives</b>	<b>PETN</b>	<b>Nitroglycerin</b>
Duplicate	Soil	1	1	1	1	1	1
	Sediment	0	0	0	0	0	0
	Surface Water	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0
		<b>Totals</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>
MS/MSD	Soil	1	1	1	1	1	1
	Sediment	0	0	0	0	0	0
	Surface Water	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0
		<b>Totals</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>

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 are chromium, copper, iron, lead, manganese, and nickel.

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**  
**Former Fort Townsend**

Analyte	USEPA Region 9 <sup>a</sup>		Washington Department of Ecology - Soil Cleanup Levels <sup>b</sup>					Final Screening Value <sup>h</sup> (mg/kg)
	Residential PRGs (mg/kg)	Industrial PRGs (mg/kg)	Method B Level - Unrestricted <sup>c</sup> (mg/kg)	Leaching - Phase 3 Model - Unrestricted <sup>d</sup> (mg/kg)	Method B Level - Industrial <sup>e</sup> (mg/kg)	Leaching - Phase 3 Model - Industrial <sup>f</sup> (mg/kg)	Natural Background Level <sup>g</sup> (mg/kg)	
<b>Explosives</b>								
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 <sup>1</sup>	0.72	2.5	NVA	NVA	NVA	NVA	NA	0.72
2,6-Dinitrotoluene <sup>1</sup>	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
Pentaerylritol tetranitrate	NVA	NVA	NVA	NVA	NVA	NVA	NA	0.5 <sup>j</sup>
<b>Metals</b>								
Aluminum	76,000	100,000	NVA	NVA	NVA	NVA	32,600	76,000
Chromium (Total)	210	450	NVA	NVA	NVA	NVA	48	210
Copper	3,100	41,000	NVA	NVA	NVA	NVA	36	3,100
Iron	23,000	100,000	NVA	NVA	NVA	NVA	58,700	23,000
Lead	400	800	NVA	3,000	NVA	3,000	24	400
Manganese	1,800	19,000	NVA	NVA	NVA	NVA	1,200	1,800
Molybdenum	390	5,100	NVA	NVA	NVA	NVA	NVA	390
Nickel	1,600	20,000	NVA	NVA	NVA	NVA	48	1,600

CLARC = Cleanup Level and Risk Calculation  
WAC = Washinton Administrative Code  
NVA = no value available  
mg/kg = milligrams per kilogram.

C = Value for carcinogen  
N = Value for noncarcinogen  
NA = not applicable, compound considered not present in natural soils  
USEPA = U.S. Environmental Protection Agency

**Table 5**  
**Human Health Soil and Sediment Screening Criteria**  
**Former Fort Townsend**

<sup>a</sup> Region 9 Preliminary Remediation Goals (PRG) table; October 2004. Values are based on residential and industrial exposure to single chemicals.

<sup>b</sup> Cleanup levels are established under the Model Toxics Control Act (MCTA) Cleanup Regulation. Chapter 173-340 WAC.

<sup>c</sup> 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 Injection Plus Dermal Contact. Based on Unrestricted land use. From CLARC Notes undated on November 23, 2004

<sup>d</sup> 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.

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

<sup>f</sup> 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.

<sup>g</sup> Values from "Natural Background Soil Metals Concentrations in Washington State", Publication #94-115, October 1994. Based on data for Puget Sound.

<sup>h</sup> 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

<sup>i</sup> Carcinogenic DNT mixture values used if more conservative than noncarcinogenic isomer-specific values.

<sup>j</sup> Value is laboratory practical quantitation limit.

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

Analyte	Proposed Benchmarks										Potential Bioaccumulative Constituent? <sup>h</sup>	Final Proposed Ecological Screening Value Soil <sup>i</sup> (mg/kg)
	Washington Department of Ecology Lowest Value for Plants/ Soil Biota/Wildlife <sup>a</sup> (mg/kg)	USEPA Region 5 ESLs <sup>b</sup> (2003) (mg/kg)	USEPA Region 7 <sup>c</sup> (mg/kg)	USEPA Region 8 <sup>d</sup> (mg/kg)	USEPA Region 10 <sup>e</sup> (mg/kg)	Other Values: Talmage et al. (1999) <sup>f</sup> or LANL (2005) <sup>g</sup> (mg/kg)						
<b>Explosives</b>												
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
<b>Metals/Inorganics</b>												
Aluminum	50	NVA	50	EPA-R4	NVA		50	EPA-R4	5.5	LANL		50
Chromium (total)	42	0.4	26	SSL	26	SSL	26	SSL	2.3	LANL	Yes	42
Copper	50	5.4	60	ORNL	190	Dutch	60	ORNL	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	100	EPA-R4	NVA		100	EPA-R4	50	LANL		1100
Molybdenum	2	NVA	2	ORNL	2	ORNL	2	ORNL	NVA			2
Nickel	30	13.6	30	ORNL	30	ORNL	30	ORNL	20	LANL	Yes	30

**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 (Efroymsen 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**  
**Former Fort Townsend**

**Notes:**

<sup>a</sup> 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).

<sup>b</sup> Ecological Screening Levels (ESLs), USEPA Region V, August 2003.

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

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

<sup>e</sup> 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.

<sup>f</sup> 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.

<sup>g</sup> Los Alamos National Laboratory (LANL), Eco Risk Database, Release 2.2, September 2005.

<sup>h</sup> 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).

<sup>i</sup> 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>.

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

Dutch Intervention Values:

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

The Netherlands Ministry of Housing, Spatial Planning and Environment's Circular on target values and intervention values for soil remediation [http://www2.minvrom.nl/Docs/internationaal/S\\_I2000.pdf](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](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  
Former Fort Townsend**

Analyte	Proposed Benchmarks										Potential Bioaccumulative Constituent? <sup>g</sup>	Final Ecological Screening Value Sediment <sup>h</sup> (mg/kg)
	Washington Department of Ecology Screening Level Values Freshwater <sup>a</sup> (mg/kg)	USEPA Region 5 Ecological Screening Levels <sup>b</sup> (mg/kg)	USEPA Region 7 <sup>c</sup> (mg/kg)	USEPA Region 8 <sup>d</sup> (mg/kg)	USEPA Region 10 <sup>e</sup> (mg/kg)	Other Ecological Screening Levels <sup>f</sup> (mg/kg)						
<b>Explosives</b>												
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,-Dinitrotoluene	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,-Dinitrotoluene	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
<b>Metals/Inorganics</b>												
Aluminum	NVA	NVA	NVA		NVA		NVA		2.80E+02	LANL		2.80E+02
Chromium	2.60E+02	4.34E+01	4.34E+01	MAC	4.34E+01	MAC	4.34E+01	MAC	5.60E+01	LANL	Yes	2.60E+02
Copper	3.90E+02	3.16E+01	3.16E+01	MAC	3.16E+01	MAC	3.16E+01	MAC	1.70E+01	LANL	Yes	3.90E+02
Iron	NVA	NVA	NVA		NVA		NVA		2.00E+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
Molybdenum	NVA	NVA	NVA		NVA		NVA		NVA			NVA
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

**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

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

**Notes:**

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

<sup>b</sup> Ecological Screening Levels (ESLs), USEPA Region V, August 2003.

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

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

<sup>e</sup> 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.

<sup>f</sup> 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.

<sup>g</sup> 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).

<sup>h</sup> Final Screening Value selected using the following hierarchy:

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

**Other References:**

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

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

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

# *Draft Worksheets*

*Site Inspection  
former Fort Townsend*

*Technical Project Planning Meeting  
May 1, 2007*