

**FINAL  
Five-Year Review Report**

**Third Five-Year Review Report  
for  
Fort Lewis CERCLA Sites  
Pierce County, Washington**

**September 2007**

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# Five-Year Review Report

## Table of Contents

List of Acronyms .....	ii
Executive Summary .....	iii
Five-Year Review Summary Form .....	iv
I. Introduction.....	1
II. Site Chronology .....	2
III. Background.....	3
IV. Remedial Actions.....	8
V. Progress Since the Last Review.....	12
VI. Five-Year Review Process.....	19
VII. Technical Assessment.....	21
VIII. Issues.....	29
IX. Recommendations and Follow-up Actions.....	30
X. Protectiveness Statement .....	31
XI. Next Review.....	31

## Figures

Figure 1 – LUCs at Fort Lewis CERCLA Sites

Figure 2 – Logistics Center TCE Groundwater Plumes

## Tables

Table 1 – Chronology of Significant Milestones

Table 2 – Actions Taken on Recommendations of the Last Five-Year Review

Table 3 – Summary of Fort Lewis CERCLA LUCs

Table 4 – Annual Logistics Center Remedy Maintenance Costs

Table 5 – Issues

Table 6 – Recommendations and Follow-Up Actions

## List of Acronyms

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIS-DCE	Cis-1,2-Dichloroethylene
DD	Decision Document
DRMO	Defense Reutilization & Marketing Office
EGDY	East Gate Disposal Yard
EPA	United States Environmental Protection Agency
ERP	Environmental Restoration Program
ESD	Explanation of Significant Difference
FFA	Federal Facility Agreement
FS	Feasibility Study
GPM	Gallons per Minute
GWM	Groundwater Monitoring
LUCs	Land Use Controls
MAMC	Madigan Army Medical Center
MCL	Maximum Contaminant Level
MTCA	Model Toxics Control Act
MWs	Monitoring Wells
NPL	National Priority List
O&M	Operation and Maintenance
PCB	Polychlorinated Biphenyls
P&T	Pump-and-Treat
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
SLA	Sea Level Aquifer
SRCPP	Solvent Refined Coal Pilot Plant
TCE	Trichloroethylene
µg/L	Micrograms per Liter
µg/m <sup>3</sup>	Micrograms per Cubic Meter
VC	Vinyl Chloride

## Executive Summary

The Fort Lewis Environmental Restoration Program (ERP) conducted this five-year review to evaluate whether the remedy selected for each of the following 8 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites continues to provide adequate protection of human health and the environment: Logistics Center, Landfill 4, Solvent Refined Coal Pilot Plant (SRCPP), Battery Acid Pit, Defense Reutilization & Marketing Office (DRMO) Yard, Illicit Polychlorinated Biphenyls (PCB) Dump Site, Landfill 1, and Pesticide Rinse Area. Landfill 4 and SRCPP are operable units to the Logistics Center National Priority List (NPL) site. Battery Acid Pit, DRMO Yard, Illicit PCB Dump Site, Landfill 1, and Pesticide Rinse Area are non-NPL CERCLA sites listed in the 1990 Federal Facility Agreement (FFA). A five-year review is required for these sites since hazardous substances remain on-site at levels that do not allow for unlimited use and unrestricted exposure. This five-year review was prepared pursuant to CERCLA §121(c), the National Oil and Hazardous Substances Control Plan, and Executive Order 12580.

Five-year reviews were previously completed for the Logistics Center in September 1997 and for the Logistics Center, Landfill 4, and Illicit PCB Dump Site in September 2002. The trigger for the five-year review process was the actual start of remedial action construction at the Logistics Center in 1992. Although the Logistics Center is the primary focus of five year reviews and is the largest and most impacted site, a review of site remedies (e.g., land use controls) is also conducted for each of the Fort Lewis CERCLA sites listed above.

In summary, the major components of the selected remedy for the Logistics Center NPL site are three groundwater pump-and-treat systems (two existing and one under construction), source reduction actions (i.e., drum removal and in-situ thermal treatment), land use controls, and long-term groundwater monitoring. Land use controls are the primary remaining remedy components for the other seven Fort Lewis CERCLA sites. In addition, long-term monitoring is a remaining remedy component for Landfill 1 and Landfill 4.

The Logistics Center remedy is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. The remedies at Landfill 4, SRCPP, Battery Acid Pit, DRMO Yard, Illicit PCB Dump Site, Landfill 1, and Pesticide Rinse Area are protective of human health and the environment.

Recommendations generated from this review are to: 1) confirm that Logistics Center remedy is protective for the lower Vashon Aquifer, 2) continue monitoring degradation byproducts in Landfill 2 groundwater, and 3) optimize groundwater monitoring approach at Landfill 4.

## Five-Year Review Summary Form

SITE IDENTIFICATION		
<b>Site name (from WasteLAN):</b> Fort Lewis Logistics Center		
<b>EPA ID (from WasteLAN):</b> WA9214053465		
<b>Region:</b> 10	<b>State:</b> WA	<b>City/County:</b> Fort Lewis, Pierce County
SITE STATUS		
<b>NPL status:</b> <input type="checkbox"/> Final <input type="checkbox"/> Deleted <input type="checkbox"/> Other (specify)		
<b>Remediation status</b> (choose all that apply): <input type="checkbox"/> Under Construction <input checked="" type="checkbox"/> Operating <input type="checkbox"/> Complete		
<b>Multiple OUs?*</b> <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<b>Construction completion date:</b> __/__/__	
<b>Has site been put into reuse?</b> <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		
REVIEW STATUS		
<b>Lead agency:</b> <input type="checkbox"/> EPA <input type="checkbox"/> State <input type="checkbox"/> Tribe <input type="checkbox"/> Other Federal Agency <u>Dept. of Army, Ft. Lewis</u>		
<b>Author name:</b> Troy Bussey Jr.		
<b>Author title:</b> Fort Lewis ERP Lead	<b>Author affiliation:</b> Dept. of Army, Ft. Lewis	
<b>Review period:</b> <u>10</u> / <u>01</u> / <u>2002</u> to <u>09</u> / <u>30</u> / <u>2007</u>		
<b>Date(s) of site inspection:</b> <u>NA</u> / __/__/__		
<b>Type of review:</b> <div style="text-align: center; margin-top: 5px;"> <input type="checkbox"/> Post-SARA    <input type="checkbox"/> Pre-SARA    <input type="checkbox"/> NPL-Removal only  <input type="checkbox"/> Non-NPL Remedial Action Site    <input type="checkbox"/> NPL State/Tribe-lead  <input type="checkbox"/> Regional Discretion </div>		
<b>Review number:</b> <input type="checkbox"/> 1 (first) <input type="checkbox"/> 2 (second) <input checked="" type="checkbox"/> 3 (third) <input type="checkbox"/> Other (specify) _____		
<b>Triggering action:</b> <input type="checkbox"/> Actual RA Onsite Construction at OU # _____ <input type="checkbox"/> Actual RA Start at OU# _____ <input type="checkbox"/> Construction Completion <input checked="" type="checkbox"/> Previous Five-Year Review Report <input type="checkbox"/> Other (specify)		
<b>Triggering action date (from WasteLAN):</b> <u>09</u> / <u>30</u> / <u>2002</u>		
<b>Due date (five years after triggering action date):</b> <u>09</u> / <u>30</u> / <u>2007</u>		
<p><b>Issues:</b> 1. It should be confirmed that Logistics Center remedy is protective for the lower Vashon Aquifer. 2. Elevated concentrations of degradation byproduct are present in a localized portion of Landfill 2 groundwater. 3. Groundwater monitoring activities at Landfill 4 should be optimized.</p> <p><b>Recommendations and Follow-up Actions:</b> Recommend 1) confirming Logistics Center remedy is protective for the lower Vashon Aquifer, 2) continued monitoring of degradation byproducts in Landfill 2 groundwater, and 3) optimizing groundwater monitoring approach at Landfill 4.</p> <p><b>Protectiveness Statement(s):</b> The Logistics Center remedy is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. The remedies at Logistics Center, Landfill 4, SRCPP, Battery Acid Pit, DRMO Yard, Illicit PCB Dump Site, Landfill 1, and Pesticide Rinse Area are protective of human health and the environment.</p> <p><b>Other Comments:</b> None</p>		

# Five-Year Review Report

## I. Introduction

The purpose of this five-year review is to determine whether the remedies selected for the Logistics Center, Landfill 4, SRCPP, Battery Acid Pit, DRMO Yard, Illicit PCB Dump Site, Landfill 1, and Pesticide Rinse Area sites at Fort Lewis continue to be protective of human health and the environment. This is the third five-year review for the Logistics Center. This review was conducted between June 2007 and September 2007 for the period between October 2002 to September 2007 by the Fort Lewis ERP lead (Troy Bussey) with support from the Fort Lewis ERP team (Jim Gillie, Joe Thompson), Army Environmental Command (Ralph Schaeffer), and United States Environmental Protection Agency (Chris Cora, Marcia Knadle). The triggering action for this five-year review was the signing of the second Logistics Center five-year review on 30 September 2002. This five-year review was prepared pursuant to CERCLA §121(c), the National Oil and Hazardous Substances Control Plan (40 Code of Federal Regulations 300.430(f)(4)(ii)), and Executive Order 12580.

## II. Site Chronology

Table 1 provides a chronological summary of significant milestones for the Logistics Center NPL site and other Fort Lewis CERCLA sites included in this review. The identified milestones are illustrative, not comprehensive.

**Table 1: Chronology of Significant Milestones**

<b>Event</b>	<b>Date</b>
Soil removal at SRCPP	1980
Illicit PCB Dump Site discovered followed by emergency removal action	1983
Trichloroethylene (TCE) discovered in shallow groundwater beneath the Logistics Center	1985
Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) completed	1986
Logistics Center NPL listing	1989
Federal Facility Agreement (FFA) signed	1990
Logistics Center Record of Decision (ROD) signed	1990
Construction of two Logistics Center pump-and-treat (P&T) systems in Vashon Aquifer begins	1992
Landfill 4/SRCPP ROD signed and sites added as operable units to Logistics Center	1993
Logistics Center Vashon Aquifer P&T systems begin operation	1995
Low-temperature thermal desorption at SRCPP conducted	1996 – 1997
Air sparging/soil vapor extraction at Landfill 4 conducted	1996 – 1999
First Five-Year Review Report for Logistics Center	1997
Logistics Center Explanation of Significant Difference (ESD) signed	1998
Decision Document (DD) for Logistics Center source area drum removal action signed	2000
DD for Pesticide Rinse Area signed	2000
Drum removal action at Logistics Center source area conducted	2000 – 2001
DD for Logistics Center source area in-situ thermal treatment signed	2002
Second Five-Year Review Report for Logistics Center, Landfill 4, & Illicit PCB Dump Site	2002
Logistics Center source area Vashon Aquifer P&T system re-configured (EGDY P&T)	2003 – 2006
In-situ thermal treatment at Logistics Center source area conducted	2003 – 2007
DDs for Battery Acid Pit, DRMO Yard, Illicit PCB Dump Site, Landfill 1, and land use controls at Logistics Center source area (Landfill 2 soil) signed	2006
Optimization of downgradient Vashon Aquifer P&T system (Interstate 5 P&T)	2006 - Ongoing
Logistics Center ESD for Sea Level Aquifer (SLA) signed	2007
Indoor air sampling conducted at Madigan Housing	2007
Existing land use controls formally documented in Land Use Control Plan	2007
Construction of Logistics Center P&T system in SLA begins	2007

### III. Background

The approximately 87,000-acre Fort Lewis military installation is located in western Washington within Pierce County and Thurston County. Fort Lewis was established in 1917 and has been in continuous use since that time. Fort Lewis is surrounded by the communities of Roy, DuPont, Lakewood, Steilacoom and Spanaway. The cities of Tacoma and Olympia are located to the north and southwest of the installation, respectively. In addition to more than 25,000 Soldiers and civilian workers, the installation supports 120,000 retirees and 29,000 family members, making it the Army's fourth most populous installation.

There are 16 sites at Fort Lewis that have been or are being addressed under CERCLA in accordance with a January 1990 FFA. The lead agency for addressing these sites is the United States Army (Army), which is represented by the Fort Lewis ERP. No further action is the selected remedy for the following seven FFA sites:

1. Landfill 5,
2. Landfill 2 (administratively closed as a separate hazardous waste unit since response is encompassed within the context of the Logistics Center NPL site),
3. Landfill 6,
4. Old Explosive Ordnance Disposal Site,
5. Old Fire Fighting Training Pit,
6. Park Marsh Landfill, and
7. Stormwater Outfalls 2 through 5.

A final remedy has not been selected yet for the FFA site known as the Industrial Wastewater Treatment Plant. Remedies have been selected for the following eight FFA sites that include ongoing action (e.g., operation of P&T systems, groundwater monitoring, and land use control maintenance):

1. Logistics Center,
2. Landfill 4,
3. SRCPP,
4. Battery Acid Pit,
5. DRMO Yard,
6. Illicit PCB Dump Site,
7. Landfill 1, and
8. Pesticide Rinse Area.

Locations of the sites are presented in Figure 1. Site-specific background information is provided below for each of these eight sites.

Logistics Center: The Logistics Center NPL site is the largest and most impacted site at Fort Lewis. The site includes the Landfill 2 source area, an approximately 2-mile-long groundwater plume of TCE at concentrations above the ROD goal of 5 micrograms per liter ( $\mu\text{g/L}$ ) in the Vashon Aquifer, and an approximately 2.5-mile-long groundwater plume of TCE at concentrations above 5  $\mu\text{g/L}$  in the SLA. The source area is the approximately 23-acre Landfill 2



(also known as East Gate Disposal Yard [EGDY]), which was a former industrial landfill between the 1940s and late 1960s/early 1970s. Waste TCE, which was the principal degreaser used for maintenance at the Logistics Center, was disposed along with waste petroleum products at Landfill 2, located immediately southeast of the Logistics Center.

A brief chronological summary of the major investigation and remedial action events includes:

- Vashon Aquifer TCE plume discovery in 1985,
- a remedial investigation (RI) in 1988,
- a feasibility study (FS) in 1990,
- construction of the EGDY P&T and Interstate 5 P&T Systems in the Vashon Aquifer between 1992 and 1995,
- various SLA studies between 1992 and 2007,
- expanded investigations of Landfill 2 between 1993 and 2002,
- operation of the EGDY and Interstate 5 P&T Systems between 1995 and current,
- innovative technology research projects for possible full-scale remedial implementation between 1998 and 2000,
- removal of buried waste drums at Landfill 2 between 2000 and 2001,
- re-configuration of the EGDY P&T System between 2003 and 2006,
- in-situ thermal treatment of the three most contaminated areas of Landfill 2 between 2003 and 2007,
- optimization of Interstate 5 P&T System between 2006 and current,
- indoor air sampling at Madigan Housing in 2007, and
- construction of the SLA P&T System beginning in 2007.

Although TCE, cis-1,2-dichloroethylene (cis-DCE), and tetrachloroethylene have groundwater cleanup goals in the ROD and although potentially unacceptable concentrations of TCE, arsenic, and lead were detected in Landfill 2 soil samples collected between 1993 and 2000, TCE in groundwater is the primary concern at the site. The current maximum groundwater concentration of TCE in Landfill 2 is on the order of 500 µg/L, although TCE was historically present at a maximum concentration on the order of 100,000 µg/L prior to the recently completed remedial actions (i.e., in-situ thermal treatment). In general, the direction of TCE migration in the Vashon Aquifer is to the northwest from Landfill 2 towards American Lake generally along the centerline axis of the Logistics Center. The “source” of the TCE plume in the SLA is a hydrogeologic preferential pathway (commonly called the “window” between the Vashon Aquifer and SLA) that enables TCE to enter the SLA from the Vashon Aquifer at a location about halfway along the Vashon Aquifer plume. The current maximum groundwater concentration in the SLA is on the order of 150 µg/L with a direction of TCE migration to the west/southwest. The extent of the TCE plumes above 5 µg/L in the Vashon Aquifer and SLA are shown in Figure 2.

The Vashon Aquifer and SLA plumes are currently located on-post with the two following exceptions. First, TCE is present in some upper Vashon Aquifer monitoring wells (MWs) located in the off-post community of Tillicum at concentrations on the order of 5 to 10 µg/L. However, the off-post TCE concentrations in the upper Vashon Aquifer plume continue to decline via natural attenuation as the Interstate 5 P&T System has minimized transport of TCE off-post. Second, it is unknown at this time whether the TCE plume in the lower Vashon

Aquifer extends northwest into the community of Tillicum (additional investigation is underway). It should be noted that the sliver of the SLA TCE plume shown in Tillicum in Figure 2 and the sliver of the Vashon Aquifer TCE plume shown north of the Fort Lewis boundary in Figure 2 are artifacts of contouring and are not representative of actual concentrations measured in MWs. Potential drinking water receptors for the site include the off-post Beachcomber Well (a Group B Public Water System Well serving approximately 10 connections) in the Vashon Aquifer as well as Fort Lewis Water Well 13, Madigan Army Medical Center (MAMC) Well 4, and the City of DuPont's Bell Hill Wells 1 and 3 in the SLA. Although these existing drinking water wells are located relatively close to the TCE plumes, none of these existing wells have TCE concentrations greater than 1 µg/L. It should be noted that Lakewood Water District is the primary water system serving Tillicum. Well A-1 is the only Lakewood Water District water supply well within Tillicum. However, Well A-1 is an emergency supply backup well completed in the SLA upgradient of the Logistics Center SLA plume. Lakewood Water District has included the Logistics Center groundwater contamination in its Wellhead Protection Program. In addition, land use controls (LUCs) are in place to prevent installation of new water supply wells within the TCE plumes as described in the 2007 Land Use Control Plan for Fort Lewis CERCLA Sites.

Current land use for Landfill 2 is as a restricted industrial cleanup area within Training Area 7 of the Fort Lewis operational range area. Landfill 2 may be re-developed for a commercial or industrial purpose in the future as discussed in the Technical Assessment Section given its strategic location between Fort Lewis and McChord Air Force Base. Current and anticipated land use designated in the Fort Lewis Master Plan for the areas over the downgradient Vashon Aquifer and SLA TCE plumes is mixed; the majority is industrial/maintenance with smaller percentages of land designated for family housing (residential), medical (equivalent to commercial), and open space. Current and anticipated land use in the off-post Tillicum community is a mix of residential, commercial, and open space.

Landfill 4: Landfill 4 is an operable unit to the Logistics Center NPL site that was also included as a separate hazardous waste unit in the 1990 FFA. The approximately 52-acre Landfill 4 was reportedly used for disposal of solid waste between 1951 and 1967. The site is located on North Fort Lewis, approximately 500 feet north of Sequalitchew Lake. Current and anticipated future land use is restricted training within Training Area 2 of the Fort Lewis operational range area. The investigation and remedial action chronology includes installation of five MWs in 1981, a site investigation in 1990, a RI/FS and ROD in 1993, operation of a air sparging/soil vapor extraction system from 1996 to 1999, and groundwater monitoring (GWM) between 1994 and current. Ongoing action (i.e., groundwater monitoring and land use controls) continues at the site since TCE and vinyl chloride (VC) are present in some Vashon Aquifer groundwater MWs at concentrations above their ROD goals. However, there are no complete exposure pathways for the site and the only potential current drinking water receptor is Sequalitchew Springs, which is located approximately 1200 feet upgradient of the site and is the primary on-post drinking water supply.

SRCPP: SRCPP is an operable unit to the Logistics Center NPL site that was also included as a separate hazardous waste unit in the 1990 FFA. The approximately 25-acre SRCPP operated from 1974 to 1981 as a production and research facility designed to develop a solvent extraction technology for deriving petroleum hydrocarbon-like products from coal. The site is located on

North Fort Lewis, between Sequalitchew Lake and Hamer Marsh. The current and anticipated future land use designated for the site in the Fort Lewis Master Plan is administration (equivalent to commercial). The investigation and remedial action chronology includes a soil removal in 1980, site investigations between 1980 and 1982, a RI/FS and ROD in 1993, low-temperature thermal desorption of excavated contaminated soil from 1996 to 1997, and GWM/surface water monitoring between 1981 and 1999. Ongoing action (i.e., land use controls) continues at the site since total petroleum hydrocarbons in the diesel and heavy oil ranges were present at concentrations above the ROD goal in an upper Vashon Aquifer groundwater sample collected from an Area B test pit in 1996. However, there are no complete exposure pathways for the site and there are no potential current drinking water receptors.

Battery Acid Pit: Battery Acid Pit is a non-NPL CERCLA site as a result of RCRA corrective action recommendations in the 1986 RFA and its inclusion in the 1990 FFA. The approximately 5-foot by 8-foot by 10-foot deep pit was used from 1971 to 1976 for discarding electrolyte solutions from vehicle batteries. The site is located within the northwest portion of the Logistics Center south of Building 9580 and adjacent to former Building 9589. The current and anticipated future land use designated for the site in the Fort Lewis Master Plan is industrial/maintenance. The investigation chronology includes soil sampling in 1986, investigation activities during the 1988 Logistics Center RI, and site investigations in 1993 and 1995. Although there are no complete exposure pathways at the paved site, ongoing action (i.e., land use controls) continues since lead was present in soil in 1995 at concentrations above residential and industrial cleanup levels for the potential direct contact pathway.

DRMO Yard: DRMO Yard is a non-NPL CERCLA site as a result of RCRA corrective action recommendations in the 1986 RFA and its inclusion in the 1990 FFA. The approximately 33-acre DRMO Yard is an active industrial laydown yard for surplus materials to be recycled or reused. The site is located in the southeast portion of the Logistics Center and immediately northwest of Landfill 2. The current and anticipated future land use designated for the site in the Fort Lewis Master Plan is industrial/maintenance. The investigation and remedial action chronology includes removal of 15 cubic yards of PCB contaminated soil in 1982, PCB confirmation soil sampling in 1986, investigation activities during the 1988 Logistics Center RI, site investigations in 1995 and 2000, and a 2005 risk assessment. Although the site does not pose an unacceptable risk or hazard given current and anticipated future land use, ongoing action (i.e., land use controls) continues since total petroleum hydrocarbons in the heavy oil range, total carcinogenic polycyclic aromatic hydrocarbons, and lead were present in soil in 1995 at concentrations above residential cleanup levels for the potential direct contact pathway.

Illicit PCB Dump Site: The Illicit PCB Dump Site is a non-NPL CERCLA site as a result of RCRA corrective action recommendations in the 1986 RFA and its inclusion in the 1990 FFA. The approximately 1.4 -acre-site is located in a forested and remote portion of the operational range area in Training Area 11. The illicit dumping of PCBs and trichlorobenzenes by an unknown person was discovered by a timber contractor in 1983. Although the site is located within the greater operational range area used for a variety of troop training activities, there is no current or future anticipated future use of the land since troop access to the site is restricted. The investigation and remedial action chronology includes emergency removal of 1869 tons of PCB contaminated soil in 1983, installation of a clay cap and perimeter fence in 1984, a site

investigation in 1994, improvements to cap and fence in 1999, and GWM events in 1999 and 2000. Although there are no complete exposure pathways at the capped and fenced site, ongoing action (i.e., cap maintenance and land use controls) continues since PCBs were present in soil in 1983 at concentrations above residential and industrial cleanup levels for the potential direct contact pathway.

Landfill 1: Landfill 1 is a non-NPL CERCLA site as a result of RCRA corrective action recommendations in the 1986 RFA and its inclusion in the 1990 FFA. The approximately 15-acre Landfill 1 was reportedly used for disposal of solid waste between 1946 and the early 1970s. The site is located in the southern portion of the Cantonment Area, approximately ½ mile southwest of Gray Army Airfield. The current and anticipated future land use designated for the site in the Fort Lewis Master Plan is industrial/maintenance. The investigation chronology includes installation of four MWs in 1984, site investigations in 1988 and 1994, installation of seven additional MWs in 1995, and GWM events conducted between 1997 and current. Ongoing action (i.e., groundwater monitoring and land use controls) continues at the site since TCE is present in two upper Vashon Aquifer groundwater MWs located adjacent to the landfill at concentrations above the maximum contaminant level (MCL) promulgated under the Safe Drinking Water Act. However, there are no complete exposure pathways for the site and the only potential current drinking water receptor is Fort Lewis Well 14. Well 14 is located approximately 1200 feet northeast of the landfill (crossgradient from the regional direction of groundwater flow) and is screened in the deeper SLA. Although not part of normal Landfill 1 monitoring activities, a review of recent Well 14 drinking water records was conducted for this five-year review at the request of the United States Environmental Protection Agency (EPA). Neither TCE nor any other volatile organic compounds were detected at a practical quantification limit of 0.5 µg/L in routine drinking water samples collected from Well 14 in 2000, 2003, and 2006.

Pesticide Rinse Area: Pesticide Rinse Area is a non-NPL CERCLA site as a result of RCRA corrective action recommendations in the 1986 RFA and its inclusion in the 1990 FFA. The site is a 34-foot by 34-foot concrete pad without secondary containment that was used for at least 24 years as a rinsing area for pesticide applicator equipment and empty chemical containers. The site is located on the south side of Building 2054. The current and anticipated future land use designated for the site in the Fort Lewis Master Plan is administration (equivalent to commercial). The investigation chronology includes soil sampling in 1986 and a site investigation in 1994. Although the site does not pose an unacceptable risk or hazard given current and anticipated future land use, ongoing action (i.e., land use controls) continues since chlordane, dieldrin, and heptachlor were present in soil in 1994 at concentrations above residential cleanup levels for the potential direct contact pathway.

## IV. Remedial Actions

Remedies have been selected for the eight CERCLA sites in various decision documents prepared by the Fort Lewis ERP with support from EPA, Washington State Department of Ecology, United States Army Environmental Command, and United States Army Center for Health Promotion and Preventative Medicine. Summary information about remedy selection and implementation is provided below for each of the eight sites being reviewed.

Logistics Center: The comprehensive Logistics Center remedy has evolved post-ROD with remedy components selected in a 1990 ROD, a 1998 ESD, a 2000 DD, a 2002 DD, a 2006 DD, and a 2007 ESD. Major components of the selected Logistics Center remedy requiring ongoing action include:

- Operation and maintenance (O&M) of a source area Vashon Aquifer P&T System (EGDY P&T)
- O&M of a downgradient Vashon Aquifer P&T System (Interstate 5 P&T)
- Construction and O&M of a SLA P&T System near MAMC
- Monitoring of P&T systems, groundwater, and surface water
- Maintenance of land use controls (LUCs)
- Well decommissioning as necessary

Major components of the selected Logistics Center remedy that have been completed include:

- Construction and re-configuration of source area Vashon Aquifer P&T System (EGDY P&T)
- Construction of downgradient Vashon Aquifer P&T System (Interstate 5 P&T), with additional system optimization underway
- Source reduction within Landfill 2 by removing buried waste drums
- Source reduction within Landfill 2 by treating three highly contaminated source areas using the innovative technology of in-situ thermal treatment
- Various investigation activities (i.e., confirmation soil sampling referenced in 1990 ROD, various SLA studies referenced in 1990 ROD and 1998 ESD, EGDY investigation referenced in 1998 ESD, Vashon Aquifer plume investigation referenced in 1998 ESD)
- Implementation of LUCs, including installation of a Landfill 2 perimeter fence equipped with signs
- Well decommissioning (i.e., MWs with long screens as referenced in ESD).

As stated in the 1990 ROD, “the goal of this remedial action is to restore groundwater to its beneficial use, which is, at this site, a drinking water source.” Groundwater remediation goals listed in the 1990 ROD for TCE, cis-DCE, and tetrachlorethylene are 5 µg/L, 70 µg/L, and 5 µg/L, respectively. These groundwater remediation goals are based on MCLs promulgated under the Safe Drinking Water Act. The only other remediation goal specified for the site is a surface water remediation goal in the 1990 ROD for TCE at 80 µg/L. It should be recognized that it may not be possible to restore groundwater within Landfill 2 to its beneficial use within a reasonable timeframe due to the nature and extensive amount of contamination within Landfill 2; however, it is premature at this time to make sure a determination.

Remedy implementation began with the design and construction of the two Vashon Aquifer P&T Systems: the source area EGDY P&T System and the downgradient Interstate 5 P&T System. Each Vashon Aquifer P&T System includes extraction wells, a packed tower aeration treatment unit, and infiltration system. Both the EGDY and Interstate 5 P&T systems have been modified from the original system designs that began operation in 1995.

The original EGDY infiltration galleries/wells were decommissioned and replaced with two new infiltration galleries and an injection well located south of Landfill 2. The galleries were decommissioned because the source area flushing concept of the 1990 ROD was ineffective and the original infiltration location was inhibiting contaminant capture at the extraction wells. They were also abandoned because the in-situ thermal treatment project would have destroyed the transmission pipeline to the original infiltration location. The original EGDY extraction wells were decommissioned and replaced with Extraction Wells PW-1 through PW-8 to provide significantly improved containment of dissolved-phase contaminants migrating from Landfill 2.

The Interstate 5 P&T System is still located as designed. The system consists of a line of extraction wells (LX-1 through LX-15), a treatment unit, and four downgradient infiltration galleries that minimize further flow of dissolved-phase contaminants across the installation boundary towards the community of Tillicum. However, LX-1 and LX-15 have been shutdown (pending confirmation monitoring) due to low TCE concentrations in these wells and their limited pumping influence. In addition, the original line-shaft turbine pumps used in the extraction wells have been replaced with variable-frequency capable submersible pumps to decrease maintenance requirements, improve operational flexibility, and enhance plume capture. Additional optimizations underway for the Interstate 5 P&T System include installing new pumps with variable-frequency drives at the treatment unit discharge and new system controls for more efficient O&M.

Construction of the SLA P&T System is underway. Implementation of the SLA P&T System is expected to include installation of 11 additional MWs, six extraction wells, a packed tower aeration treatment unit, and transmission of treated effluent to MAMC for re-use as hospital cooling water.

Design flowrates for the current EGDY P&T, Interstate 5 P&T, and SLA P&T Systems are 800 gallons per minute (gpm), 1600 gpm, and 1800 gpm (projected), respectively. The groundwater discharge criterion for the current EGDY P&T and Interstate 5 P&T Systems as well as the SLA P&T System under construction is 5 µg/L of TCE. The air discharge criteria for the current EGDY P&T System and Interstate 5 P&T System are 325 pounds/month and 75 pounds/month, respectively. The air discharge criteria for the SLA P&T System will be determined during design of the packed tower aeration unit.

Although GWM and surface water monitoring activities have been ongoing since 1985, the quarterly monitoring of P&T systems, groundwater, and surface water specifically associated with remedial implementation has been ongoing since 1995. Monitoring locations, frequency, and methodology have been periodically optimized as technology, management approaches, and the conceptual site model improve. Monitoring optimizations are discussed further in the 2002 five-year review and in the Progress Since Last Review Section of this review. The current

monitoring approach is presented in the 2007 Logistics Center Remedial Action Monitoring Compliance Plan.

Implementation of the Landfill 2 drum removal action in 2001/2002 is discussed in the 2002 five-year review. Implementation of the following remedy components is discussed in the Progress Since Last Review Section of this review: in-situ thermal treatment at Landfill 2, implementation of LUCs, and well decommissioning.

Implementation of the various investigation activities listed in the 1990 ROD and/or 1998 ESD were addressed in various reports, including but not limited to: 1993 Lower Aquifer Groundwater Study document (including 1994 addendum) by Ebasco Environmental, 1993 Confirmation Soil Sampling document (including 1995 addendum) by Woodward-Clyde, 1997 through 1999 East Gate Disposal Yard Expanded Site Investigation documents by Woodward-Clyde, 2002 Phase II Remedial Investigation by United States Army Corps of Engineers, 2005 Hydrogeology and Trichloroethene Contamination in the Sea-Level Aquifer Beneath the Logistics Center by United States Geological Survey, 2006 Numerical Flow and Transport Model for the Fort Lewis Logistics Center by Pacific Northwest National Laboratory, 2007 Logistics Center Sea Level Aquifer Feasibility Study by Pacific Northwest National Laboratory, and various well installation documents.

Landfill 4: The remedy selected in the 1993 ROD was operating an air sparging/soil vapor extraction system in the source area for an expected duration of three years, GWM, and LUCs. As stated in the 1993 ROD, the remedial action objectives are to “prevent exposure to contaminated groundwater; restore contaminated groundwater to its beneficial use, which is drinking water; minimize movement of contaminants from soil to groundwater; and prevent exposure to landfill contents.” The air sparging/soil vapor extraction system component of the remedy was completed as indicated in a 2001 Landfill 4 Air Sparging/Soil Vapor Extraction Remediation Report. The land use control portion of the remedy was formally implemented in a 2007 Land Use Control Plan as discussed in the Progress Since Last Review Section of this review. GWM has been ongoing since 1988. GWM is being implemented in accordance with the 2006 GWM Plan for Landfill 4. Groundwater remediation goals listed in the 1993 ROD for TCE and VC are 5 µg/L and 1 µg/L, respectively.

SRCPP: The remedy selected in the 1993 ROD was excavating and treating contaminated soils with low-temperature thermal desorption, GWM, and LUCs. As stated in the 1993 ROD, the remedial action objectives are to “prevent exposure to contaminated soils; prevent movement of contaminants from soil to groundwater; and prevent exposure to contaminated upper aquifer groundwater beneath the former SRCPP.” The soil excavation/treatment and GWM components of the remedy were completed as indicated in a 1999 Remedial Action Report and 28 September 1999 letter written by the EPA Remedial Project Manager. The land use control portion of the remedy was formally implemented in a 2007 Land Use Control Plan as discussed in the Progress Since Last Review Section of this review.

Battery Acid Pit: A remedy of LUCs was selected for the site in a 2006 DD. The remedy objectives stated in the 2006 DD are to “control land use planning within the site boundary and

ensure the asphalt cap is maintained.” The remedy was formally implemented in a 2007 Land Use Control Plan as discussed in the Progress Since Last Review Section of this review.

DRMO Yard: A remedy of LUCs was selected for the site in a 2006 DD. The remedy objective stated in the 2006 DD is to “prevent residential land use within the site boundary.” The remedy was formally implemented in a 2007 Land Use Control Plan as discussed in the Progress Since Last Review Section of this review.

Illicit PCB Dump Site: A remedy of LUCs was selected for the site in a 2006 DD. The remedy objectives stated in the 2006 DD are to minimize potential direct contact with soil and to “ensure the cap and fence are not disturbed.” The remedy was formally implemented in a 2007 Land Use Control Plan as discussed in the Progress Since Last Review Section of this review.

Landfill 1: A remedy of LUCs and GWM was selected for the site in a 2006 DD. The remedy objectives stated in the 2006 DD are to “prevent unplanned and inappropriate land uses over the top of the landfill”, “prevent installation of new water supply wells within 1000 feet of the landfill boundary”, and to monitor potential volatile organic compound exceedances. The land use control portion of the remedy was formally implemented in a 2007 Land Use Control Plan as discussed in the Progress Since Last Review Section of this review. GWM has been ongoing since 1988. GWM is being implemented in accordance with the 2006 DD and 2004 GWM Plan for Landfill 1 (as amended in 2005).

Pesticide Rinse Area: A remedy of LUCs was selected for the site in a 2000 DD. The remedy objective in the 2000 DD is to prevent residential land use. The remedy was formally implemented in a 2007 Land Use Control Plan as discussed in the Progress Since Last Review Section of this review.



## V. Progress Since the Last Review

The protectiveness statement from the last five-year review was: “In the short-term, the groundwater treatment system remedy, along with institutional controls, protects human health and the environment. The optimized groundwater treatment system, along with the implementation of source area treatment, will ensure long-term protectiveness of human health and the environment.”

Table 2 summarizes the actions taken in response to the recommendations made during the last five-year review.

**Table 2: Actions Taken on Recommendations of the Last Five-Year Review [1]**

Issues from Previous Review	Recommendation/Follow-up Actions	Action Taken and Outcome
Source Removal	Treat Source Area NAPL (EGDY) via Thermal Treatment Technology	<p>In-situ thermal treatment via electrical resistance heating was used to remediate non-aqueous phase liquids in three Landfill 2 treatment areas (covering a total area of approximately 1.5 acres) that contained the highest concentrations of TCE in soil and groundwater. The remediation system removed and treated an estimated 4500 kilograms of TCE, 900 kilograms of cis-DCE, and 52,000 kilograms of petroleum hydrocarbons. These mass removal estimates do not account for un-quantified mass removed via in-situ dechlorination reactions. TCE concentrations in the groundwater under each of the three treatment areas were reduced from maximum concentrations on the order of 10,000 µg/L to 100,000 µg/L (depending on the area) down to a maximum concentration less than 10 µg/L in the first area and average concentrations less than 150 µg/L in the second and third areas. This approximately \$15 million project consumed approximately 23,000 megawatt-hours of energy. It should be noted that smaller and less significant source areas exist within the approximately 23-acre Landfill 2 that were not targeted for in-situ thermal treatment. As a result, there are some locations within Landfill 2 that now have higher concentrations of TCE in groundwater than the three former source areas remediated with in-situ thermal treatment (i.e., the maximum current TCE concentration is on the order of 500 µg/L as mentioned in the Background Section).</p> <p>During the in-situ thermal treatment project a number of different data collection techniques were conducted to measure remedial performance. Techniques ranged from collecting samples of groundwater and soils to conducting elaborate aquifer tests to estimate the mass flux entering and leaving the treatment areas. This associated \$3 million effort will assist the Department of Defense in determining the level of data needed to effectively implement and evaluate in-situ thermal treatment at prospective sites.</p>

Issues from Previous Review	Recommendation/ Follow-up Actions	Action Taken and Outcome
Decreased GTS [2] Well Capacity	Implement Preventative Maintenance Schedule	This recommendation was based on the issue raised in the last five year review that “extraction wells have experienced gradual decrease in capacity and several wells have experienced biofouling, indicating biofouling may be widespread.” At this time, the actual extraction rates from the Interstate 5 and EGDY P&T Systems are at or near design flowrates (see also the Technical Assessment Section of this review). In addition, submersible pumps have now been installed in Interstate 5 and EGDY P&T extraction wells to enable more finely-tuned pumping rates from individual wells. All extraction wells with a significant decrease in capacity have been rehabilitated. As it turns out, biofouling is not widespread. There are only two extraction wells with recurring biofouling issues (LX-5 and LX-13) and both wells have been rehabilitated twice since 2002. LX-5 and LX-13 will continue to be rehabilitated every two to three years. Silting had caused decreased production from LX-8 and LX-14, but both wells have been redeveloped such that their capacity is now 95% of the original yield. A larger maintenance issue in the past five years has been the mechanical reliability of the Interstate 5 P&T System, which experienced failures of six extraction pumps during the period. Consequently, all of the original cast iron vertical turbine pumps for the Interstate 5 P&T System except LX-1 and LX-15 have been replaced with stainless steel submersible pumps, which are expected to better maintain the pumping capacity of the system with significantly lower maintenance. Likewise, stainless steel submersible pumps were installed in the eight new EGDY P&T extraction wells. The stainless steel construction of the new pumps should limit the growth of the iron bacteria and eliminate biofouling of the pumps themselves. Nonetheless, the programmed budget for each year includes requirements for periodic maintenance and/or replacement of extraction wells and pumps due to biofouling, silting, pump failure, etc.
RA Monitoring Optimization	Further Optimize MW Network after 8 Quarters	Fort Lewis ERP completed a major optimization of MW locations and monitoring frequency in 2004 and continues to optimize as needed. In addition, monitoring costs have been greatly optimized through the use of in-house Fort Lewis ERP labor and by using passive diffusion bag samplers for the majority of monitoring locations.

Issues from Previous Review	Recommendation/ Follow-up Actions	Action Taken and Outcome
Optimize GTS [2]	Optimize GTS to Reduce Total Operating Time & Cost, & Assure Complete Plume Capture	<p>This recommendation was primarily based on the following issues raised during the last five year review: 1) identification of “bulge in TCE plume to SW of EGDY”, and 2) “I-5 system may not be capturing all of TCE plume SW of LX-1”. The southwestern “bulge” has been addressed in several ways. First, a numerical groundwater model was used to understand how the interaction of Landfill 2, localized groundwater conditions, Kinsey Marsh, Murray Creek, and the former EGDY infiltration system created the “bulge”. Second, the EGDY P&amp;T infiltration system was re-located to minimize contaminant flow to the southwest and to increase plume capture within Landfill 2. Third, the Landfill 2 source areas most responsible for the “bulge” (NAPL Areas 1 and 2) were remediated using in-situ thermal treatment as described above. Fourth, the EGDY P&amp;T extraction well locations were re-configured to minimize contaminant flow to the southwest and to increase plume capture within Landfill 2. Finally, additional MWs (i.e., LC-218, MT-1 through MT-6, and LC-222 through LC-224) were installed southwest of Landfill 2 and the monitoring frequencies for many of the MWs located southwest of Landfill 2 were increased. As far as the TCE plume southwest of the Interstate 5 is concerned, numerical groundwater modeling demonstrated that Interstate 5 P&amp;T System was adequately capturing the plume southwest of LX-1 and that LX-1 is unnecessary for adequate plume capture. In addition, numerical groundwater modeling demonstrated that pumping LX-15 is likely counter-productive to plume capture due to localized hydrogeological conditions north of LX-15. As a result, LX-1 and LX-15 have been shutdown, pending confirmation monitoring results. The plume capture of the Interstate 5 P&amp;T extraction wells has also been improved with the installation of variable-frequency capable submersible pumps that will allow optimizing pumping rates for each well.</p> <p>Modeling indicates that the operating duration of the EGDY P&amp;T System will be reduced from centuries to decades as a result of the source removal actions (drum removal and in-situ thermal treatment), which will result in order of magnitude reduction in life-cycle operating costs. Likewise modeling shows that the operating duration and cost of the Interstate 5 P&amp;T System will be reduced through the source removal actions and the re-configuration of the EGDY P&amp;T System. Finally, P&amp;T operating costs have been greatly optimized in the short-term through the use of in-house Fort Lewis ERP labor and by installing more efficient discharge pumps and controls.</p>

<b>Issues from Previous Review</b>	<b>Recommendation/ Follow-up Actions</b>	<b>Action Taken and Outcome</b>
Institutional Controls	The EPA Region 10 Final Policy on the Use of Institutional Controls at Federal Facilities will be implemented where feasible and concurrent to DOD guidance	EPA concurred with the 2002 five-year review, with the following exception mentioned in a 30 September 2002 cover letter: "EPA believes that an Explanation of Significant Difference (ESD) is needed to enhance the institutional requirements in the Record of Decision to ensure long-term protectiveness for those areas that have not been cleaned up to levels that allow for unlimited use and unlimited exposure. These areas include the East Gate Disposal Yard and areas containing groundwater greater than cleanup levels, both on and off the base. The need for, and the contents of, such an ESD are stated in the Region 10 Final Policy on the Use of Institutional Controls at Federal Facilities, May 3, 1999. EPA believes that such an ESD should be completed no later than December 21, 2003." Fort Lewis ERP has implemented land use controls (LUCs) to address the substantive concerns raised in EPA's 30 September 2002 letter. A LUC remedy was selected with EPA concurrence for Landfill 2 (also known as East Gate Disposal Yard) soil in a DD eventually signed in April 2006. A comprehensive boundary fence and additional signage for Landfill 2 were installed in 2004 as described in that DD. A LUC remedial component for Logistics Center groundwater was already selected in the 1990 ROD and does not need to be selected again in an ESD. The specifics of how Fort Lewis ERP implements, monitors, reports on, and keeps records for LUCs on Landfill 2 soil and Logistics Center groundwater (both on-post and off-post) are presented in a 2007 Land Use Control Plan for Fort Lewis CERCLA Sites. In addition, it should be noted that LUC remedies were selected with EPA concurrence for Battery Acid Pit, DRMO Yard, Illicit PCB Dump Site, and Landfill 1 in their respective April 2006 DDs. The 2007 Land Use Control Plan referenced above includes specific of how Fort Lewis ERP implements, monitors, reports on, and keeps records for LUCs at these four sites as well as for Landfill 4, SRCPP, and Pesticide Rinse Area, which had LUC remedial components selected in previous decision documents. The LUC objectives listed in the Land Use Control Plan for all eight Superfund sites are reproduced in Table 3 below.
Beachcomber Complex Well	Insure Well is Periodically Sampled for TCE	This recommendation was based on the issue raised during the last five-year review that the Beachcomber Complex Well was located near the TCE plume in the Vashon Aquifer. TCE and other volatile organic compounds were not detected in samples collected in July 2002 and September 2007. The well will be monitored annually until further notice.

Issues from Previous Review	Recommendation/ Follow-up Actions	Action Taken and Outcome
Sea Level Aquifer	Conduct Source Treatment at EGDY; Continue Innovative Technology Evaluation for Expediting Vashon Aquifer Cleanup and to Reduce Contamination Entering Sea Level Aquifer; Sample new wells; Continue to Evaluate the Sea Level Aquifer Contamination	This recommendation was based on the following issue raised in the last five-year review: "Sea Level Aquifer contaminant plume character and condition (i.e., expanding, contracting, or stable) not defined and capture or containment not currently addressed." Tremendous progress has been made for the SLA as summarized below. The accomplishments of the past five years should be appreciated in the context of the 2002 conceptual site model for the SLA as alluded to in the 2002 issue quoted above. Source treatment at EGDY, which has expedited Vashon Aquifer cleanup and will eventually reduce contamination entering the SLA, has been completed via drum removal and in-situ thermal treatment as described above. SLA MWs LC-79D through LC-83D were sampled as recommended, which is significant considering that sampling these deep multi-port MWs pushed the limits of this sampling technology. SLA contamination was evaluated in the following ways. First, 16 MWs (eight pairs designated as LC-84D1 through LC-91D2) were installed to delineate the southwestern flow direction of the SLA in this area. Second, a fate and transport study was completed by the United States Geological Survey that greatly improved the SLA conceptual site model. Third, Pacific Northwest National Laboratory developed a numerical groundwater model to predict fate and transport of TCE in the SLA. Fourth, eight MWs (four pairs designated as LC-92D1 through LC-95D2) were installed to determine the potential future migration direction of the plume. Finally, Pacific Northwest National Laboratory completed a SLA FS that evaluated possible remediation technologies and assembled remedial alternatives for the SLA. Based on these evaluations, the remedy selected for the SLA in the 2007 ESD was installation and operation of a SLA P&T System near MAMC, with re-use of treated effluent for MAMC cooling water. Installation of 11 additional MWs and construction of six SLA P&T extraction wells is underway.

[1] All recommendations were related to Logistics Center NPL site

[2] GTS = Groundwater Treatment System, referred to in this review as P&T Systems

**Table 3. Summary of Fort Lewis CERCLA LUCs**

Site Name	Document Requiring LUC	Applicable Area of Site	LUC Objective
Logistics Center	April 2006 DD	Landfill 2 (aka EGDY)	<ul style="list-style-type: none"> <li>Prevent residential land use</li> <li>Prevent unplanned excavation of contaminated soil</li> <li>Prevent training access</li> <li>Maintain boundary fence and signs</li> </ul>
		1000 feet buffer around site boundary and within Fort Lewis boundary	<ul style="list-style-type: none"> <li>Prevent new drinking water wells without EPA approved monitoring plan</li> </ul>
		Off-post portion of Vashon Aquifer trichloroethylene (TCE) plume above 5 ug/L	<ul style="list-style-type: none"> <li>Remind Lakewood Water District that Logistics Center should remain listed as possible source of contamination in its Wellhead Protection Program</li> </ul>
		Upper Vashon Aquifer TCE 100 ug/L isoconcentration contour [1]	<ul style="list-style-type: none"> <li>Prevent residential land use</li> </ul>
Landfill 4	September 1993 ROD	Landfill boundary	<ul style="list-style-type: none"> <li>Prevent residential land use</li> <li>Prevent unplanned excavation of contaminated soil</li> <li>Prevent digging, bivouacking, or off-road vehicle maneuvering during training</li> </ul>
		1000 feet buffer around site boundary	<ul style="list-style-type: none"> <li>Prevent new drinking water wells without EPA approved monitoring plan</li> </ul>
SRCPP	September 1993 ROD	Site boundary	<ul style="list-style-type: none"> <li>Prevent new drinking water wells without EPA approved monitoring plan</li> </ul>
Battery Acid Pit	April 2006 DD	Site boundary	<ul style="list-style-type: none"> <li>Prevent residential land use</li> <li>Prevent unplanned excavation of contaminated soil</li> <li>Maintain asphalt cap</li> </ul>
DRMO Yard	April 2006 DD	Site boundary	<ul style="list-style-type: none"> <li>Prevent residential land use</li> </ul>
Illicit PCB Dump	April 2006 DD	Site boundary	<ul style="list-style-type: none"> <li>Prevent residential land use</li> <li>Prevent unplanned excavation of contaminated soil</li> <li>Prevent training access</li> <li>Maintain boundary fence and signs</li> <li>Maintain clay cap</li> </ul>
Landfill 1	April 2006 DD	Landfill boundary	<ul style="list-style-type: none"> <li>Prevent residential land use</li> <li>Prevent unplanned excavation of contaminated soil</li> </ul>
		1000 feet buffer around landfill boundary	<ul style="list-style-type: none"> <li>Prevent new drinking water wells without EPA approved monitoring plan</li> </ul>
Pesticide Rinse Area	December 2000 DD	Site boundary	<ul style="list-style-type: none"> <li>Prevent residential land use</li> </ul>

[1] The 100 ug/L isoconcentration contour used as the criteria for the vapor intrusion LUC is based on the groundwater threshold concentration calculated in the 2007 Madigan Family Housing Area Vapor Intrusion Study. However, it should be noted that this LUC boundary is conservative because the 1) the assumptions used to calculate the 100 ug/L threshold were quite conservative, 2) the depth to the upper Vashon Aquifer is typically deeper than groundwater depths at Madigan Family Housing Area, and 3) the upper Vashon Aquifer TCE plume is expected to continue decreasing.

Additional progress made in the past five years that should be noted includes the following:

- As indicated in the last five-year review, the 2002 Risk Assessment Addendum concluded the potential vapor intrusion pathway at the Logistics Center did not pose an unacceptable risk or hazard to residents at Madigan Housing. However, a study was conducted in 2004 to reduce possible uncertainty associated with the pathway. The 2004 study was not finalized due to differences that arose between Fort Lewis and EPA on how to interpret the study data. Although Fort Lewis and the EPA were working together, and would have resolved their differences in due time, an April 2007 article in the Seattle Post-Intelligencer brought the vapor intrusion issue to the forefront. As a result, indoor air samples were collected from 10 potentially impacted housing units in June and July 2007. No TCE was detected in 96% of the 94 valid samples. TCE was detected in 4% of the samples at estimated concentrations ranging from 0.2 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) to 1.3  $\mu\text{g}/\text{m}^3$ . Since the maximum estimated TCE concentration of 1.3  $\mu\text{g}/\text{m}^3$  is below the no further action threshold of 5  $\mu\text{g}/\text{m}^3$ , no further action is necessary for the vapor intrusion pathway as long as TCE concentrations in all groundwater MWs within or immediately adjacent to Madigan Housing remain below 100  $\mu\text{g}/\text{L}$  (as determined in the 2007 Madigan Family Housing Area Vapor Intrusion Sampling Report). Even though there is no current or anticipated future residential land use in areas where TCE concentrations in groundwater exceed 100  $\mu\text{g}/\text{L}$  and the TCE plume is expected to decrease over time, a LUC objective of preventing residential land use within the upper Vashon Aquifer 100  $\mu\text{g}/\text{L}$  isoconcentration contour was included in the 2007 LUC Plan.
- To improve delineation of TCE in the lower Vashon Aquifer at the Logistics Center, MWs LC-216, LC-217, and LC-219 were installed in 2004. Two additional lower Vashon Aquifer MWs (proposed as LC-225 and LC-226) are currently being installed in the community of Tillicum.
- GWM activities at Landfill 1 and Landfill 4 were optimized by reducing costs with the use of in-house Fort Lewis ERP labor, conversion to passive-diffusion bag samplers at Landfill 1, and specifying long-term monitoring locations, frequency, and duration in the respective GWM Plans.
- The following MWs were decommissioned between 2004 and 2006: T-09E, 85-PA-383A, LC-02, LC-06A, LC-12, LC-100 through LC-102, SRC-06, SRC-07, SRC-09, SRC-24, SRC-25, SRC-29, SRC-31, SRC-39 through SRC-43, SRC-45 through SRC-48, SRCMW-01A, SRCMW-03, SRCMW-04, SRCMW-08, SRCMW-09, and SRCMW-11 through SRCMW-14. MWs LC-185, LC-136A, and LC-136B were decommissioned prior to in-situ thermal treatment in Area 3. In addition, the six former EGDY P&T extraction wells (LX-17 through LX-21 and RW-01) and the majority of the MWs installed for the in-situ thermal treatment project were decommissioned in 2007.
- Fort Lewis received the fiscal year 2005 Secretary of Defense Environmental Award for Environmental Restoration.

## VI. Five-Year Review Process

This review was prepared by the Fort Lewis ERP lead (Troy Bussey) with support from the Fort Lewis ERP team (Jim Gillie, Joe Thompson), Army Environmental Command (Ralph Schaeffer), and EPA (Chris Cora, Marcia Knadle). Applicable points of contact at Fort Lewis Public Works, Fort Lewis Staff Judge Advocate, Army Environmental Command, and EPA were notified on 4 June 2007 about the start of this five-year review process. The review was conducted between June and September 2007, with final signatures expected by 30 September 2007. A legal notice announcing that a five-year was being conducted was published in the Tacoma News Tribune on 25 July and 1 August 2007. No community response was received in response to the legal notice. The installation does not have a Restoration Advisory Board.

The following documents were reviewed and used as the basis for this five-year review:

- September 1986 RCRA Facility Assessment for Fort Lewis
- January 1990 Federal Facility Agreement for Fort Lewis
- May 1990 Feasibility Study Report for Logistics Center
- May 1990 Baseline Human Health Risk Assessment for Logistics Center
- July 1990 Hazardous Waste Evaluation Report for Fort Lewis
- September 1990 Record of Decision for Logistics Center
- February 1993 Remedial Investigation Report for Landfill 4 and SRCPP
- March 1993 Baseline Risk Assessment Report for Landfill 4 and SRCPP
- May 1993 Feasibility Study Report for Landfill 4 and SRCPP
- September 1993 Record of Decision for Landfill 4 and SRCPP
- November 1994 Limited Field Investigation Report: Multi-Site Limited Field Investigation
- March 1997 Chemical Reports 2 and 3 for SRCPP Soil Remediation
- September 1997 Five-Year Review Report for Logistics Center
- September 1998 Explanation of Significant Difference for Logistics Center
- November 1998 Remedial Action Report for Groundwater Treatment Project at Logistics Center
- July 1999 Remedial Action Report for SRCPP, along with 28 September 1999 letter from EPA
- July 2000 Decision Document for Removal Action for Containerized Source from Landfill 2
- December 2000 Decision Document for the Storm Water Outfalls/Industrial Wastewater Treatment Plant, Pesticide Rinse Area, Old Fire Fighting Training Pit, Illicit PCB Dump Site, and the Battery Acid Pit
- August 2002 Decision Document for In-Situ Thermal Treatment
- March 2001 Landfill 4 Air Sparging/Soil Vapor Extraction Remediation Report
- September 2002 Second Five-Year Review Report for Logistics Center
- October 2002 Risk Assessment Addendum for East Gate Disposal Yard (Landfill 2) and Logistics Center
- April 2004 Groundwater Monitoring Plan for Landfill 1, as amended in May 2005
- June 2004 Closure Report for Logistics Center EGDY Infiltration System Relocation
- January 2005 Screening-Level Risk Evaluation for DRMO Yard



- April 2005 NAPL Area 1 Completion Report for In Situ Thermal Remediation at East Gate Disposal Yard
- February 2006 Groundwater Monitoring Plan for Landfill 4
- April 2006 Decision Document for Battery Acid Pit
- April 2006 Decision Document for Direct Contact with Landfill 2 Soil
- April 2006 Decision Document for DRMO Yard
- April 2006 Decision Document for Illicit PCB Dump Site
- April 2006 Decision Document for Landfill 1
- April 2006 NAPL Area 2 Completion Report for In Situ Thermal Remediation at East Gate Disposal Yard
- June 2006 Groundwater Monitoring Report for June 2006 Event at Landfill 1 (Draft), along with to be published data for 2007 from ERP files
- August 2006 Army Defense Environmental Restoration Program Installation Action Plan for Fort Lewis
- October 2006 9<sup>th</sup> Annual Report for Logistics Center Operation and Maintenance, along with to be published data for period between January 2006 and June 2007 from ERP files
- December 2006 Groundwater Monitoring Report for August 2006 Event at Landfill 4 (Draft), along with to be published data for 2007 from ERP files
- December 2006 Fort Lewis East Gate Disposal Yard Pump-And-Treat System Upgrade Completion Report
- February 2007 Logistics Center Sea Level Aquifer Feasibility Study
- February 2007 Explanation of Significant Difference for Logistics Center
- March 2007 Logistics Center Remedial Action Monitoring Compliance Plan
- May 2007 2005 Annual Monitoring Report for Logistics Center Remedial Action Monitoring Program, along with to be published data for period between January 2006 and June 2007 from ERP files
- June 2007 Well Installation Work Plan for the Sea Level Aquifer Pump-and-Treat System
- June 2007 NAPL Area 3 Completion Report for In Situ Thermal Remediation at East Gate Disposal Yard
- June 2007 I-5 Capture Analysis (Draft)
- June 2007 Quality Assurance Project Plan for Vapor Intrusion Study at Madigan Family Housing Area
- September 2007 Madigan Family Housing Area Vapor Intrusion Sampling Report
- September 2007 Land Use Control Plan for Fort Lewis CERCLA Sites

Data in the above-referenced documentation was used as necessary to summarize site conditions, contaminant concentrations and trends, and current status of remedial actions (such as what is presented in the Technical Assessment Section). No formal site inspections (beyond normal site inspections and site work included in the above documentation) were performed specifically for the purpose of this five-year review period. No formal interviews (beyond correspondence between the review team) were conducted specifically for the purpose of supporting this five-year review period.

## VII. Technical Assessment

### QUESTION A: IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS?

Answer: Yes.

The remedy is functioning as intended by the decision documents for each of the eight FFA sites covered by this review: Logistics Center, Landfill 4, SRCPP, Battery Acid Pit, DRMO Yard, Illicit PCB Dump Site, Landfill 1, and Pesticide Rinse Area. The basis for this determination for each site is provided below.

Logistics Center: Significant portions of the Logistics Center remedy have been successfully completed as described in the Remedial Actions Section and Progress Since the Last Review Section of this review. As a result, this technical assessment will focus on the major components of the remedy requiring additional action as identified in the Remedial Actions Section of this review.

O&M of the EGDY P&T System was not continuous during the five-year period. Beyond the routine and necessary system and system component shutdowns for periodic maintenance or repair, the entire system was shutdown between December 2004 and August 2006 to allow other investigations and remedial actions to be completed at Landfill 2 (i.e., re-configuration of EGDY P&T System, in-situ thermal treatment, and the performance assessment of in-situ thermal treatment). While the extended shutdown may have impacted groundwater immediately downgradient of Landfill 2, it is not expected to have a significant impact on the nature or extent of the overall contaminant plumes, especially considering the overall remedy benefit obtained from these actions that required the shutdown. The necessary components of the system (i.e., extraction wells, a packed tower aeration treatment unit, and infiltration system) specified in the decision documents are in place and operating as intended. As discussed in the Remedial Actions Section and Progress Since the Last Review Section, the extraction wells and infiltration system have been re-configured and upgraded to significantly improve source containment and reduce maintenance and repair. Since the upgrade, the actual extraction flowrate has ranged from 450 gpm (when not all of the extraction wells had been re-started) to 800 gpm, which is the design flowrate. The EGDY P&T System continued to remove TCE mass from groundwater during the five-year period. Average TCE concentrations for the treatment plant influent were on the order of 250 µg/L prior to December 2004 and are currently on the order of 70 µg/L as a result of in-situ thermal treatment. The maximum and average groundwater discharge concentrations for TCE from the treatment plant effluent during this five-year period were 7 µg/L and less than 1 µg/L, respectively (the criterion is 5 µg/L). The 7 µg/L maximum was observed recently and is likely due to increased biological growth on the packing caused by elevated temperatures and microbial activity in water being extracted immediately downgradient of in-situ thermal treatment Area 3. The cause of this isolated reduction in treatment efficiency is currently being investigated and addressed. The maximum air discharge of TCE from the EGDY P&T System during this five-year period was 77 pounds/month, which is less than the 325 pounds/month criterion.

O&M of the Interstate 5 P&T System was continuous during the five-year period with the

exception of routine and necessary system and system component shutdowns for periodic maintenance or repair. The necessary components of the system (i.e., extraction wells, a packed tower aeration treatment unit, and infiltration system) specified in the decision documents are in place and operating as intended. As discussed in the Remedial Actions Section and Progress Since the Last Review Section, the Interstate 5 P&T System is currently being improved to optimize contaminant removal and to reduce maintenance and repair. As discussed in the Progress Since the Last Review Section, O&M issues related to biofouling, silting, and mechanical failures have been identified and addressed. The actual flowrate for the Interstate 5 P&T System during the five-year period has ranged from 1275 gpm to 1625 gpm, which is similar to the current optimized design flowrate of 1600 gpm. The Interstate 5 P&T System continued to remove TCE mass from groundwater during the five-year period. Average TCE concentrations for the treatment plant influent were on the order of 40 µg/L during the entire period. The maximum groundwater discharge for TCE from the treatment plant effluent during this five-year period was 0.8 µg/L, which is less than the criterion of 5 µg/L. The maximum air discharge from the Interstate 5 P&T System during this five-year period was 25 pounds/month, which is less than the 75 pounds/month criterion.

Construction of the SLA P&T System is underway. Implementation of the SLA P&T System is expected to include installation of 11 additional MWs, six extraction wells, a packed tower aeration treatment unit, and a pipeline and pumping system to supply treated effluent to MAMC for re-use as hospital cooling water. Installation of the MWs and extraction wells is scheduled to be completed near the time this five year review is completed. Design and construction of the packed tower aeration treatment unit and transmission to MAMC is scheduled to begin in fiscal year 2008.

GWM demonstrates that the TCE groundwater remediation goal of 5 µg/L has not been achieved in a significant portion of the Vashon Aquifer and SLA. The currently estimated plan-view areas of the Vashon Aquifer and SLA plumes with TCE concentrations above 5 µg/L are 1200 acres and 1000 acres, respectively. However, remedy components (e.g., source strength reduction via drum removal and in-situ thermal treatment at Landfill 2, three P&T Systems) have worked and/or are working as intended such that it is possible that restoration of a significant portion of impacted groundwater is expected within a reasonable timeframe (i.e., decades). Current GWM includes 99 monitoring locations in the upper Vashon Aquifer, 16 MWs in the lower Vashon Aquifer (including LC-225 and LC-226), and 67 MWs in the SLA (including LC-96D through LC-102D2). It should be noted that 51 of the 67 SLA MWs being monitored are located downgradient of the SLA P&T extraction wells. TCE trends in individual MWs are presented in the annual GWM reports. Overall, the upper Vashon Aquifer plume during the past five years has been stable or decreasing slightly based on comparison of the current plume size, influent concentrations for the EGDY P&T and Interstate 5 P&T Systems, and concentrations in individual MWs compared to historical data. The data record is not long enough to evaluate the plume stability of the lower Vashon Aquifer or SLA. For instance, accurate comparisons of lower Vashon Aquifer and SLA plume sizes with older figures are not applicable due to changes in MW density, plume delineation, and contouring techniques over time. However, the lower Vashon Aquifer and SLA plumes are not expected to pose an unacceptable risk and are expected to decrease over time based on the remedial actions taken and underway. Cis-DCE and tetrachloroethylene were not detected in groundwater outside of Landfill 2 during the five-year

period above their respective remediation goals of 70 µg/L and 5 µg/L, with the following exception. Cis-DCE was detected in one sample collected from MW FL-2 at a concentration of 170 µg/L, but was less than 0.5 µg/L in all other samples collected from FL-2 during the five year period. The maximum detected TCE concentration in surface water during the past five years is 1.6 µg/L, which is significantly below the TCE surface water remediation goal of 80 µg/L.

As discussed in the Progress Since the Last Review Section and detailed in Table 3, LUCs are in place as intended by the decision documents in order to complement other in place remedial components and to prevent potentially unacceptable exposures. Fort Lewis ERP has specified the details of how the LUCs are implemented (e.g., LUC objectives, mechanisms, monitoring, enforcement, reporting, enforcement) in the 2007 LUC Plan. Fort Lewis ERP oversees on a daily basis the effective and consistent functioning of the LUC mechanisms described in the LUC Plan (e.g., LUC data layer in Geographic Information System, LUC overlay for Real Property Master Plan, LUC overlay for environmental review procedures, LUC overlay for Digging Permit approval).

Currently all existing Logistics Center extraction and MWs are in operable condition, and are being actively used or may be used in the future. As a result, there are no wells that currently need to be decommissioned. It should be noted that MWs such as LC-79D through LC-83D may be used again in the future even though they are not currently being monitored.

The total estimated cost to maintain the ongoing components of the Logistics Center remedy (i.e., P&T O&M, GWM, LUCs, well decommissioning) for the past five years is summarized in Table 6. It is impossible to accurately compare the total remedy operation costs with predicted costs in the original 1990 FS since 1) the 1990 FS significantly underestimated the number of samples needed for compliance monitoring (1990 FS estimated 52 samples per year while current number of samples is on the order of 450 per year), 2) the 1990 FS did not include any labor costs to complete compliance monitoring, 3) the 1990 FS significantly underestimated the labor necessary for overall maintenance of the comprehensive Logistics Center remedy, and 4) the 1990 FS significantly overestimated actual electricity costs. Nonetheless, current annual remedy operation costs are less than the 1990 FS annual operation costs in 1989 dollars (\$517,000 + \$16,120) when escalated to 2002 dollars at a 3% inflation rate (\$780,000). It should be noted that remedy operation costs have been optimized through a transfer of remedy operation tasks from outside contractors to an in-house Fort Lewis ERP engineering team in fiscal year 2005. It should also be noted that future five-year reviews should compare future remedy operation costs to those presented in the February 2007 SLA FS rather than the 1990 FS.

**Table 4: Annual Logistics Center Remedy Maintenance Costs**

Fiscal Year	Estimated Cost
2003	\$700,000
2004	\$700,000
2005	\$400,000
2006	\$400,000
2007	\$400,000

No additional opportunities for remedial action optimization were identified at this time beyond ongoing actions to optimize the Interstate 5 P&T System. Additional optimization of P&T O&M and monitoring will be evaluated periodically (e.g., in annual O&M and annual GWM reports).

Landfill 4: As discussed in the Remedial Actions Section, the only remaining components of the site remedy are maintenance of LUCs along with GWM. As discussed in the Progress Since the Last Review Section and detailed in Table 3, LUCs are in place as intended by the ROD in order to complement other in place remedial components and to prevent potentially unacceptable exposures. Fort Lewis ERP has specified the details of how the LUCs are implemented (e.g., LUC objectives, mechanisms, monitoring, enforcement, reporting, enforcement) in the 2007 LUC Plan. Fort Lewis ERP oversees on a daily basis the effective and consistent functioning of the LUC mechanisms described in the LUC Plan (e.g., LUC data layer in Geographic Information System, LUC overlay for Real Property Master Plan, LUC overlay for environmental review procedures, LUC overlay for Digging Permit approval). TCE in the groundwater source area (i.e., LF4-MW8A, MW-DG1, and MW-UG1) has decreased from pre-treatment concentrations greater than 100 µg/L to a maximum 2007 concentration of 11 µg/L as a result of the air sparging/soil vapor extraction treatment from 1996 to 1999. Downgradient TCE concentrations have also decreased such that the only MWs with TCE concentrations above 5 µg/L in the 2007 GWM event were MW-DG1 and MW-UG1 (which are located in the former source area). Although VC concentrations in downgradient MWs LF4-2 and LF4-MW15B remain above the ROD goal of 1 µg/L, VC concentrations appear to be decreasing slightly from pre-treatment concentrations and are expected to continue decreasing as TCE concentrations decrease. During this five-year review period, concentrations of manganese in LF4-2, LF4-PNL1, and LF4-MW12A were detected above the Model Toxics Control Act (MTCA) Standard Method B groundwater cleanup level of 2200 µg/L. TCE, VC, and manganese concentrations in these isolated locations are relatively stable or declining and do not pose an unacceptable risk to human health or the environment since there are no complete exposure pathways. The annual remedy operation cost during the five-year review period has been less than \$6000 per year, which is less than the annual cost estimated in the 1993 FS of \$18,000 per year (when \$13,750 estimate in 1993 dollars is escalated to 2002 dollars at a 3% inflation rate) as a result of previous optimizations. One further GWM optimization that should be implemented is to stop monitoring for manganese at all MWs except LF4-2, LF4-PNL1, and LF4-MW12A in accordance with the ROD objective and to change the sampling methodology for the rest of the MWs from pumps to passive diffusion bag samplers.

SRCPP: As discussed in the Remedial Actions Section, the only remaining component of the site remedy is maintenance of LUCs. As discussed in the Progress Since the Last Review Section and detailed in Table 3, LUCs are in place as intended by the ROD in order to complement other in place remedial components and to prevent potentially unacceptable exposures. Fort Lewis ERP has specified the details of how the LUCs are implemented (e.g., LUC objectives, mechanisms, monitoring, enforcement, reporting, enforcement) in the 2007 LUC Plan. Fort Lewis ERP oversees on a daily basis the effective and consistent functioning of the LUC mechanisms described in the LUC Plan (e.g., LUC data layer in Geographic Information System, LUC overlay for Real Property Master Plan, LUC overlay for

environmental review procedures, LUC overlay for Digging Permit approval). There is no direct project cost associated with maintenance of LUCs, which is consistent with the 1993 FS. No additional opportunities for LUC optimization were identified at this time.

Battery Acid Pit: As discussed in the Remedial Actions Section and Progress Since the Last Review Section and detailed in Table 3, LUCs are the selected remedy and are in place as intended by the DD in order to prevent potentially unacceptable exposures. Fort Lewis ERP has specified the details of how the LUCs are implemented (e.g., LUC objectives, mechanisms, monitoring, enforcement, reporting, enforcement) in the 2007 LUC Plan. Fort Lewis ERP oversees on a daily basis the effective and consistent functioning of the LUC mechanisms described in the LUC Plan (e.g., LUC data layer in Geographic Information System, LUC overlay for Real Property Master Plan, LUC overlay for environmental review procedures, LUC overlay for Digging Permit approval). There is no direct project cost associated with maintenance of LUCs, which is consistent with the DD. No additional opportunities for LUC optimization were identified at this time.

DRMO Yard: As discussed in the Remedial Actions Section and Progress Since the Last Review Section and detailed in Table 3, LUCs are the selected remedy and are in place as intended by the DD in order to prevent potentially unacceptable exposures. Fort Lewis ERP has specified the details of how the LUCs are implemented (e.g., LUC objectives, mechanisms, monitoring, enforcement, reporting, enforcement) in the 2007 LUC Plan. Fort Lewis ERP oversees on a daily basis the effective and consistent functioning of the LUC mechanisms described in the LUC Plan (e.g., LUC data layer in Geographic Information System, LUC overlay for Real Property Master Plan, LUC overlay for environmental review procedures, LUC overlay for Digging Permit approval). There is no direct project cost associated with maintenance of LUCs, which is consistent with the DD. No additional opportunities for LUC optimization were identified at this time.

Illicit PCB Dump Site: As discussed in the Remedial Actions Section and Progress Since the Last Review Section and detailed in Table 3, LUCs are in place as intended by the DD in order to complement other in place remedial components and to prevent potentially unacceptable exposures. Fort Lewis ERP has specified the details of how the LUCs are implemented (e.g., LUC objectives, mechanisms, monitoring, enforcement, reporting, enforcement) in the 2007 LUC Plan. Fort Lewis ERP oversees on a daily basis the effective and consistent functioning of the LUC mechanisms described in the LUC Plan (e.g., LUC data layer in Geographic Information System, LUC overlay for Real Property Master Plan, LUC overlay for environmental review procedures, LUC overlay for Digging Permit approval). The annual LUC cost associated with cap maintenance has been less than \$2000 per year since 2004 (when the draft DD was first prepared), which is consistent with the annual cost of \$2000 indicated in the DD. No additional opportunities for LUC optimization were identified at this time.

Landfill 1: As discussed in the Remedial Actions Section, LUCs along with GWM are the selected remedy. As discussed in the Progress Since the Last Review Section and detailed in Table 3, LUCs are in place as intended by the DD in order to complement other in place remedial components and to prevent potentially unacceptable exposures. Fort Lewis ERP has specified the details of how the LUCs are implemented (e.g., LUC objectives, mechanisms,

monitoring, enforcement, reporting, enforcement) in the 2007 LUC Plan. Fort Lewis ERP oversees on a daily basis the effective and consistent functioning of the LUC mechanisms described in the LUC Plan (e.g., LUC data layer in Geographic Information System, LUC overlay for Real Property Master Plan, LUC overlay for environmental review procedures, LUC overlay for Digging Permit approval). The only exceedances of a MCL or MTCA Method A/Standard Method B groundwater cleanup levels are TCE in MWs 84-CD-LF1-3 and 84-CD-LF1-4, which are located adjacent to the landfill. TCE concentrations in these two MWs ranged from 5 µg/L to 24 µg/L between 2002 and 2007. TCE concentrations in these isolated locations are relatively stable and do not pose an unacceptable risk to human health or the environment since there are no complete exposure pathways. The total remedy cost between 2004 (when the draft DD was first prepared) and 2007 has been on the order of \$5000, which is consistent with the total cost estimated in the DD of \$10,000 for this period. No additional opportunities for GWM or LUC optimization were identified at this time.

Pesticide Rinse Area: As discussed in the Remedial Actions Section and Progress Since the Last Review Section and detailed in Table 3, LUCs are the selected remedy and are in place as intended by the DD in order to prevent potentially unacceptable exposures. Fort Lewis ERP has specified the details of how the LUCs are implemented (e.g., LUC objectives, mechanisms, monitoring, enforcement, reporting, enforcement) in the 2007 LUC Plan. Fort Lewis ERP oversees on a daily basis the effective and consistent functioning of the LUC mechanisms described in the LUC Plan (e.g., LUC data layer in Geographic Information System, LUC overlay for Real Property Master Plan, LUC overlay for environmental review procedures, LUC overlay for Digging Permit approval). There is no direct project cost associated with maintenance of LUCs, which is consistent with the implication in the DD. No additional opportunities for LUC optimization were identified at this time.

**QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICITY DATA, CLEANUP LEVELS, AND REMEDIAL ACTION OBJECTIVES (RAOs) USED AT THE TIME OF REMEDY SELECTION STILL VALID?**

Answer: Yes.

The assumptions used and remedy goals established at the time of remedy selection are still valid for each of the 8 FFA sites covered by this review as discussed below.

Logistics Center: The exposure assumptions and toxicity data used in the 1990 Baseline Human Health Risk Assessment as amended by the 2002 Risk Assessment Addendum that were used to develop the cleanup levels and remedial action objectives in the 1990 ROD as amended by subsequent decision documents are still valid and conservative. For instance, the most conservative value of the 2001 provisional draft cancer slope factor range for TCE was used in the 2002 Risk Assessment Addendum. There have been no changes in the physical condition assumptions such as land use changes that affect the protectiveness of the remedy. It should be noted that while commercial or industrial redevelopment of Landfill 2 for a construction material laydown yard or administrative building has been discussed conceptually, these potential land use changes would not affect the protectiveness of the remedy as long as the LUC objectives are achieved or the potential risks are controlled in another fashion. There have been no changes to

the MCLs promulgated under the Safe Drinking Water Act, which is the principal applicable and/or relevant and appropriate requirement for the site, that impact the groundwater remediation goals. No new contaminants of concern have been identified, although elevated concentrations of cis-DCE and VC have been detected in an isolated portion of Landfill 2 as discussed in the Issues Section. It should be noted that 1,4-dioxane is not a potential contaminant of concern based on 2004 groundwater sampling results. Finally, all potential exposure pathways have been addressed or are being controlled. The last five-year review had “No” as the answer to this question as the result of three Logistics Center potential exposure pathways identified in the 2002 Risk Assessment Addendum that had not been addressed at the time the review was prepared. However, in the past five years, all three of these potential exposure pathways have been addressed. Human ingestion, inhalation, and dermal exposure to SLA groundwater is being remedied by the SLA P&T System under construction in conjunction with LUCs and source reduction actions (i.e., drum removal, in-situ thermal treatment, EGDY P&T System). Human ingestion, inhalation, and dermal exposure to Landfill 2 soil is being remedied by LUCs per a 2006 DD and 2007 LUC Plan. Current human inhalation via vapor intrusion has been demonstrated to not pose an unacceptable risk or hazard in accordance with the 2007 indoor air sampling and potential future human inhalation is being remedied by LUCs as described in the 2007 LUC Plan. Thus, no necessary changes to these assumptions or remedy goals were identified in this review.

Landfill 4: As discussed in the Remedial Actions Section, the only remaining components of the site remedy are maintenance of LUCs along with GWM. The LUC and GWM portion of the remedy selected in the 1993 ROD was based on conservative exposure assumptions and toxicity data that are still valid. There have been no changes in the physical condition assumptions that affect the protectiveness of the remedy. There have been no changes to the MCLs promulgated under the Safe Drinking Water Act, which is the principal applicable and/or relevant and appropriate requirement for the site, that impact the groundwater remediation goals. Thus, no necessary changes to these assumptions or remedy goals were identified in this review.

SRCPP: As discussed in the Remedial Actions Section, the only remaining component of the site remedy is maintenance of LUCs. The LUC portion of the remedy selected in the 1993 ROD was based on conservative exposure assumptions and toxicity data that are still valid. There have been no changes in the physical condition assumptions such as installation of a water supply well within the site boundary that affect the protectiveness of the remedy. Thus, no necessary changes to these assumptions or remedy goals were identified in this review.

Battery Acid Pit: The LUC remedy selected in the 2006 DD was based on conservative exposure assumptions and toxicity data that are still valid. There have been no changes in the physical condition assumptions such as a change in land use to residential that affect the protectiveness of the remedy. Thus, no necessary changes to these assumptions or remedy goals were identified in this review.

DRMO Yard: The LUC remedy selected in the 2006 DD was based on conservative exposure assumptions and toxicity data that are still valid. There have been no changes in the physical condition assumptions such as a change in land use to residential that affect the protectiveness of the remedy. Thus, no necessary changes to these assumptions or remedy goals were identified in



this review.

Illicit PCB Dump Site: The LUC remedy selected in the 2006 DD was based on conservative exposure assumptions and toxicity data that are still valid. There have been no changes in the physical condition assumptions such as a change in land use or fence/cap disrepair that affect the protectiveness of the remedy. Thus, no necessary changes to these assumptions or remedy goals were identified in this review.

Landfill 1: The LUC and GWM remedy selected in the 2006 DD was based on conservative exposure assumptions and toxicity data that are still valid. There have been no changes in the physical condition assumptions that affect the protectiveness of the remedy. There have been no changes to the applicable MCLs promulgated under the Safe Drinking Water Act or MTCA Method A/Standard Method B groundwater cleanup levels, which are being used for conservative compliance evaluation purposes. Thus, no necessary changes to these assumptions or remedy goals were identified in this review.

Pesticide Rinse Area: The LUC remedy selected in the 2000 DD was based on conservative exposure assumptions and toxicity data that are still valid. There have been no changes in the physical condition assumptions such as a change in land use to residential that affect the protectiveness of the remedy. Thus, no necessary changes to these assumptions or remedy goals were identified in this review.

**QUESTION C: HAS ANY OTHER INFORMATION COME TO LIGHT THAT COULD CALL INTO QUESTION THE PROTECTIVENESS OF THE REMEDY?**

Answer: No.

No new information has come to light beyond what is described elsewhere in this five-year review that could call into question the protectiveness of the remedy such as new or previously unidentified ecological risks or natural disaster impacts.

## VIII. Issues

Table 5 summarizes outstanding issues to be addressed at the Fort Lewis CERCLA sites.

**Table 5: Issues**

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
<p>1. It was discovered following installation of LC-219 in 2004 that a portion of the lower Vashon Aquifer TCE plume located downgradient of the Logistics Center Interstate 5 P&amp;T System may extend off-post. The Logistics Center remedy is protective for the lower Vashon Aquifer since TCE in the lower Vashon Aquifer does not pose an unacceptable risk or hazard because there is no current or anticipated future drinking water use. However, it should be confirmed that the existing remedy (i.e., GWM to monitor protectiveness along with source control activities such as Landfill 2 drum removal activities, Landfill 2 in-situ thermal treatment, and the re-configured EGDY P&amp;T System) remains protective for TCE in the lower Vashon Aquifer by completing the recommendations outlined in the Recommendations and Follow-Up Actions Section.</p>	N	N
<p>2. An in-situ bioremediation research project was conducted near the Landfill 2 source area known as non-aqueous phase liquid Area 3 between 2004 and 2006. Although the research project was successful in treating a significant portion of TCE in Area 3 groundwater prior to and in conjunction with in-situ thermal treatment, cis-DCE and VC were produced as degradation byproducts. As a result, elevated concentrations of cis-DCE and VC that were not removed during the subsequent in-situ thermal treatment are now present immediately downgradient of Area 3. Cis-DCE and VC concentrations downgradient of Area 3 have been steadily declining since the research project was completed such that the current maximum concentrations are on the order of 1000 µg/L and 400 µg/L, respectively. The re-configured EGDY P&amp;T System is expected to continue capturing and treating the elevated cis-DCE and VC concentrations remaining in this isolated location. Each sample collected for compliance monitoring purposes is already analyzed for cis-DCE and VC. The groundwater remediation goal for cis-DCE is 70 µg/L, but there is no remediation goal stated in the ROD for VC. In the absence of a ROD remediation goal, the VC MCL of 2 µg/L is currently being used for evaluating data (e.g., VC concentrations in the EGDY P&amp;T effluent are below 2 µg/L).</p>	N	N
<p>3. As stated in the 1993 ROD, “the localized area of elevated manganese along the western borders of South and Northwest LF4 will be monitored to determine any changes in manganese concentrations.” An extensive groundwater monitoring data record has demonstrated that manganese concentrations are well below the MTCA Standard Method B groundwater cleanup level of 2200 µg/L for manganese in all MWs except LF4-2, LF4-PNL1, and LF4-MW12A, which are all along the western borders of South and Northwest LF4. Thus, the current practice of monitoring manganese in all MWs being sampled is unnecessary. Since manganese does not need to be monitored in most MWs, sampling of volatile organic compounds in all MWs except LF4-2, LF4-PNL1, and LF4-MW12A could be accomplished more efficiently with passive diffusion bag samplers.</p>	N	N

## IX. Recommendations and Follow-up Actions

Table 6 summarizes recommendations and follow-up actions associated with this review.

**Table 6: Recommendations and Follow-up Actions**

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
1. Lower Vashon Aquifer	Recommend confirmation of protectiveness of Logistics Center remedy for lower Vashon Aquifer following installation and sampling of two MWs currently being installed in Tillicum (proposed as LC-225 and LC-226). Potential follow-up actions could include additional GWM, installation of additional MWs, groundwater modeling, and/or remedy modifications in decision document, as necessary.	Fort Lewis ERP	EPA	Confirm protectiveness by September 2009	N	N
2. Landfill 2 Degradation Byproducts	Recommend discussion of cis-DCE and VC GWM results for MWs located downgradient of Area 3 in future annual GWM monitoring reports, until no longer warranted.	Fort Lewis ERP	EPA	Include in monitoring report for 2007 GWM events	N	N
3. Landfill 4 Monitoring Optimization	As discussed in the Technical Assessment Section, Landfill 4 monitoring should be optimized by stopping monitoring for manganese at all MWs except LF4-2, LF4-PNL1, and LF4-MW12A and changing the sampling methodology for the rest of the MWs from pumps to passive diffusion bag samplers.	Fort Lewis ERP	EPA	Amend GWM plan before next sampling event in 2008	N	N

**X. Protectiveness Statement**

The Logistics Center remedy is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. The remedies at Landfill 4, SRCPP, Battery Acid Pit, DRMO Yard, Illicit PCB Dump Site, Landfill 1, and Pesticide Rinse Area are protective of human health and the environment.

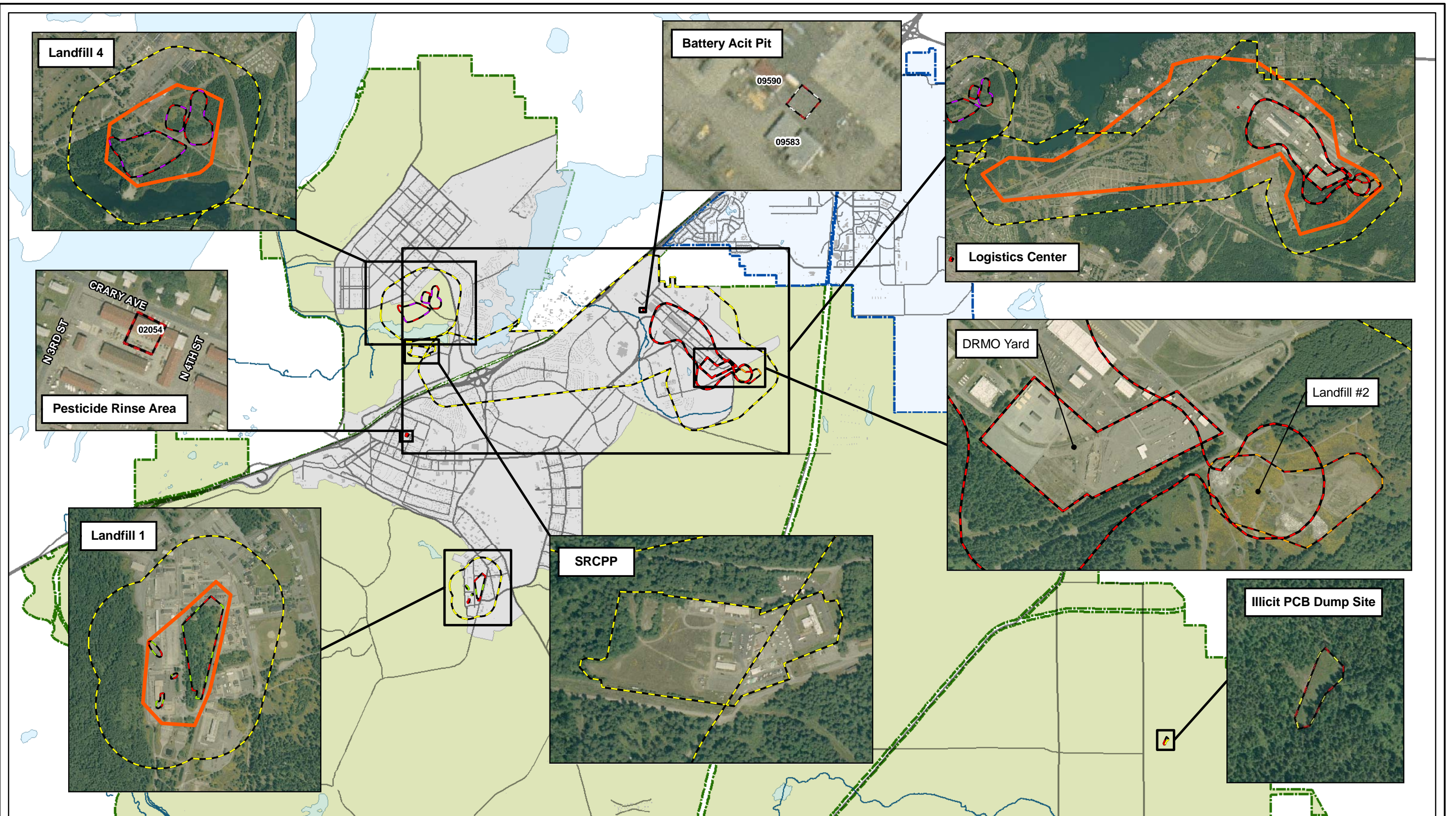
**XI. Next Review**

The next five year review is expected to be completed by September 2012, which is five years from the anticipated finalization of this report.



RANDALL W. HANNA  
Director of Public Works

26 Sept 2007  
Date



**Figure 1. LUCs at Fort Lewis CERCLA Sites**

0 0.5 1 2 3 4 5 Miles  
 Note: Scales vary for inset maps

- Fort Lewis Installation Boundary
- Fort Lewis Cantonment Area (Limit of Urban Development)
- Fort Lewis Military Training Areas and Golf Course
- CERCLA Site Boundary
- Prevent residential land use.
- Prevent residential land use, prevent unplanned excavation of contaminated soil, prevent training access, and maintain boundary fence with signs.
- Prevent new drinking water wells without EPA approved monitoring plan.
- Prevent residential land use, prevent unplanned excavation of contaminated soil, and prevent digging, bivouacking, or off-road vehicle maneuvering during training.
- Prevent residential land use and prevent unplanned excavation of contaminated soil.
- Prevent residential land use, prevent unplanned excavation of contaminated soil, and maintain cap.
- Prevent residential land use, prevent unplanned excavation of contaminated soil. Prevent training access. Maintain boundary fence with signs, and maintain cap.

reference file L:\angela\mxd\luc\_11x17\_20070925.mxd; print file N:\maplibrary\monthly\200709\luc\_11x17\_20070925.pdf

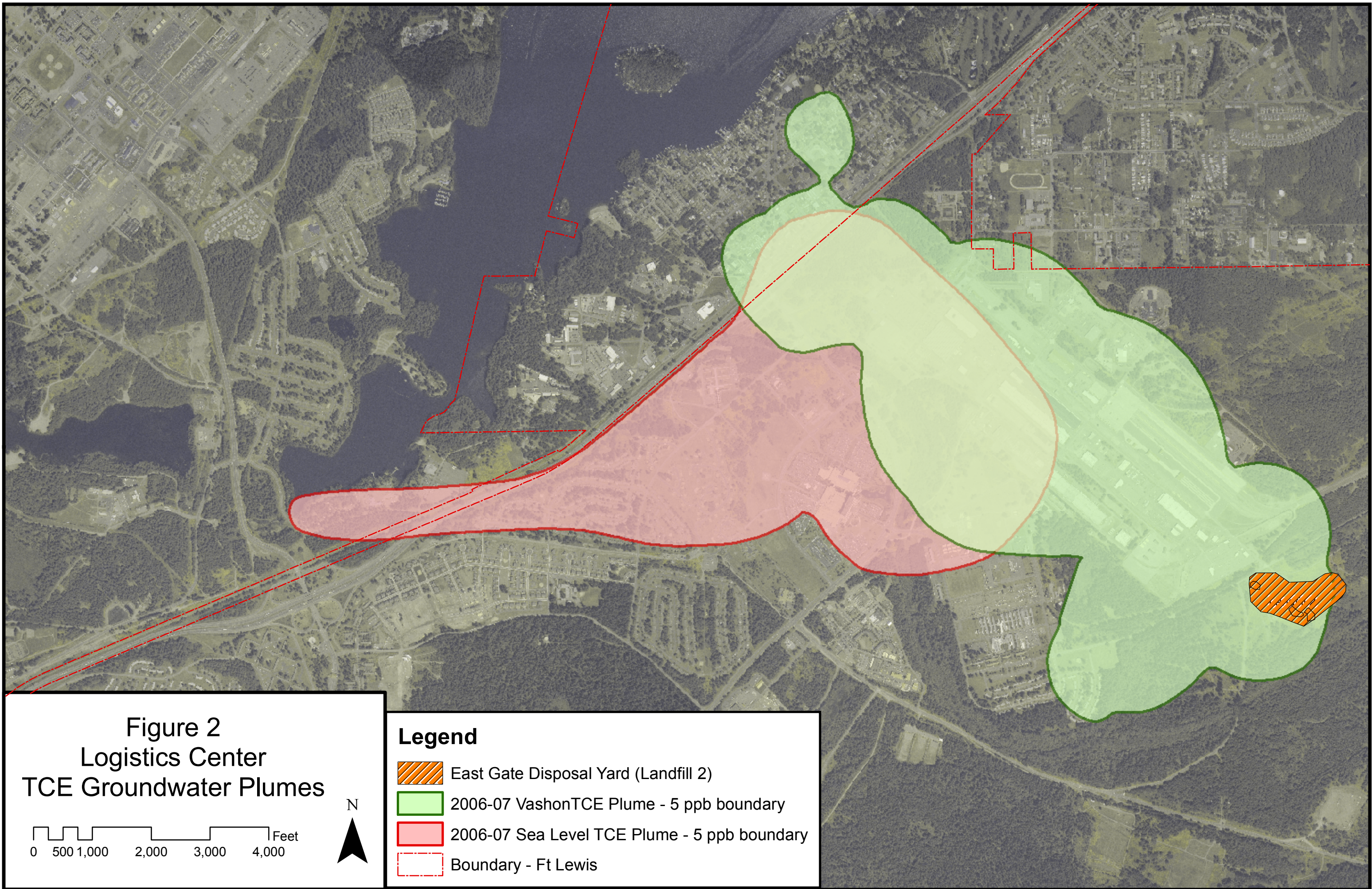

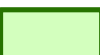




Figure 2  
Logistics Center  
TCE Groundwater Plumes

0 500 1,000 2,000 3,000 4,000 Feet



**Legend**

-  East Gate Disposal Yard (Landfill 2)
-  2006-07 Vashon TCE Plume - 5 ppb boundary
-  2006-07 Sea Level TCE Plume - 5 ppb boundary
-  Boundary - Ft Lewis



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 10  
1200 Sixth Avenue  
Seattle, WA 98101

SEP 28 2007

Reply to  
Attn Of: ECL-117

Randall W. Hanna, Director  
Public Works  
Attn: IMWE-LEW-PW, MS 17 (R Hanna)  
Box 339500  
Fort Lewis, WA 98433-9500

Re: EPA Concurrence with Third Five Year Review,  
Fort Lewis CERCLA Sites, Pierce County, Washington

Dear Mr. Hannah:

EPA has reviewed the Third Five Year Review for the Fort Lewis CERCLA Sites, Pierce County, Washington, which was signed by the U.S. Army on September 26, 2006. EPA is encouraged by the progress the Army has made in implementing the recommendations set forth in previous Five Year Reviews and acknowledges the efforts of the Federal Facility Agreement (FFA) project team. This Five Year Review covers all CERCLA sites identified in the FFA with remedies that require ongoing action. This review does not cover the Ft. Lewis Landfill Number 5 National Priorities List (NPL) Site, which was separately listed, resulted in a No Action Record of Decision, and does not require Five Year Reviews.

EPA reviewed the document for technical adequacy, accuracy, and consistency with EPA guidance. The document provides a clear summary of the status of individual sites. It also identifies a number of actions to be taken that affect the protectiveness of the selected remedies and documents a schedule for completion of the recommended actions.

Based on EPA's review of the 2007 Third Five-Year Review, and other knowledge and documents regarding the site and remedies, and consistent with EPA's "Comprehensive Five Year Review Guidance," July 2001, EPA concurs with the Reports findings and recommendations, with the exception of the use of Decision Documents for Institutional Controls. EPA's additional recommendation and follow-up action for the Army to address this issue is detailed in the enclosure.

EPA is generally in agreement with the Army's determinations that the selected remedies are or will be protective so long as the Remedial Actions are completed as planned and the follow up actions identified by the Army and EPA are addressed in a timely manner, and that in the interim exposure pathways that could result in unacceptable risks are being controlled. However, because of the need for follow-up to ensure the remedies remain protective, EPA's formal protectiveness determinations for

each of the five Ft. Lewis CERCLA Operable Units (as required by EPA Guidance for sites which are not yet construction complete) are "protective in the short term." The complete protectiveness statements for each Operable Unit are detailed in the enclosure.

EPA looks forward to working with the Army on implementing the recommended actions in the five year review report and in EPA's findings.

The next statutory five year review will be done no later than five years from date of this concurrence letter. If you have questions concerning this letter, please call me at 206/553-1855, or contact EPA's site manager for this review, Christopher Cora, at 206/553-1478 (email: [cora.christopher@epa.gov](mailto:cora.christopher@epa.gov)).

Sincerely,



Daniel D. Opalski, Director  
Office of Environmental Cleanup

Enclosure

cc: Barry Rogowski, WDOE  
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EPA's Fort Lewis Operable Unit Specific Protectiveness Determinations

Operable Unit	Protectiveness Determination	Protectiveness Statement
1 - Upper Aquifer	Protective in the short term	The remedy at the Upper Aquifer OU currently protects human health and the environment because the remedy is operating as expected and in the interim, exposure pathways that could result in unacceptable risks are being controlled. However in order to ensure the remedy remains protective for the long term, the following action needs to be taken: confirm that existing DDs and LUCs (Institutional Controls) satisfy CERCLA requirements and are consistent with EPA guidance and current policies. If not, consolidate all LUC remedies into an ESD.
2 - Landfill #4	Protective in the short term	The remedy at the Upper Aquifer OU is complete and currently protects human health and the environment because the remedy is operating as expected and in the interim, exposure pathways that could result in unacceptable risks are being controlled. However in order to ensure the remedy remains protective for the long term, the following action needs to be taken: confirm that existing DDs and LUCs (Institutional Controls) satisfy CERCLA requirements and are consistent with EPA guidance and current policies. If not, consolidate all LUC remedies into an ESD.
3 - Solvent Refined Coal Pilot Plant	Protective in the short term	The remedy at the SRCPP OU currently protects human health and the environment because the remedy is complete and in the interim, exposure pathways that could result in unacceptable risks are being controlled. However in order to ensure the remedy remains protective for the long term, the following action needs to be taken: confirm that existing DDs and LUCs (Institutional Controls) satisfy CERCLA requirements and are consistent with EPA guidance and current policies. If not, consolidate all LUC remedies into an ESD.
4 - East Gate Disposal Yard	Protective in the short term	The remedy at the East Gate Disposal Yard OU is complete and currently protects human health and the environment and in the interim, exposure pathways that could result in unacceptable risks are being

		controlled. However in order to ensure the remedy remains protective for the long term, the following action needs to be taken: confirm that existing DDs and LUCs (Institutional Controls) satisfy CERCLA requirements and are consistent with EPA guidance and current policies. If not, consolidate all LUC remedies into an ESD.
5 – Lower Aquifer	Protective in the short term	The remedy at the Lower Aquifer OU currently protective is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. However in order to ensure the remedy remains protective for the long term, the following action needs to be taken: monitor to confirm Logistics Center remedy is protective for the lower Vashon Aquifer, confirm that existing DDs and LUCs (Institutional Controls) satisfy CERCLA requirements and are consistent with EPA guidance and current policies. If not, consolidate all LUC remedies into an ESD.