Five-Year Review Report

First Five-Year Review Report

for

Manchester Annex Superfund Site

Manchester

Kitsap County, Washington

September, 2004

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FIVE-YEAR REVIEW FOR

MANCHESTER ANNEX SUPERFUND SITE

MANCHESTER

KITSAP COUNTY, WASHINGTON

Approved by:

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Table of Contents

List of Acronyms……iii
Executive Summary…… v
Five-year Review Summary Form…… viii

1 INTRODUCTION..... 1

2 SITE CHRONOLOGY..... 2

3 BACKGROUND..... 2

3.1 PHYSICAL CHARACTERISTICS..... 2
3.2 LAND AND RESOURCE USE – PAST, PRESENT, AND FUTURE..... 2
3.3 HISTORY OF CONTAMINATION AND INITIAL RESPONSE..... 3
3.4 BASIS FOR TAKING ACTION..... 4

4 REMEDIAL ACTIONS..... 6

4.1 REMEDY SELECTION..... 6
4.2 REMEDY IMPLEMENTATION..... 9
4.3 OPERATIONS AND MAINTENANCE..... 14

5 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW..... 18

6 FIVE-YEAR REVIEW PROCESS..... 18

6.1 ADMINISTRATIVE COMPONENTS..... 18
6.2 COMMUNITY INVOLVEMENT..... 18
6.3 DOCUMENT REVIEW..... 19
6.4 DATA REVIEW AND TRENDS..... 20
6.5 SITE INSPECTION..... 22
6.6 INTERVIEWS..... 23

7 TECHNICAL ASSESSMENT & SUMMARY OF REMEDY PROTECTIVENESS . 26

7.1 QUESTION A: IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS?..... 26
7.2 QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICITY DATA, CLEANUP LEVELS, AND REMEDIAL ACTION OBJECTIVES (RAOS) USED AT THE TIME OF THE REMEDY STILL VALID? 28
7.3 QUESTION C: HAS ANY OTHER INFORMATION COME TO LIGHT THAT COULD CALL INTO QUESTION THE PROTECTIVENESS OF THE REMEDY?..... 30

8 ISSUES, RECOMMENDATIONS, AND FOLLOW-UP ACTIONS..... 30

9 PROTECTIVENESS STATEMENT(S)..... 33

10 NEXT REVIEW..... 34

11 REFERENCES..... 35

Table of Contents - continued

TABLES

Table 1. Site Chronology 2
Table 2. I&M Activities and Associated Costs 15
Table 3. System Operations/O&M Costs 18
Table 4. Documents Reviewed 19
Table 5. Cleanup Levels and Cleanup Goals for Manchester Site 20
Table 6. Comparison of Consumption Rates of Shellfish (grams per day per individual) 29
Table 7. Changes to Chemical-specific Standards 29
Table 8. Issues 30
Table 9. Recommendations and Follow-up Actions 31

ATTACHMENTS

Attachment A – Site Map
Attachment B – Regulations, Guidance, and "To-Be-Considered" (TBC) Documents
Attachment C – Site Inspection Checklist
Attachment D – Site Photos

List of Acronyms

AET	Apparent Effects Threshold
ARAR	Applicable or Relevant and Appropriate Requirement
ATSDR	Agency for Toxic Substance and Disease Registry
BMP	Best Management Practices
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
CMP	Compliance Monitoring Plan
CO	Cleanout
COPCs	Chemicals of Potential Concern
CRCMP	Cultural Resources Construction Management Plan
CT	Central Tendency
EPA	United States Environmental Protection Agency
FCS	Fish Consumption Survey
FFTA	Former Fire Training Area
GSA	Garry Struthers Associates
HC	Hart Crowser
HI	Hazard Index
HRS	Hazard Ranking Score
I&M	Inspection and Maintenance
IAG	Interagency Agreement
ICP	Institutional Control Plan
MFS	Minimum Functional Standards
MTCA	Model Toxics Control Act
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
O&M	Operations and Maintenance
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PPM	Parts per million (mg/kg)
QA	Quality Assurance
RAO	Remediation Action Objective
RAR	Remedial Action Report
RD	Remedial Design
RI/FS	Remedial Investigation / Feasibility Study
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
RME	Reasonable maximum exposure
ROD	Record of Decision

List of Acronyms – continued

SAP	Sampling and Analysis Plan
SOW	Statement of Work
SPLP	Synthetic Precipitation Leaching Procedure
SQS	Sediment Quality Standard
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
USACE	United States Army Corps of Engineers
USC	United States Code
WAC	Washington Administrative Code

Executive Summary

Purpose for the Five-year Review

The U.S. Army Corps of Engineers (USACE) has conducted the first five-year review of the Manchester Annex Superfund Site in Manchester, Washington, pursuant to an Interagency Agency Agreement (IAG) between the USACE and the U.S. Environmental Protection Agency (EPA), Region 10. Under the Defense Environmental Restoration Act, the USACE is responsible for cleanup actions at Formerly Used Defense Sites (FUDS) on behalf of all three Services. The purpose of this five-year review is to determine whether the remedial actions implemented at the Manchester site (a former Navy complex) are protective of human health and the environment. This five-year review is required because hazardous substances remain on-site above the risk-based levels determined in the Record of Decision (ROD), thereby preventing unlimited use and unrestricted exposure. The methods, findings, and conclusions of the review are documented in this report. In addition, this report summarizes issues identified during the review and includes recommendations and follow-up actions for them. For those issues that should have been completed by the time of the review but were not, the reasons can be attributed to repeated changes in project management and limited funds.

Triggering Action for the Review

According to EPA five-year review guidance (EPA 540-R-01-007), a five-year review should be completed within five years from the start date of remedial action (the "triggering action"), which is defined as the day the contractor mobilizes on-site to begin construction. The Superfund database ("CERCLIS") did not list a start date for construction for the Manchester Annex Site at the time this report was initially prepared. Consequently, the completion date for the remedial design phase, June 22, 1999, was identified by EPA Region 10 as the accepted trigger date for the five-year review. The reason this five-year review was not completed by June 22, 2004 was due to the USACE's different understanding of when a five-year review is triggered, based on Department of Army Guidance for FUDS sites (ER200-3-1). The Army guidance indicates that a five-year review should be completed within five years from the *completion date* of remedial actions, which in this case would have been 2006 since remedial actions were completed in 2001.

Site Location and Contaminants

The site is located on the western shore of Clam Bay, about one mile north of Manchester, Washington. The Manchester site, also known as the Old Navy Dump/Manchester Laboratory (USEPA/NOAA) Site, was historically owned by the U.S. Navy and consists of a former fire training area (FFTA), a landfill, and a former submarine net and boat depot (the Net Depot). The activities in these areas resulted in various types of contamination. Fire training activities contaminated the soil with dioxins and petroleum hydrocarbons, and landfilling activities contaminated soil and sediment with dioxins and furans, polychlorinated biphenyls (PCBs), metals, vinyl chloride, and asbestos. Although activities at the Net Depot resulted in low-level metal contamination in the soil and seeps nearby, the potential health risks were determined to be minimal and consequently no cleanup measures were proposed for the Net Depot.

Remedial Actions

The selected remedy to clean up the contamination included a landfill cap and shoreline protection system, a sediment cap in the intertidal area, and removal of contaminated soil and structures in the former fire training area. In addition, a restriction on subsistence-level shellfish harvesting was put into place until it can be determined that the shellfish are safe for subsistence-level harvesting. This determination can be made once sediment and tissue sampling occurs, which is scheduled to occur in late 2004 to early 2005.

Neighboring Beaver Creek, though not contaminated, was also restored as part of the remedial actions to compensate for losses in wetland area caused by construction of the landfill cap and shoreline protection system. On a positive note, subsequent biological monitoring at Beaver Creek has determined that a large number of salmon were using the newly restored stream almost as soon as the construction was finalized, indicating that the restoration has been successful at improving fish habitat.

Costs to date for operation and maintenance of the remedial actions have been approximately $44,500, which are very close to the costs estimated by EPA in the Preliminary Close-out Report for the Manchester Site (2002).

Site Visit

As part of the five-year review process, a site inspection took place on July 20, 2004 to observe the condition of the site. On the same day, a group interview was conducted with personnel from the EPA Manchester Laboratory, National Oceanic and Atmospheric Administration (NOAA) Fisheries, EPA Region 10, and the Suquamish Tribe. The five-year review was also advertised in local papers to solicit public input.

Remedy Protectiveness and Future Actions

The remedy was determined to be protective of human health in the short-term because a restriction on subsistence-level harvesting of intertidal bivalve organisms is in place, the landfill cap and shoreline protection system are intact, and the cleanup requirements for the FFTA have been met. The shellfishing restriction, however, was intended only as a temporary measure during the initial recovery period. Seep, sediment, and tissue sampling data are necessary to evaluate the current status and the long-term protectiveness of the actions implemented for the landfill and Clam Bay. New information was also provided to EPA and the USACE in the Suquamish Tribe's 2000 *Fish Consumption Survey*, which indicated that tribal shellfishers consume clams at a rate several times greater than originally estimated in the remedial investigation/feasibility study (RI/FS) and ROD during the determination of a sediment cleanup level for PCBs. At this time, it is considered premature to revisit the attainment of cleanup levels. Instead, the compliance monitoring plan (CMP), which will be completed and implemented during fiscal year 2005 (subject to the availability of funds), will address the status of PCBs in sediment and shellfish tissue in Clam Bay. This topic may then be appropriate for discussion during the next five-year review.

The protectiveness of the remedy for the environment (flora and fauna on land and in the marine environment) could only be partially determined during the five-year review, due to the lack of monitoring data. The landfill cap was determined to be sufficient to prevent wildlife contact with the landfill wastes, to provide adequate protection from upland exposure conditions, and to

prevent infiltration of precipitation into the landfill. The protectiveness of the remedy regarding marine intertidal fauna, however, cannot be determined until seep, sediment, and tissue monitoring and sampling occur. These activities will be undertaken as soon as funds are available following the five-year review. Once data are available, a protectiveness determination can be made.

Other issues found with respect to the requirements of the ROD were as follows: (1) a final institutional control plan (ICP) has not been implemented due to unresolved issues that EPA identified in the original 1998 draft; (2) the presence of landfill seeps has not been systematically sought during normal inspection and maintenance activities; and (3) maintenance on the landfill cap does not appear to be aggressive enough to prevent unwanted vegetation (with roots that could potentially damage the liner) from growing on the landfill cap.

To ensure that the remedy complies with the requirements of the ROD and provides long-term protection of human health and the environment, the following measures should be taken: (1) a final institutional control plan, including a compliance monitoring plan, should be implemented; (2) the presence of any landfill seeps should be actively sought and documented; and (3) unwanted vegetation such as blackberries, alders, and scotch broom present on the landfill cap should be aggressively removed to prevent possible future damage to the cap. In addition, sediment and shellfish tissue sampling is scheduled to occur in late 2004 to early 2005 to determine when shellfish will be safe for subsistence-level harvesting.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name *(from CERCLIS)*: OLD NAVY DUMP/MANCHESTER LABORATORY (USEPA/NOAA)		
EPA ID *(from CERCLIS)*: WA8680030931		
Region: 10	**State:** WA	**City/County:** Manchester/Kitsap
SITE STATUS		
NPL status: on the final NPL		
Remediation status: Complete		
Multiple OUs?[1] No	**Construction completion date:** October 2001	
Has site been put into reuse? The landfill portion is excluded from active use. However, portions of the former fire training area are now covered with asphalt and used for parking. Also, recreational fishers are now permitted to use the beach and collect shellfish.		
REVIEW STATUS		
Lead agency: US EPA, Region 10		
Author name: Veronica Henzi		
Author title: Environmental Engineer	**Author affiliation:** US Army Corps of Engineers	
Review period: 6/17/04 – 9/30/04		
Date(s) of site inspection: 7/20/04		
Type of review: Statutory		
Review number: 1		
Triggering action: Start of remedial action construction		
Triggering action date *(from CERCLIS)*:[2] 6/22/1999		
Due date *(five years after triggering action date)*: 6/22/2004		

Issues:

1. An institutional control plan needs to be finalized and implemented at the Manchester site, which will address contaminants left in-place, deed covenants, fishing restrictions, and maintaining the integrity of the landfill cap and shoreline protection system.
2. Monitoring of seeps at the toe of the landfill has not been occurring.
3. Unwanted vegetation with roots that may be capable of damaging the landfill cap is growing on the landfill.

Recommendations and Follow-up Actions:

1. Finalize and implement an institutional control plan.
2. Monitor (and test if necessary) landfill seeps.
3. Remove unwanted vegetation from landfill cap.

Protectiveness Statement:

The remedy was determined to be protective of human health in the short-term because a restriction on subsistence-level harvesting of intertidal bivalve organisms is in place, the landfill cap and shoreline protection system are intact, and the cleanup requirements for the FFTA have been met. The shellfishing restriction, however, was intended only as a temporary measure during the initial recovery period. Seep, sediment, and tissue sampling

data are necessary to evaluate the current status and the long-term protectiveness of the actions implemented for the landfill and Clam Bay. New information was also provided to EPA and the USACE in the Suquamish Tribe's 2000 *Fish Consumption Survey*, which indicated that tribal shellfishers consume clams at a rate several times greater than originally estimated in the remedial investigation /feasibility study (RI/FS) and ROD during the determination of a sediment cleanup level for PCBs. At this time, it is considered premature to revisit the attainment of cleanup levels. Instead, the compliance monitoring plan, which will be completed and implemented during fiscal year 2005 (subject to the availability of funds), will address the status of PCBs in sediment and shellfish tissue in Clam Bay.

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To ensure that the remedy complies with the requirements of the ROD and provides long-term protection of human health and the environment, the following measures should be taken: (1) a final institutional control plan, including a compliance monitoring plan, should be implemented; (2) the presence of any landfill seeps should be actively sought and documented; and (3) unwanted vegetation such as blackberries, alders, and scotch broom present on the landfill cap should be aggressively removed to prevent possible future damage to the cap.

Other Comments: The ROD is not explicit as to which "shellfish" should be restricted from subsistence-level consumption. The RI/FS seems to suggest that only clams should be restricted. Table 15 of the ROD also indicates that the point of compliance is "intertidal clams" for achieving PCB cleanup goals. Other edible shellfish such as subtidal crab, sea cucumbers, and geoducks were not sources of significant risk from site-related contamination, and thus are not deemed to be covered by the ROD restriction. Since the Suquamish Tribe currently maintains a restriction on subsistence-level harvesting of bivalves (clams, oysters, etc.) in the intertidal areas of Clam Bay, the requirements of the ROD are being met.

1- "OU" refers to operable unit.

2 - This was the completion date for the remedial design phase. This date has been identified by Bob Kievit, Site Manager for EPA Region 10, as the accepted trigger date for the five-year review.

1 INTRODUCTION

The purpose of a five-year review is to determine whether remedial actions performed at a Superfund site are protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and identify recommendations to address them.

The United States Environmental Protection Agency (EPA) is overseeing this five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121(c), 42 United States Code (USC) Section 9621(c), and the National Contingency Plan (NCP). CERCLA §121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with Section 9604 (CERCLA §104) or Section 9606 (CERCLA §106) the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The EPA interpreted this requirement further in the NCP, as stated in 40 CFR §300.430(f)(4)(ii):

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

The United States Army Corps of Engineers (USACE), Seattle District, has conducted the first five-year review of the remedial actions implemented at the Manchester Annex Superfund Site in Manchester, Washington (EPA ID# WA8680030931). The Manchester site, also known as the Old Navy Dump/Manchester Laboratory (USEPA/NOAA) Site, is considered one operable unit (OU) and consists of a former fire training area (FFTA), a landfill, and a former submarine net and boat depot (the Net Depot). This review was conducted from June 2004 through September 2004 by the USACE, and the results are documented in this report.

The triggering action for this statutory review was the initiation of remedial action on June 22, 1999.[1] The five-year review is required due to the fact that contaminants (landfill waste, petroleum-contaminated soil, PCBs) remain on-site above risk-based levels that allow for unlimited use and unrestricted exposure.

[1] This was the completion date for the remedial design phase. This date has been identified by Bob Kievit, Site Manager for EPA Region 10, as the accepted trigger date for the five-year review.

2 SITE CHRONOLOGY

Table 1 below lists the chronology of ownership and events at the Manchester site [USEPA, 2004a].

Table 1. Site Chronology

Event	Dates
U.S. Army establishes ownership of site	1898
Ownership is transferred to U.S. Navy	1919
State of Washington, EPA, and National Oceanic and Atmospheric Administration acquire parts of the property	1970s
Discovery of Site	3/1/87
Preliminary Assessment	3/25/88
Hazard Ranking Score (HRS) Package complete	10/29/93
Final listing on National Priorities List	5/31/94
Interagency Agreement (IAG) negotiations and final agreement	7/6/94 to 7/30/97
Remedial Investigation (RI)/Feasibility Study (FS)	10/18/94 to 12/96
Record of Decision (ROD) signed	9/30/97
Non time-critical removal action[1]	6/8/98 to 9/29/98
Remedial Design (RD)	11/18/97 to **6/22/99**
Remedial Action - Construction dates (start and finish)	6/99 to 10/01
Preliminary close-out report	9/30/02

1 – In 1998, the main concrete simulator structures, underground piping, and petroleum-contaminated soil at the FFTA were removed.

3 BACKGROUND

3.1 Physical Characteristics

The Manchester site, located approximately one mile north of Manchester, Washington, is situated on the western shore of Clam Bay in Puget Sound (see Attachment A - Site Map). Clam Bay is a sensitive marine estuary, used primarily by recreational shellfishers and known to be used by bald eagles and chinook salmon.[2]

3.2 Land and Resource Use – Past, Present, and Future

The U.S Army established ownership of the site in 1898 and transferred ownership to the U.S. Navy in 1919. The Navy used the site for submarine net and boat construction and maintenance, fire fighting training, and waste disposal of on-site waste and waste generated from the Puget Sound Naval Shipyard in Bremerton, Washington. As shown on the map, the landfill area is bordered to the north by the former Net Depot, to the south by the FFTA, to the west by Manchester State Park, and to the east by Clam Bay.

In the 1970s, the EPA and NOAA acquired parts of the property and currently operate an analytical laboratory and a fisheries research laboratory, respectively. As of 2000,

[2] The bald eagle and chinook salmon are designated as threatened under the Endangered Species Act, but they are not the focus of the ecological risk assessment for the Manchester Site. The ecological risk assessment is discussed further in section 3.4.

approximately 100 employees were employed at the laboratories. The EPA's property encompasses the northern 17.5 acres of the site. The EPA Manchester laboratory, an associated concrete parking pad, and other facilities occupy the northern-most fives acres of the EPA property, which is also the location of the former Net Depot. The landfill is located within the central 12.5 acres of the site and a small portion of the northwestern corner of the landfill area extends onto Manchester State Park property. The southern 22.5 acres of the site was the location of the former Navy Fire Training School and is currently occupied by the NOAA National Marine Fisheries Service (NMFS).

Future use of the site assumes continued operation of the laboratories, and subsistence-level shellfishing by the Suquamish Indian Tribe once the PCB levels in shellfish tissue have been reduced to acceptable levels.

3.3 History of Contamination and Initial Response

When the Navy owned the site, the primary activities were submarine net construction and maintenance, fire fighting training, and waste disposal. The Net Depot operated from approximately 1940 to the 1950s and included additional operations such as sand blasting, painting, and machining.

The fire training area was used to train Navy personnel on procedures for extinguishing ship fires. Large concrete structures known as "simulators" were used to simulate ship compartments. Diesel, gasoline, and waste oil were used in live fire training exercises and stored in underground storage tanks (USTs). The use and burning of fuel resulted in soil contaminated primarily with dioxins and total petroleum hydrocarbons (TPH).

From roughly 1946 to 1962 the Navy formed the landfill by using the tidal lagoon area between the Net Depot and the fire training area to dispose of approximately 70,000 cubic yards of demolition debris. The landfill occupies roughly six acres, has an average thickness of six feet, and was initially covered with a one-foot layer of sand and gravel. The landfill soil is contaminated with dioxins and furans, PCBs, metals, vinyl chloride, and asbestos. Over time, waste from the southeastern landfill edge eroded into Clam Bay and subsequently contaminated the water, sediment, and shellfish with PCBs, dissolved metals, and polycyclic aromatic hydrocarbons (PAHs) (a breakdown is provided in Section 3.4).

As an initial response measure to minimize contact with landfill waste, the Navy placed a one-foot thick soil cap over the landfill in the late 1950s/early 1960s. Further investigation into site contamination, however, was not formally conducted until 1987. Between 1987 and 1994, several investigations and a UST removal and closure action were undertaken by the USACE, EPA, and NOAA. Based on the findings, the Manchester site was listed on the CERCLA National Priorities List in 1994. The CERCLA remedial activities are being conducted under the Formerly Used Defense Site program. The RI/FS for the Manchester site, completed in 1996, was conducted by the USACE and overseen by the EPA in accordance with the IAG.

3.4 Basis for Taking Action

Twelve chemicals of potential concern (COPCs) identified by the RI/FS in site media that exceeded risk-based remediation goals are listed below:[3]

Soil (Landfill)	**Soil (FFTA)**	**Sediment**	**Tissue (clams, geoducks, sea cucumbers)[4]**
PCBs	Dioxins/Furans (also in simulator debris)	PCBs	PCBs
Arsenic		Cadmium	Dioxins
Cadmium		Copper	Arsenic
Copper		Lead	*PAHs*
Lead		*Mercury*	Copper
Nickel		Zinc	*Manganese*
Silver		Dioxins	
Zinc		2,4-dimethylphenol	
Dioxins/Furans			
Asbestos			
Vinyl Chloride			

These chemicals were identified by screening validated sampling data from the site against the following risk-based criteria:

- Model Toxics Control Act (MTCA) cleanup levels for soil, groundwater, and surface water [WAC173-340];
- State surface water quality standards [WAC173-201A] and federal Clean Water Act criteria [40 CFR 131, the National Toxics Rules]
- EPA Region 3 screening levels for soil, water, and fish/shellfish tissue [Smith, 1995]
- Plant and wildlife protection screening values for soils obtained from Will and Suter [1994] and Oak Ridge National Laboratory [1994]
- Washington State Department of Ecology Sediment Management Standards [WAC173-204]

Human health and ecological risk assessments were then performed to determine appropriate site cleanup requirements based on the current use of the site (non-residential). The human health risk assessment evaluated three scenarios: risk to an on-site worker; risk to a subsistence consumer of shellfish; and risk to an occasional site visitor (including children). The assessment established that potential long-term risks to an on-site worker and occasional site visitor were associated primarily with potential skin contact and incidental ingestion of waste materials (soil and debris from the landfill and FFTA) containing elevated metals and dioxin/furan concentrations. Long-term health risks to subsistence shellfish consumers were based on consumption of PCB-contaminated shellfish collected from the Clam Bay intertidal area.[5]

[3] Although the italicized chemicals and compounds were detected in tissue and sediment samples, they were not included as part of the final twelve COPCs. After risk assessment evaluation, it was determined that they posed either minimal risk to human health and the environment, or that remedial actions to address the twelve COPCs would also manage risk associated with these additional constituents.

[4] Manganese concentrations, which were most significantly elevated in subtidal geoducks, were assumed to be the result of nearby commercial salmon net pen activities, rather than site-related activities.

[5] "Intertidal" is defined as the area between high and low tide [Ecology, 2004].

The ecological risk assessments established that metals, PCBs, and furans in the landfill could negatively impact microbial and soil processes, plant growth, earthworms, and small rodents. Metals leaching from the landfill, as well as PCBs and 2,4-dimethylphenol detected in marine sediments, could result in acute and/or chronic toxicity to marine life and pose a risk to wildlife whose entire diet consisted of Clam Bay prey. The risk assessments concluded that there could be a current or potential threat to human health and the environment if actual or threatened releases from the site were not cleaned up.

Based on the RI/FS and the risk assessments, a set of remedial action objectives (RAOs) was developed for the site areas. The RAOs, as specified in the ROD, are listed below by area:

Landfill and Clam Bay Areas

- Prevent human and wildlife contact with solid wastes and soils/sediments in the landfill
- Prevent fugitive dust emissions containing asbestos
- Prevent shoreline erosion of landfill wastes
- Reduce solubilization and migration of landfill contaminants to Clam Bay by eliminating seeps or by improving the quality of the seeps so that they meet water quality criteria
- Reduce concentrations of metals, PCBs, and 2,4-dimethylphenol to below cleanup levels for sediments in the biologically active zone (0 to 10 centimeter depth)
- Prevent subsistence-level harvesting of shellfish in the near-shore areas of Clam Bay until the shellfish are determined to be safe

Additional cleanup levels and goals were established for aquatic exposure pathways in the marine environment, which included:

- A cumulative hazard index under 1, and a cumulative cancer risk goal under future reasonable maximum exposure (RME) conditions of 1 in 100,000 ($1x10^{-5}$) (MTCA Method C criterion), considering combined seafood ingestion, sediment contact, and incidental sediment ingestion pathways[6]
- No identified risk to aquatic biota and other wildlife
- Compliance with applicable or relevant and appropriate requirements (ARARs), including State of Washington surface water quality standards [Chapter 173-201A WAC] and sediment management standards [Chapter 173-204 WAC]

Former Fire Training Area

- Prevent human and wildlife contact with simulator debris and soils containing dioxin/furan concentrations greater than the cleanup level
- Minimize solubilization and migration of TPH into groundwater.

[6] A hazard index is the sum of more than one hazard quotient for multiple substances and/or multiple exposure pathways, and is calculated separately for chronic, subchronic, and shorter-duration exposures. A hazard quotient is the ratio of a single substance exposure level over a specified time period (e.g., subchronic) to a reference dose for that substance derived from a similar exposure period. A hazard index greater than 1 indicates a potential risk to human health. Reasonable Maximum Exposure means the highest exposure that is reasonably expected to occur at a site [USEPA, 1989].

Additional cleanup levels and goals were established for the upland area containing the FFTA, which included:

- A cumulative hazard index under 1, and a cumulative cancer risk goal under future reasonable maximum exposure (RME) conditions of $1x10^{-5}$ (MTCA Method C criterion), considering cumulative soil contact, incidental soil ingestion, inhalation, and drinking water pathways
- No identified risk to aquatic biota and other wildlife
- Compliance with applicable or relevant and appropriate requirements (ARARs), including State of Washington MTCA Method C soil cleanup levels for non-industrial sites [WAC173-340-740]

Groundwater in the area is used to supply local residents with drinking water. Shallow groundwater beneath the FFTA and the Outwash Aquifer near the FFTA was tested for contaminants. The risk assessment confirmed that the cancer risk was less than 1 in 1,000,000 ($1x10^{-6}$) and that the hazard index was less than 0.3, indicating that risks from contaminants in the groundwater were below the thresholds of concern (HI <1 and cancer risk < $1x10^{-5}$). Consequently, no remedial action objectives were developed for the groundwater in this area.

Remaining Areas

The risk assessments performed during the RI/FS also allowed some of the Manchester site areas to be excluded from remedial actions:

- **Net Depot and Manchester State Park**. Although metals were detected at low concentrations in the soil and seeps in the Net Depot area, the potential health risks were determined to be minimal and consequently no additional actions were proposed for the Net Depot or Manchester State Park.
- **Former Fire Training Area – TPH-contaminated Soil.** A limited amount of TPH-contaminated soil was excavated during the UST closure (described in Section 4.2 below). However, the bulk of the TPH-contaminated soil at the FFTA was left in-place for the following reasons: the total petroleum hydrocarbons were tested using the Synthetic Precipitation Leaching Procedure (SPLP) and considered to be no longer leachable because they were highly weathered and consisted primarily of heavy petroleum constituents (very low aqueous solubility). For confirmation, no petroleum constituents were detected during sampling of shallow groundwater beneath the TPH-impacted soil. Thus, the TPH-impacted soils were considered not to pose a risk to neighboring private and public water supply wells. In addition, the risk assessment concluded that the elevated levels of TPH in the soil would not pose a threat to human health.

4 REMEDIAL ACTIONS

4.1 Remedy Selection

On September 30, 1997, the EPA issued the Record of Decision that selected the final remedial actions for the site based on the RI/FS and risk assessments. The remedial actions were specified for each area as follows:

Landfill Area and Clam Bay Sediments

(1) Excavation and Relocation. Excavate landfill debris from the intertidal zone of Clam Bay and, if suitable, place on the upland landfill area prior to capping. Any debris unsuitable for placement will be tested for waste designation purposes and disposed of in an appropriate off-site landfill. As an additional measure prior to capping, relocate solid waste located west of the utility corridor (on EPA/Manchester State Park boundary) to the upland landfill area prior to cap construction, or relocate utility corridor to be outside of the solid waste area. The goal of the intertidal excavation was no net loss of aquatic habitat and the establishment of a shoreline protection system.

(2) Shoreline Protection and Seeps. Design the shoreline excavation backfill to meet seep discharge cleanup levels, provide suitable habitat for marine organisms, and ensure beach stability. Monitor groundwater seeps, if present after remedial action, for compliance with surface water cleanup levels and implement additional remedial measures if necessary. (Seeps were contaminated with metals and low-level PCB concentrations).

(3) Sediment Cap. Place a cap of clean sediment using windrows over contaminated intertidal Clam Bay sediment to protect sediment dwelling organisms and support unrestricted use of the area within several years of completion of the remedial action.[7] Monitor sediment and shellfish tissue until compliance with PCB cleanup goals for sediment (40 µg/kg-dry) is achieved, or until the Washington State Department of Health and the Suquamish Tribe determine that the shellfish are safe for subsistence-level harvesting, whichever comes first.

(4) Landfill Cap and Hydraulic Cutoff System. Cap the upland portion of the landfill in accordance with the State of Washington's Minimum Functional Standards (MFS) for solid waste landfill closures [WAC173-304-460], which require a low permeability cover liner with a 2 percent minimum slope, protective layers above and below the cover liner, landfill gas controls, and close construction quality control and inspection requirements. Install a hydraulic cutoff system upgradient of the cap and revegetate the area in accordance with operations and maintenance (O&M) and site development requirements. During construction develop a post-closure plan that specifies O&M, monitoring, and inspection requirements for the landfill cap, hydraulic system, and shoreline protection system, and implement the plan after construction. Address as part of the final design a plan to mitigate potential construction-related impacts to existing wetlands in the vicinity of the landfill. The goal of the landfill cap and hydraulic cutoff system was to minimize direct contact with landfill debris and to isolate the debris from precipitation and groundwater infiltration to reduce leaching.

Former Fire Training Area

(5) Simulator Debris Removal. Remove dioxin-contaminated debris from the main simulator complex in the former fire training area and dispose of it in a RCRA hazardous waste landfill.

[7] Windrows are rows of material designed to be spread out evenly over time by wind and wave action. During the construction activity a more uniform sediment cap was actually applied (see Section 4.2).

Inspect simulators for cracks, and if leaks are identified, test soil for dioxins. Demolish simulators and excavate soil beneath the simulators if the soil exceeds dioxin cleanup levels.

(6) Soil Testing. Test the near-surface soils adjacent to the main simulator complex and the soil/debris piles north of the main complex for dioxins. If cleanup levels are exceeded, excavate and dispose of the soil in appropriate off-site landfills.

(7) UST Closure. For concrete USTs remaining in the FFTA, close in-place in accordance with UST closure requirements. Excavate UST piping systems and associated TPH-impacted soil, and dispose of in an appropriate off-site landfill. If any pipe sections are impractical to remove, purge and abandon in-place.

General

(8) Implement the following institutional controls:

- Provide a written description of activities or prohibitions necessary to ensure long-term protection and maintenance of the selected remedy;
- Prepare draft deed covenants prohibiting future residential use of the property;
- Place a restriction on subsistence-level harvesting of shellfish (to be enforced by the Suquamish Tribe) until the Washington State Department of Health and the Suquamish Tribe determine that the shellfish are safe for subsistence-level harvesting; and
- Develop an institutional control plan to address TPH-impacted soil left in-place at the FFTA (i.e., location of soil, depth of contamination, concentrations, and health and safety measures). In addition, the plan will specify temporary storm water controls and other best management practices (BMPs) to minimize infiltration and runoff, should any future excavation occur at the site. Storm water systems will be designed to divert runoff away from former UST areas. If future excavation occurs and free product is discovered, the material will be disposed of off-site; if free product is not discovered, the soils will be returned as near to the original excavation as possible.

(9) Meet the following monitoring requirements during construction:

Monitor shoreline excavation for hunter-fisher-gatherer cultural resources. Develop a cultural resources management plan during the remedial design phase that describes monitoring procedures, personnel qualifications, notification requirements, and proper handling of cultural resources if found.

(10) Meet the following monitoring requirements post-construction:[8]

- **Monitor Seeps.** Monitor seeps at the seaward toe of the shoreline protection system, if observed, for compliance with cleanup levels and implement additional remedial measures if compliance has not been achieved.

  In the first year after cap placement, quarterly observations for seeps should occur. If no seeps are observed in the first year, then observations will continue once a year

[8] Italicized text has been provided from the Compliance Monitoring Plan [Hart Crowser, 1999a], which was drafted after the ROD, to provide additional detail on the monitoring requirements.

for five years. If seeps are observed, they should be tested for dissolved metals (As, Cd, Cr, Cu, Hg, Pb, Ni, and Zn) and total PCBs, and the samples should be collected from up to three locations. Thereafter, the sampling should occur semi-annually for two years, followed by annual monitoring for three years. The Compliance Monitoring Plan (CMP) [Hart Crowser, 1999a] also recommends analysis of total suspended solids (TSS), temperature, pH, salinity, turbidity, and dissolved oxygen to facilitate interpretation of the primary results.

- **Monitor sediment and shellfish tissue.** Monitor sediment and shellfish tissue until compliance with PCB cleanup goals for sediment (40 ug/kg-dry) is achieved, or until the Washington State Department of Health and the Suquamish Tribe determine that the shellfish are safe for subsistence-level harvesting, whichever comes first.

  Sampling of sediments should occur initially immediately after cap placement. Thereafter, shellfish tissue and sediment should be sampled for compliance with PCB cleanup goals four (which would be in 2004), seven, and ten years after cap placement. In addition, the CMP recommends analysis of total lipids (in tissue) and total organic carbon (in sediment) to facilitate interpretation of the PCB results. Metals testing is also recommended by the CMP for any tissue samples collected near a seep. The CMP specifies 18 locations from which to collect samples and recommends collecting the following clams (in order of decreasing preference): Manila, Littleneck, Butter, Horse, and Cockles.

Overall, the ROD states that the chosen remedial actions are protective of human health and the environment, and are compliant with applicable laws, but that they do not meet the statutory preference for treatment of the principal threat (the large volume of landfill waste and sediment) due to impracticality of treatment. As a result, hazardous substances may remain on-site above levels that are protective of human health and the environment. Therefore, reviews will be conducted every five years, at a minimum, to ensure that the remedial actions remain protective.

4.2 Remedy Implementation

The remedial design was finalized on June 22, 1999. The remedial design addressed the practical implementation of the remedial actions described above. The initial construction work (known as "Phase I construction") was awarded in June of 1999 and terminated in early 2001 with the majority of the remedial work having been completed. In October of 2001, the remaining remedial work (known as "Phase II construction") was completed. Other construction tasks that were not mentioned in the ROD but were performed during remedial construction included decommissioning of wells used during the RI, inspection for and closure of any drain lines in the shoreline area that could have served as conduits of landfill leachate, and construction of a service road behind the EPA facility.

The status of the remedial actions is described below (numbers correspond to those used in Section 4.1). Any design changes to original ROD construction elements are discussed below as well.

Landfill and Clam Bay Sediments

(1) Excavation and Relocation. All debris, soil, and sediment was found suitable for placement on the upland landfill area and placed in accordance with the specifications. A review of quality control records for the excavation indicated that placements were closely monitored. However, the final volume of material to be placed was much larger than originally estimated. As a result, the final finished slope of the landfill area (approximately 7%) was greater than the 5% specified by remedial design. This slightly steeper slope did not compromise compliance with the MFS for Washington State solid landfill closures.

Regarding the small amount of waste located on Manchester State Park property, the decision was made to relocate the utility corridor to outside of the solid waste, rather than excavate and move the waste to the upland landfill. A service road that runs behind the EPA facility was also constructed.

(2) Shoreline Protection and Seeps. The shoreline protection system abuts the landfill along its southern edge and extends nearly 1200 feet along the Clam Bay shoreline. It consists of layers of granular material that are designed to protect the shoreline from tidal erosion, allow landfill drainage yet prevent tidal flushing, and provide fish spawning habitat. Specifically, pit run/cobbles were placed along the slope of landfill that extended toward the Bay. A drainage filter fabric was placed next, followed by design fill, more drainage filter fabric, loose riprap, overlying pit run/cobbles, and beach fill. The beach fill was intended to provide spawning substrate attractive to fish consumed by local salmon. (See section item (10) below for a discussion of landfill seep monitoring).

(3) Sediment Cap. Instead of placing the sediment cap material in windrows, the decision was made to place it in a layer of uniform thickness. There was concern that the windrows would not disperse evenly over time, resulting in a layer of non-uniform thickness. Consequently, a six-inch minimum thickness cap of clean sediment was placed over the intertidal area identified as the "thin cap" area in the design plans. Similarly, another cap of clean sediment was placed in an intertidal depression area known as the "silt basin" to create an even transition to the main capped area. Capping materials were provided by Allen Shearer Trucking and Landscape Supply of Belfair, Washington, and tested to verify compliance with Ecology's sediment quality standards for metals (cleanup standards are listed in Table 5) prior to application. All metals were below the cleanup standards, with the exception of silver, which appears not to have been tested. This issue has been flagged for follow-up in Section 8.

Rather than serve as a traditional cap on contamination, the sediment cap placed in the intertidal area was designed to enhance natural recovery in the following ways. The addition of cap material would benefit filter-feeding shellfish immediately by effectively lowering PCB concentrations in the upper sediment. The cap would also help prevent recontamination of the intertidal area caused by resuspension of any residual PCBs in unremediated sediments, because the thickness of the cap placed (greater than six inches) was greater than the biologically active zone (approximately four inches).

(4) Landfill Cap and Hydraulic Cutoff System. After debris had been relocated to the upland landfill area, the cap installation began with installation of an impermeable 50-mil polyvinyl

chloride (PVC) geomembrane over approximately half the landfill area. In February 2001, however, the USACE found the membrane to be out of compliance with design specifications due to large wrinkles in the membrane that could not be removed. The USACE subsequently decided to stabilize the area for the remainder of the wet season and initiate a new contract to correct and finish the landfill work during the following dry season, in the summer/fall of 2001.

The final landfill cap system consisted of the following layers (from top to bottom):

- grass and shrub vegetation
- a 12-inch minimum topsoil layer to support the vegetation
- an 18-inch minimum fill layer to protect the underlying geosynthetics
- a geocomposite layer to drain water and filter out any soil particles in the draining water
- a new 50-mil PVC geomembrane to replace the old membrane (which was removed)
- a 12-inch minimum granular vent and bedding layer to route landfill gases to vents and protect the geomembrane from the landfill debris.

The landfill cap contains six passive gas vents that are constructed from three-inch diameter PVC pipe and facilitate equalization of gas pressure above and below the geomembrane. The landfill cap is also traversed by the EPA laboratory access road (902 linear feet) and a service road (less than 50 linear feet).

For the hydraulic cutoff system, a cutoff wall was constructed along the upland perimeter of the landfill using soil-bentonite slurry trench technology. The wall was designed to prevent groundwater from seeping into the landfill. A perimeter drainage system was also created immediately upgradient of the cutoff wall to route water around the landfill perimeter and into Clam Bay. The system addresses both surface and subsurface drainage, and consists of ditches, drainpipes, drainpipe cleanouts, manholes, catch basins, culverts, and outfalls. An 18-inch storm drain that ran through the landfill and transported storm water to Clam Bay was abandoned in-place and accounted for in the new perimeter drainage system. A drainage swale system that ties into the perimeter drainage system was also created to convey water off the central portion of the landfill.

The ROD required that a post-closure plan be developed to address O&M, monitoring, and inspection requirements for the landfill cap, hydraulic system, and shoreline protection system. An *Inspection and Maintenance Manual* [Hart Crowser, 2002a] was developed, which, according to the *Draft Remedial Action Report* [Hart Crowser, 2002b], satisfies the requirement for a post-closure plan.

To address the loss of wetlands due to shoreline excavation and construction of the landfill cap, the restoration of nearby Beaver Creek was chosen. Beaver Creek is located on Manchester Navy Fuel Depot property immediately southwest of the FFTA. Beaver Creek, in its natural state, originally meandered through the Naval Fuel Depot area. In years past, Beaver Creek was straightened and forced to flow through a man-made channel. The goal of the Beaver Creek restoration was to restore natural creek functions and improve fish habitat, as no contamination exists at Beaver Creek. The initial restoration plan included placement of several log weir structures; however, the weir structures were not designed to Washington Department of Fish and Wildlife specifications (George Hart, USACE, personal communication on 7/12/04), and

subsequently failed. Modifications to the original design were prepared, and work subsequently completed, between July 1 and August 30, 2003. Monitoring of the restored reach was performed by the USACE (by G. Hart on 2/6/04) to assess the condition of the stream and associated plantings, and no degradation of the redesigned weir structures was observed. However, some of the vegetation along the reach has not survived and certain areas of the reach are experiencing erosion. The USACE recommends replanting vegetation to replace the failed species and to stabilize areas that are currently experiencing erosion. The replanting is currently scheduled for October of 2004. On a positive note, the monitoring also determined that a large number of salmon were using the newly restored stream almost as soon as the reconstructed weirs were open, indicating that the restoration has been successful at improving fish habitat.

Former Fire Training Area

(5) Simulator Debris Removal. In 1998, a non-time-critical remedial action took place at the FFTA, which included removal of the debris located within the main simulator complex; demolition of the simulators to below ground surface and in-place closure of the subgrade foundations; closure of some concrete USTs and vaults; and removal of associated inactive underground piping, hydrocarbon-contaminated wastewater, and TPH-contaminated soil. The waste materials were characterized in accordance with local, state, and federal regulations prior to transportation off-site for recycling or disposal.

The USACE, Ecology, and EPA determined that the remaining work to be completed as part of remedial construction would include off-site disposal of dioxin-contaminated debris piles within and near the northern simulator; six-inch excavation and off-site disposal of soil below the debris piles and soil around the northern simulator perimeter; and sampling and analysis of soil from eight locations within the FFTA to confirm that the dioxin cleanup level had been achieved.

(6) Soil Testing. As part of the early removal action, waste characterization tests of the debris removed from the main simulator complex indicated that the debris was not hazardous. Therefore, it was disposed of in a RCRA Subtitle D landfill, rather than RCRA Subtitle C landfill, as specified in the ROD. Likewise, during the actual remedial action, dioxin-contaminated debris and near-surface soil within and near the northern simulator were disposed of in a Subtitle D landfill.

After construction was completed, eight samples were to be taken from the FFTA to confirm that the dioxin cleanup level had been achieved. However, at the end of the early removal action before the samples were taken, the landowner of the FFTA (NOAA) paved over the main simulator complex area to expand parking availability, which inadvertently reduced the available number of sampling locations to four. The USACE, Ecology, and EPA subsequently decided that sampling in the paved area was not necessary because the asphalt provided a sufficient barrier to soil exposure, and institutional controls would prohibit future residential use and restrict subsurface excavations (discouraged due to TPH contamination left in-place). The final sampling set consisted of 18 pre-remedial action samples and four post-remedial action samples, which were analyzed for dioxin congeners and converted to 2,3,7,8-TCDD equivalent concentrations.

Using Ecology guidelines, the calculated results were evaluated against the following criteria: (1) no results could be greater than two times the ROD cleanup level of 270 ng/kg, (2) the 95% upper confidence limit needed to be less than 270 ng/kg, and (3) no more than 10 percent of the sample results could be greater than 270 ng/kg.[9] These criteria were satisfied**,** and thus the remedy has performed as intended.

(7) UST Closure. Several concrete USTs and vaults near the main simulator complex were closed and associated piping was removed. Approximately 100 linear feet of asbestos-clad piping were discovered during the removal and subsequently removed in accordance with applicable regulations. In addition, one vault contained approximately 300 gallons of sludge that had to be disposed of as Washington State Dangerous Waste because it failed the Toxicity Characteristic Leaching Procedure (TCLP) for lead (regulatory level is 5 mg/L). During FFTA work the monitoring wells used during the RI were also decommissioned (abandoned in-place).

General

(8) Implement the following institutional controls:

- A written description of activities or prohibitions necessary to ensure long-term protection and maintenance of the selected remedy has not been prepared. It is assumed that this information will be incorporated into the finalized ICP.
- Deed covenants prohibiting future residential or childcare use of the property have not been developed. It is assumed that this information will be incorporated into the finalized ICP.
- A restriction on subsistence-level harvesting of bivalves in intertidal areas is currently in place (Denice Taylor, Suquamish Tribe Representative, personal communication on 7/20/04 and 7/27/04).
- Regarding the ICP, the EPA found the draft ICP submitted by Hart Crowser in 1998 to contain a number of issues requiring resolution; consequently, the ICP was left to be finalized by the USACE. However, at this writing, the ICP has not been finalized due to repeated changes in project management, and is listed as a task for follow-up in Section 8.

(9) Meet the following monitoring requirements during construction:

A cultural resources construction management plan was prepared prior to remedial construction that specified how to handle cultural resources if found. Specifically, the plan indicated that a professional archaeologist would be on-site to monitor during critical activities such as relocation of the main utilities corridor, installation of the hydraulic cutoff system, and excavation of intertidal debris. If not on-site, the archaeologist would be on call at all times. Non-critical activities (those with a low probability of finding cultural resources) would be monitored by the contractor performing the work and a USACE quality assurance (QA) site representative. The site was monitored during construction and no hunter-fisher-gatherer deposits were identified.

(10) Meet the following monitoring requirements post-construction:

[9] The upper confidence limit is the upper limit of a confidence interval. A confidence interval is bounded by a lower limit and an upper limit, which are calculated. For the Manchester Site, the upper limit was set at 270 ng/kg. If many data values (e.g., sampling results) are used and the confidence interval computed many times, in the case of a 95% confidence interval, for example, the true average (mean) of the values would be captured in the interval 95% of the time [NIST, 2004].

- **Monitor seeps.** Monitoring of seeps at the seaward toe of the landfill has not occurred (John Nielsen, Garry Struthers Associates, personal communication on 7/14/04). This issue has been flagged for follow-up in Section 8.
- **Sample sediment and shellfish tissue.** The sediment cap should have been sampled initially immediately after cap placement [Hart Crowser, 1999a], but this sampling did not occur due to an oversight in compliance monitoring requirements. Regarding sediment and shellfish tissue monitoring, the start date for monitoring is four years after cap placement, which would be 2004. At this time, the USACE is planning to initiate sediment and tissue sampling in late 2004 to early 2005.

4.3 Operations and Maintenance

This section describes the general and specific O&M requirements for the remedy components, summarizes the O&M activities that have been conducted so far, and describes any problems that have been identified through O&M. Since the remedy technically does not consist of systems to be "operated," the following section refers frequently to "inspection" and maintenance instead.

General inspection requirements for the landfill cap and shoreline protection system, as outlined in the *Inspection and Maintenance Manual* [Hart Crowser 2002a], would consist of quarterly monitoring during the first two years of post-closure, and twice-yearly monitoring (with the possibility of two additional inspections) thereafter. Quarterly monitoring would continue indefinitely, however, if problems were identified and not resolved. Emergency inspections would be performed as needed (e.g., due to extremely heavy rains or powerful waves). Inspection requirements, associated maintenance requirements, and current status for each specific remedy component are described below.

Landfill Cap & Hydraulic Cutoff System (including vents, drainage features, and roads)

The Inspection and Maintenance (I&M) Manual specified that the cap area should be inspected for localized depressions, wet or saturated areas, sloughing, cracks in the soil, bulging, erosion, exposure of geosynthetic materials, rodent holes, distressed vegetation, and plants with deep root systems (e.g., trees, large bushes) that could damage the geosynthetic layers. The gas vents and screens should be inspected for evidence of damage or clogging, and during the first year of inspections, the vents should be screened for explosive gas concentrations using a combustible gas indicator. If any concentration exceeds 10 percent of the lower explosive limit (LEL), the USACE point of contact, EPA Region 10, and the EPA Manchester laboratory must be notified to determine if increased monitoring or other measures are necessary to protect human health and the environment. After four quarterly monitoring events, screening for combustible gases can be discontinued if no measurements are recorded above the 10% LEL.

Roads traversing the cap should be inspected for depressions, cracking, potholes, and unwanted vegetation. Other cap features such as drainage ditches, culverts, outfalls, and catch basins should be inspected for problems such as erosion, significant odor, signs of burrowing animals, unwanted vegetation, and material clogging drains or otherwise impeding flow. The perimeter drainage pipes should be flushed with water on an annual basis with a minimum of 500 gallons injected into pipe cleanouts(CO) CO-1 through CO-4, and a minimum of 700 gallons into CO-5

through CO-8, at a rate of 370+ gallons per minute.[10] The injections should be logged onto a Drainpipe Water Injection Log.

Any problems that have occurred with the landfill cap or drainage system should be addressed promptly, and could include measures such as sediment, debris, and unwanted vegetation removal; erosion repair; reseeding; sealing of asphalt cracks; and control of burrowing animals. Significant erosion should be repaired to meet original design thicknesses and grades depicted on the as-built drawings. Any deficiencies should be photographed before and after repair, and the photos should be included in the Annual Maintenance Report.

Shoreline Protection System

The interface between the landfill cap and the shoreline protection system should be inspected to determine if sloughing of the vegetative landfill cover has occurred. The beach area should be inspected for signs of exposed riprap, exposed geosynthetics, or other exposed materials that would indicate that tidal erosion is occurring. During the first inspection event, eight to ten photo locations should be established on the beach from which subsequent photos can be taken to document the condition of the site. Any repairs to the shoreline protection system should conform to the original construction specifications, as-built drawings, and any subsequent modifications.

Inspection and Maintenance Activities to Date

Table 2 below summarizes I&M activities that have taken place to date regarding the landfill cap, hydraulic cutoff system, and shoreline protection system. The table also describes any problems encountered and includes recommendations. I&M monitoring is being provided by Garry Struthers Associates, Inc. (GSA), a USACE Contractor. Although the inspections were to be performed quarterly, the dates indicate that the inspections took place somewhat irregularly. The I&M manual also specified that annual reports of the I&M findings would be produced by the USACE and distributed to the EPA; to date, these reports have not been produced (Bob Kievit, EPA, email communication on 7/12/04). This issue is flagged for follow up in Section 8.

Table 2. I&M Activities and Associated Costs

Area	I&M Activities	Problems Encountered	Recommendations (by GSA)	Activity Cost
1st Quarter Inspection (December 2002) – Year 1				
Cap and Cutoff Sys.	- Perimeter and swale drain lines flushed - Manholes and catch basins cleaned - Air sampled at four gas vents - Some scotch broom removed	- Ponding water on swale - Considerable amounts of scotch broom on landfill cap - Strong odors in manholes - Paint residue noted near north Culvert (#2)	- Regrade swale area - Spray to eradicate scotch broom and mow cap	$5491

[10] Pipe cleanouts are used to remove debris that may accumulate in drain pipes.

Table 2 continued

Area	I&M Activities	Problems Encountered	Recommendations (by GSA)	Activity Cost
Shoreline Protection Sys.	Inspection to determine if sloughing or erosion occurred	Tidal action pulling gravel away from heavy riprap	--	
2nd Quarter Inspection (June 2003) – Year 1				
Cap and Cutoff Sys.	- Cap inspection - Spraying of scotch broom - Air sampling at six gas vents	- Ponding water on swale - Scotch broom on cap - Alder trees starting to grow on cap - Minor erosion at south end of swale	- Regrade swale area - Monitor erosion	$5841
Shoreline Protection Sys.	Inspection to determine if sloughing or erosion occurred	--	--	
3rd Quarter Inspection (July 2003) – Year 1				
Cap and Cutoff Sys.	- Swale area regraded - Cap mowed - Scotch broom sprayed - Air sampled at six gas vents	- New scotch broom growing - 80% LEL peak (reading was cyclic); same vent two days later was 0.0	--	$3075
Shoreline Protection Sys.	Inspection to determine if sloughing or erosion occurred.	--	--	
4th Quarter Inspection (October 2003) - Year 1				
Cap and Cutoff Sys.	- Weed-eating along road and drainage ditches - Reseeding of cap with rye grass and creeping red fescue -Air sampling of six gas vents	- Ponding water on swale - Minor erosion on south end of swale - Scotch broom and blackberries growing	--	$6901
Shoreline Protection Sys.	Inspection to determine if sloughing or erosion occurred.	--	--	
1st Quarter Inspection (December 2003) - Year 2				

Table 2 continued

Area	I&M Activities	Problems Encountered	Recommendations (by GSA)	Activity Cost
Cap and Cutoff Sys.	- Perimeter drains flushed - Catch basins washed and pumped - Manholes pumped - Straw bales and silt fence removed from north perimeter drainage ditch - Swale drain raked and debris removed from landfill - Air sampled at six gas vents	- Ponding water on swale - Scotch broom and blackberries growing - Minor erosion on NW side of cap - Most plants dead	- 1200 sun-tolerant, drought-resistant shrubs to be planted in spring 2004	$4014
Shoreline Protection Sys.	Inspection to determine if sloughing or erosion occurred.	--	--	
2nd Quarter Inspection (April & May 2004) – Year 2				
Cap and Cutoff Sys.	- Air sampled at six gas vents - Swale ditch excavated and backfilled with drain rock - 1200 plants planted	- Minor ponding on swale drain - Excessive vegetation in drain rock along western perimeter - Significant amount of scotch broom on cap; blackberries also - Molehills at south end of swale drain and near gas vent 1 - Heavy erosion at south end of swale drain	- To eliminate ponding water and erosion in the swale area, unearth swale drain pipe and place drain rock	$11443
Shoreline Protection Sys.	Inspection to determine if sloughing or erosion occurred.	--	--	
3rd Quarter Inspection (May & June 2004) – Year 2				
Cap and Cutoff Sys.	- Air sampled at six gas vents - Scotch broom sprayed everywhere except east of asphalt access road (EPA placed a hold on spraying plants east of the road)	- Scotch broom, alder and blackberry on cap - Same mole hill noted - Excessive vegetation in drain rock along western perimeter - Barnacles noted in manhole #3 - EPA put herbicide spraying on hold for 30 days	- Address removal of scotch broom and alder if spraying is put on hold indefinitely, otherwise previous weed control efforts will be lost	$7503
Shoreline Protection Sys.	Inspection to determine if sloughing or erosion occurred.	--	--	

Based on the I&M activities performed to date, the primary problem appears to be persistent growth of scotch broom, blackberries, and alder on the cap. Excavation and backfill of the swale area seems to have minimized, but not solved, the ponding problem (see Section 6.6). Except for the riprap erosion noted in the first monitoring event (which was not mentioned again), no additional problems were noted for the shoreline protection system.

At the time the ROD was written (1997), the estimated annual O&M costs were $260,000 for the landfill cap and Clam Bay area, and $0 for the FFTA (due to the use of institutional controls to handle the TPH-contaminated soil left in-place). In the *Preliminary Closeout Report* [USEPA, 2002] prepared for the Manchester site, the O&M costs were estimated at $40,000 per year (including monitoring) for the landfill remediation, $0 for the FFTA, and $20,000 per year for the Beaver Creek restoration project. As of this writing, no costs have been determined for Beaver Creek O&M work.

The actual post-construction O&M costs are summarized in Table 3 below.

Table 3. System Operations/O&M Costs

Dates		Area	Total Cost ($) – rounded to the nearest $500
From	To		
December 2002	October 2003	Landfill cap, hydraulic cutoff system, and shoreline protection system	21,500
December 2003	June 2004	Landfill cap, hydraulic cutoff system, and shoreline protection system	23,000
		Beaver Creek	To be determined
		TOTAL:	**$44,500**

5 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first five-year review.

6 FIVE-YEAR REVIEW PROCESS

6.1 Administrative Components

The five-year review began with a kickoff meeting on June 17, 2004 between the USACE Project Manager and the USACE technical staff assigned to the project. Other parties who provided input to the five-year review included:

- Bob Kievit, Site Manager for EPA Region 10
- Mark Ader, Director of the Manchester EPA Laboratory
- Denice Taylor, Representative for the Suquamish Indian Tribe
- Desmond Maynard, Facilities Manager, NOAA Fisheries
- James Hackett, Facility Mechanic, NOAA Fisheries

After the initial kickoff meeting took place, data collection and review began. A site inspection and interviews with Manchester site personnel were scheduled for July 20th, 2004.

The findings of the five-year review process are discussed in Sections 6.2 to 6.6.

6.2 Community Involvement

Notification of the five-year review was provided to the public through newspaper ads in the *Bremerton Sun* (on July 9, 2004) and the *Port Orchard Independent* (on July 10, 2004).

6.3 Document Review

Documents and information sources used for review are listed in Table 4 below.

Table 4. Documents Reviewed

Documents and Information Sources	Summary of Contents Relevant to Five-Year Review
Preliminary Assessment. Manchester Field Station, Manchester. October 1993.	Provides an initial summary of findings on the Manchester site, which was requested by NOAA.
U.S. Army Corps of Engineers. *Community Updates.* 1994-1999.	Updates for the general community on progress of the remedial actions at the Manchester site.
Final Remedial Investigation / Feasibility Study, Manchester Annex Superfund Site. Volume 1A and 1B. December 1996.	Provides initial investigative work that forms the basis for the ROD.
Proposed Plan for Site Cleanup. March 1997.	Describes remedial alternatives and rationale for choosing the preferred alternative.
Public Health Assessment: Old Navy Dump/Manchester Laboratory (USEPA/NOAA), Manchester, Kitsap County, WA. March 25, 1997.	Discusses human health concerns related to wastes at the Manchester site.
Record of Decision – Manchester Annex Superfund Site. September 1997.	Describes overall remedy for the site, including background, remedial action objectives, remedial tasks, ARARs, cleanup levels, and cleanup goals.
Developing Health-Based Sediment Quality Criteria for Cleanup Sites: A Case Study Report. December 1997.	Provides a comparison of the Manchester sediment cleanup goals with criteria developed by Ecology.
Draft Final Institutional Control Plan, Manchester Annex Superfund Site. December 1998.	Describes institutional controls for the landfill cap, hydraulic cutoff system, shoreline protection system, and FFTA.
Final Report: Removal of Simulator Debris, Former Simulator Training Facility, Manchester Annex. January 1999.	Discusses the early FFTA removal action (1998). Includes sampling results from soil and sludge in and around simulators.
Compliance Monitoring Plan, Manchester Annex Superfund Site. March 1999.	Describes during-construction and post-construction monitoring requirements.
Cultural Resources Construction Management Plan, Manchester Annex Superfund Site. April 1999.	Describes how to identify and handle cultural deposits, if found. Gives background on potential cultural resources that might be found.
Beaver Creek Restoration Monitoring and Adaptive Management Plan. June 2000.	Describes qualitative and quantitative monitoring and restoration methods for Beaver Creek.
Landfill Closure Work Plan, Landfill Cap and Intertidal Remediation, Manchester Superfund Site. August 2000.	Discusses plan of operations for the landfill and intertidal area. Has definition of "suitable/unsuitable" material. Lists remedial schedule, which indicates that the intertidal cap was placed in August of 2000.
Offshore Capping Plan: Landfill Cap and Intertidal Remediation, Manchester Superfund Site. August 2000.	Indicates size gradation and requirements for material used as capping. Lists provider.
Fish Consumption Survey of the Suquamish Indian Tribe of the Port Madison Indian Reservation, Puget Sound Region. August 2000.	Provides updated data on Suquamish fish consumption.
Underground Storage Tank Closure, Dioxin-Impacted Soil and Debris Removal, Former Fire Training Area Closure, Landfill Cap and Intertidal Remediation, Manchester Superfund Site. Volume 1. February 2001.	Provides more detail than the draft RAR on remedial work performed at the FFTA.
Inspection and Maintenance Manual, Landfill Cap and Shoreline Protection System, Manchester Annex Superfund Site. January 2002.	Describes how to inspect and maintain the landfill cap and shoreline protection system.
Draft Remedial Action Report, Manchester Annex Superfund Site. August 2002.	Provides a description of completed remedial actions.

Table 4 continued

Documents and Information Sources	Summary of Contents Relevant to Five-Year Review
Preliminary Close-out Report: Manchester Annex (Old Navy Dump) Superfund Site. September 2002.	Documents the close-out status of remedial actions (EPA-written).
Manchester Landfill Quarterly Inspection and Maintenance Invoice Summaries. December 2002 – June 2004.	Describes long-term monitoring activities at the landfill cap and hydraulic cutoff system. Includes checking shoreline protection system but not seep monitoring.
Addendum to Design Analysis Report, Beaver Creek Restoration, Manchester Annex Superfund Site. May 2003.	Lists schedule of repairs for weirs at Beaver Creek.

6.4 Data Review and Trends

In order to establish if the remedy has been functioning as intended, a data review was performed to assess compliance with site-specific cleanup levels and goals that were defined in the ROD. The cleanup levels and goals have been reproduced from the ROD in Table 5 below [USACE, 1997]. Regulatory requirements, guidance, and "to-be-considered (TBC)" documents that were used at the time of the ROD are summarized in Attachment B. For reference, cleanup levels were defined in the ROD as specific concentrations not to be exceeded in order to protect human health and the environment. Cleanup goals, which were conceptual targets, were specified in the ROD for TPH and PCBs only. Cleanup levels needed to be met during construction; cleanup goals were established to indicate desired long-term results. Because of the low leachability and risk associated with the TPH at the FFTA, the ROD concluded that the TPH value (200 mg/kg for diesel-range TPH as defined in WAC173-240) did not need to be met, but that additional O&M controls may be appropriate to further reduce TPH-related risks.

Table 5. Cleanup Levels and Cleanup Goals for Manchester Site

Chemicals of Concern	Cleanup Level	Basis for Level	Cleanup Goal	Basis for Goal	Point of Compliance
Landfill Area – Seeps					Seep discharge
Copper	10.6 µg/L	Regional Background			Seep discharge
Nickel	7.9 µg/L	WAC173-201A-240 marine chronic			Seep discharge
Zinc	77 µg/L	WAC173-201A-240 marine chronic			Seep discharge
Total PCBs	0.03 µg/L	WAC173-201A-240 marine chronic			Seep discharge
Clam Bay - Sediments					
Copper	390 mg/kg dry	WAC173-204-330 SQS			0 to 10 cm depth
Lead	450 mg/kg dry	WAC173-204-330 SQS			0 to 10 cm depth
Silver	6.1 mg/kg dry	WAC173-204-330 SQS			0 to 10 cm depth
Zinc	410 mg/kg dry	WAC173-204-330 SQS			0 to 10 cm depth
2,4-Dimethylphenol	29 µg/kg dry	WAC173-204-330 SQS			0 to 10 cm depth
Total PCBs	130 µg/kg dry	Lowest AET	40 µg/kg dry	Bioaccumulation correlation (est.)	0 to 10 cm depth

Table 5 continued

Chemicals of Concern	Cleanup Level	Basis for Level	Cleanup Goal	Basis for Goal	Point of Compliance
Clam Bay – Tissue					
Total PCBs	N/A[1]		42 µg/kg wet[2]	Subsistence fishing	Intertidal Clams
Fire Training Area – Soil					
2,3,7,8-TCDD Equivalents	270 ng/kg	WAC173-340 Method C			0-15 ft depth
TPH (as diesel)	N/A[3]		200 mg/kg	WAC173-340 Method A	

1 – Existing (baseline) site concentrations are at or below risk-based cleanup levels except for the subsistence fishing scenario.
2 – A tissue PCB cleanup goal of 42 ug/kg wet weight is associated with a cumulative cancer risk of 1×10^{-5} for a subsistence fishing scenario. Risks associated with subsistence fishing can be controlled by implementing temporary limitations on subsistence-level consumption during the initial recovery period.
3 – Site-specific risk assessment and leachability testing indicated only a low risk associated with TPH; consequently, no chemical-specific cleanup level is necessary.

Ideally, data sources such as monitoring logs, progress reports, and analytical chemistry data would have been reviewed to assess compliance with the cleanup levels presented in Table 5. However, such data sources are currently limited due to the lack of monitoring activities. The status of monitoring and compliance for the landfill seeps, Clam Bay sediments, shellfish tissue, and fire training area soil is summarized below:

- **Landfill seeps.** No monitoring has occurred, which is an issue flagged for follow-up in Section 8.
- **Clam Bay sediments.** No sampling occurred immediately after cap placement, which is a data gap. The remaining monitoring and sampling events are scheduled to start in 2005.
- **Shellfish tissue.** Monitoring and sampling events are scheduled to start in 2005.
- **FFTA soil.** As indicated in Section 4.2 (6), the confirmatory soil sampling for dioxins indicated that the cleanup levels had been achieved. Thus, the remedy has functioned as intended in the FFTA.

Changes that have occurred to the cleanup levels and goals are discussed in Section 7.2, though none of the changes appear to affect the protectiveness of the remedy.

The decision to focus only on PCBs in intertidal clams regarding health concerns was also revisited during the data review. About the time that the ROD was finalized, the Agency for Toxic Substances and Disease Registry (ATSDR, 1997) published a Public Health Assessment of the Manchester site that incorporated data from the RI/FS. In their assessment they concluded that arsenic, lead, PAHs, PCBs, and dioxins were high enough in the littleneck clams of the intertidal areas closest to the shore to present a public health hazard to subsistence consumers. As noted in Table 5, the ROD point of compliance for contaminants in tissue samples was for PCBs in intertidal clams only. Although arsenic, PAHs, lead. dioxins, and copper were also detected in intertidal shellfish (as indicated in Section 3.4), the RI/FS (RI/FS Tables 6-16 and 6-17) indicated that all compounds except PCBs taken together had neither a cumulative RME Hazard Index that exceeded 1 nor RME cancer risks that exceeded $1x10^{-5}$ in the subsistence fishing scenario. Therefore, the non-PCB compounds were excluded in the ROD from the list of compounds to monitor in intertidal clams after remedy completion. However, it is proposed to

document the rationale for this exclusion, and to re-examine the need for monitoring these non-PCB compounds during the development of the Compliance Monitoring Plan.

Since the ROD frequently refers to a "shellfishing" restriction rather than an intertidal clam restriction, the rationale for focusing only on intertidal clams as the point of compliance was also evaluated during the data review. Information from the RI/FS that supports focusing only on intertidal clams is provided below:

- Page 5-25 and 5-26 of the RI state, "Screening levels were not adjusted for elevated reference concentrations in subtidal geoducks or sea cucumbers because intertidal clams are the primary resource being investigated."

- Page 6-20 of the RI states, "In general, intertidal clam tissue contained the highest and most frequently detected concentrations of the chemicals of potential concern within Clam Bay."

- Page 6-21 of the RI states, "As discussed above, consumption of edible clams and sea cucumbers harvested from the upper intertidal and subtidal areas represent the only complete fish or shellfish exposure pathway within Clam Bay." (Note that clams were found in the intertidal area and sea cucumbers were found in the subtidal area).

6.5 Site Inspection

An initial site inspection was conducted on July 20, 2004 by John Wakeman and Veronica Henzi, USACE technical staff (see Attachment C, *Site Inspection Checklist*). A second inspection occurred on the same day with Manchester site personnel after the interview. The purpose of the site inspection was to assess the integrity of the landfill cap and shoreline protection system, assess the condition of the FFTA, and document the presence of institutional controls (signs, fencing, and any other access restrictions). Photos that document the site condition are included in Attachment D and referenced below.

Upon initial site inspection, the landfill cap appeared to be structurally sound (no depressions, cracks in soil, molehills, etc.) but there was an abundance of scotch broom and alder. Although the scotch broom has been sprayed as part of the I&M plan, it continues to survive (see Photo 1). Likewise, the alder seemed to be thriving in the northwestern corner of the cap, with some of the alder seedlings measuring nearly five feet high (see Photo 2). Also, it appeared that the plants on the portion of the cap that extends seaward of the road have not been sprayed. Regarding the shoreline protection system, there was evidence that a few of the riprap stones had shifted along the beach, but the riprap wall was intact and functional. Overall, the shoreline protection system appeared to be in good condition (see Photo 3). The FFTA had been paved over or covered with gravel, and also appeared to be in good condition. The following institutional controls were noted on-site (see Photos 4, 5, and 6):

- "No trespassing" signs on the landfill cap facing Manchester State Park property and a barbed-wired fence between the two properties
- A fishing, crabbing, and shellfishing restriction sign on the main pier
- A weathered "Hazardous Area" sign near the beach. (This sign is recommended for removal, since all hazardous material has been either removed from the site or capped).

6.6 Interviews

Interviews were conducted at the EPA laboratory from 9.30 to 11.00 a.m. on July 20, 2004 in a group discussion format. The following persons were present:

- Bob Kievit, Remedial Project Manager, EPA Region 10
- Mark Ader, Health and Safety Officer / Facility Manager, EPA Manchester Lab
- Denice Taylor, Environmental Scientist, Representative for the Suquamish Tribe
- John Wakeman, Risk Assessor, USACE
- Veronica Henzi, Environmental Engineer, USACE
- Desmond Maynard, Facilities Manager, NOAA Fisheries
- James Hackett, Facility Mechanic, NOAA Fisheries

The interview questions that were used to facilitate the discussion are listed (and grouped together when appropriate) below, followed by a summary of the responses.

1. What is your overall impression of the cleanup efforts at the Manchester site?
2. Are you aware of any community concerns regarding the cleanup activities (that is, that emerged during or because of the construction)? If so, please give details and status, if ongoing.

The overall impression of the cleanup efforts at the Manchester site was positive; however, the Suquamish Tribe continues to be concerned about the safety of ingesting seafood from Clam Bay.

3. Do you have any comments, suggestions, or recommendations regarding the site's management or operation, as related to the cleanup by the Department of Defense?

Regarding site management and operation, Denice Taylor indicated that she would like to have better information flow between the USACE and the Suquamish so that when sediment and shellfish monitoring begins, she has access to the data that she needs. These concerns were noted, and the USACE will provide better communication with the Suquamish (and EPA and NMFS) regarding future actions on the site. James Hackett and Desmond Maynard indicated that they did not seem to have any final documents for the site and would like copies of the as-builts, final RI/FS, and remedial design for the FFTA. (This issue is flagged for follow-up in Section 8).

4. Are you aware of any situations that may require changes to the completed remedial actions or the decision documents?

None were identified.

5. Have any problems or difficulties been encountered regarding land-use/ or other institutional controls?

Regarding land use and institutional controls, both Mark Ader and Desmond Maynard indicated that they did not have an institutional control plan in place that addressed management of the

remediated areas. As discussed in Section 8, an ICP needs to be finalized by the USACE and distributed for implementation. Mark Ader mentioned that he had seen an unmarked commercial vessel in Clam Bay (presumed to be tribal) with five or six crab pots set out. This issue raised the question of which shellfish were covered in the ROD and where the "intertidal" boundaries lay. Denice Taylor indicated that the Suquamish's policy is that all beaches are closed to shellfishing unless open by regulation, and none have been opened. Thus, it seems that no shellfishing of any kind should be occurring on or near the beaches.

Additional research conducted after the site visit determined that both the ROD and RI/FS indicated that only clam, geoduck, and sea cucumber tissues were sampled and used for the human health risk assessment. The RI/FS indicated that these species were assumed to be representative of other fish and shellfish (including crab); however, the final point of compliance in the ROD (for achieving PCB cleanup goals) was "intertidal clams" only. Telephone communication with Denice Taylor on 7/27/04 clarified that the Suquamish's fishing restriction pertains only to subsistence-level harvesting of bivalves in the intertidal area. Thus, it seems that the shellfish harvesting restriction is being met, if the intention of the ROD were only to restrict consumption of intertidal clams. If it were also the intention of the ROD to restrict consumption of other shellfish (sea cucumbers, etc), then the restriction is currently not adequate.

Bob Kievit also felt that the restriction should be applied to all shellfish (including crab) in order to provide the best protection (email communication on 7/23/04). However, Bob Kievit agreed that the current subsistence restriction on bivalves in the intertidal area is adequate (email communication on 7/28/04). Denice Taylor indicated that it was also adequate in the short-term, but not acceptable as a long-term remedy (email communication on 7/29/04), as the subsistence-level harvesting restriction was to be a temporary measure during the initial recovery period.

6. Do you feel the completed remedies are functioning as expected? Why or why not?

Denice Taylor stated that she did not have any data to make a decision on this issue, because long-term monitoring of tissue and sediment has not begun. Also, no attempt to determine the presence of seeps has occurred since construction completion. (This issue is flagged for follow-up in Section 8). In addition, no data were found that indicated that sampling of sediment occurred immediately after placement of the intertidal cap. Thus, the status of contamination in the intertidal area is not currently known.

7. Are you aware of any issues, which may call into question the site's short-term or long-term protectiveness?
8. Are you aware if there are any trends that indicate contaminant levels are increasing or decreasing since construction ended?

Denice Taylor provided a shellfish consumption survey (2000) for the Suquamish that indicated that the assumptions used during the RI/FS (1996) for the risk assessment may have been too low regarding consumption rate and portion size, thereby underestimating the risk from subsistence-level consumption. (This issue is discussed further in Section 7.2).

9. Is the Operations and Maintenance (O&M) program satisfactory? (O&M consists of periodic inspections, signage, maintenance schedules, sampling to support the monitoring, and land use controls). Please describe your overall perception of the program.
10. Have there been any significant changes in O&M requirements? If so, do they affect the protectiveness or effectiveness of the remedies?
11. Have there been unexpected O&M difficulties or costs at the site? If so, please give details.

Regarding I&M operations, Mark Ader reiterated that scotch broom and alder continue to be a persistent problem on the landfill cap. Although the scotch broom has been sprayed, it continues to survive. (This issue is flagged for follow-up in Section 8).

12. Do you have any other comments, concerns or recommendations regarding the site?

Mark Ader also stated that he has noticed continued ponding of water on the drain rock in the landfill cap area during the wet season. (This issue was supposedly fixed by placement of the rock, and it will be inspected for adequacy). He suggested that someone make certain that the I&M inspections take place during the wet season. On a similar note, James Hackett pointed out that soil excavated when the drain rock was placed is still piled up on a former FFTA concrete pad (see Photo 7). Some hay bales, metal stakes, an unidentified rusty drum, and filthy liquid in a plastic bucket are also located on the concrete pad (see Photos 8, 9, and 10). The latter four items appear to be left over from the remedial construction in 2000/2001, and NOAA personnel would like to know when they will be removed. (This issue is flagged for follow-up in Section 8).

Other I&M concerns brought up by James Hackett included a small depression that has appeared in a gravelly area where FFTA structures were removed (see Photo 11). Also, he indicated that some of the decommissioned wells in front of NOAA's Building #1 are no longer flush with the ground surface and cause problems for the forklift drivers (see Photo 12). A final concern was an open concrete vault adjacent to Building #1 that was never closed. The group hypothesized that since the vault may have been used at the time of the remediation (though this was not confirmed), it was not assessed for removal during the remediation. Although the vault is currently empty and does not appear to contain any fluid, no one knows what purpose the vault serves. (This issue is flagged for follow-up in Section 8).

James Hackett and Desmond Maynard also mentioned that NOAA has plans to install a large intake pipeline (approximately 12 inches in diameter) through the FFTA to provide saltwater to one of their endangered species laboratories. James Hackett was not aware of any local NMFS policy that would specify what to do if contaminated substances were found; their protocol is to contact their Safety and Environmental Compliance Officer at the NMFS Montlake station, who would then advise them on further action. Although it does not appear that the pipeline will go through the contaminated areas, it would still be prudent to ensure that an ICP is in place, should contaminated soil be encountered.

Denice Taylor indicated that after the first sediment and shellfish sampling event has occurred, she would like to have a working group meeting to reevaluate the sampling strategy. A copy of the sampling and analysis plan (to be developed) will be made available to her for this purpose.

7 TECHNICAL ASSESSMENT & SUMMARY OF REMEDY PROTECTIVENESS

Sections 7.1, 7.2, and 7.3 discuss three questions that are designed to assess the overall status and protectiveness of the remedy. Each component of the remedy will be discussed generally in the order in which it was listed in Section 4.2. Issues that affect the protectiveness of the remedy and associated follow-up actions are further outlined in Section 8.

7.1 Question A: Is the remedy functioning as intended by the decision documents?

The answer to this question addresses remedial action performance, early indicators of potential issues, O&M issues, opportunities for O&M optimization, and implementation of institutional controls. These items are discussed by site area as follows.

Landfill Area and Clam Bay Sediments

Remedial action objectives for these areas were outlined in Section 3.4. Regarding performance of the landfill cap, the cap is preventing human and wildlife contact with landfill waste and dust, thereby functioning as intended by the ROD. Inspection and maintenance of the cap is occurring, with the primary recurring issue being the persistent presence of scotch broom, alder, and blackberries on the cap (ponding water on the swale, also a recurring problem, has been minimized through excavation and backfill of the ponding area). These plants/trees have roots that could damage the membrane if they are allowed to continue to grow; thus they need to be eradicated. Ongoing spraying is occurring to remove these species on the landfill cap; however, scotch broom east of the EPA's access road (still on cap area) is not being sprayed. Consequently, these plants are thriving. Thus, specific improvements to I&M procedures could include more aggressive removal (by hand) of scotch broom on the eastern edge of the landfill cap and reiteration of the target species to eradicate (i.e., alder and blackberry, in addition to scotch broom). In general, annual reports of the I&M activities also need to be produced.

Regarding institutional controls, an ICP needs to be finalized to ensure that drilling and construction that would affect the integrity of the cap do not take place. In addition, the ICP should specify that the cap area will not be used for future residential or childcare property.

In the context of the ICP, seep, sediment, and shellfish monitoring data are needed to determine whether the remedy is achieving the rest of the remedial action objectives listed in Section 3.4 for Clam Bay. Specifically, monitoring of the landfill seeps needs to occur in order to establish if they exist, and if they comply with cleanup levels and goals. Additionally, as mentioned previously, sediment monitoring did not occur immediately after cap placement, and consequently there is no post-remedial baseline for establishing recovery trends. Also, one I&M monitoring event indicated that tidal action was pulling some gravel away from the heavy riprap along shoreline protection system. It is unclear from subsequent monitoring events if any action was taken (or necessary) to address this issue. These issues need to be addressed to ensure that inspection, maintenance, and monitoring as intended by the ROD occurs.

Regarding performance of the remedy related to ecological risks, the ROD indicated that potential unacceptable ecological risks were limited to the Landfill Area and Clam Bay. As such, the remedy focused on achieving the RAOs for these areas. The landfill cap was determined to be sufficient to prevent wildlife contact with the landfill wastes and to provide adequate protection from upland exposure conditions. The landfill cap, hydraulic cutoff system (slurry wall), and shoreline protection system were designed to limit infiltration of precipitation into the landfill, thereby achieving seep cleanup levels immediately and providing protection to the marine environment. Since neither seep (nor sediment) monitoring has occurred, compliance with the ROD cannot be determined in this five-year review. The RAO for reduction in concentration of metals, PCBs, and 2,4-dimethylphenol to below cleanup levels for sediments in the biologically active zone (0 to 10 centimeter depth) should have been achieved immediately upon construction because the thickness of the sediment cap placed (more than six inches) was greater than the biologically active zone (approximately four inches). Once sediment and tissue monitoring has occurred (scheduled for late 2004/early 2005), compliance with the RAOs can be evaluated.

Beaver Creek

As mentioned in Section 4.2(4), the restoration of Beaver Creek was chosen to address the loss of wetlands due to shoreline excavation and construction of the landfill cap. The goal of the restoration was to restore natural creek functions and improve fish habitat. Monitoring of the restoration effort is currently being conducted by the USACE at a minimum of twice per year and is scheduled to continue through 2008, in accordance with the *Beaver Creek Restoration Monitoring and Adaptive Management Plan* [Pentec Environmental, 2000]. Monitoring performed in February 2004 indicated that some planted vegetation had not survived and that certain areas were experiencing erosion. Replanting of vegetation to replace the failed species and to provide stabilization is scheduled for October 2004. The monitoring also determined that a large number of salmon were using the newly restored stream almost as soon as the reconstructed weirs were open, indicating that the restoration has been successful at improving fish habitat.

Former Fire Training Area

Remedial action objectives for the FFTA were outlined in Section 3.4. As described in Section 4.2(6), testing of the soils for dioxins indicated that compliance with the cleanup level of 270 ng/kg had been achieved. Thus, the remedy has functioned as intended by the ROD to prevent human and wildlife contact with simulator debris and soils containing dioxin/furan concentrations greater than the cleanup levels.

Regarding institutional controls, an ICP needs to be finalized to address the TPH-impacted soil left in-place near the main simulator complex of the FFTA. Implementation of the ICP will help ensure compliance with the ROD.

7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?

The exposure assumptions, toxicity data, cleanup levels, and RAOs presented in the ROD were reviewed to determine their continuing validity and the results are discussed below.

Exposure Assumptions, Toxicity Data and Cleanup Levels for Protection of Terrestrial Organisms (Landfill Area) and Benthic Organisms (Clam Bay)

The ROD indicated that potential unacceptable ecological risks were limited to the landfill area and Clam Bay. As such, the remedy focused on achieving the RAOs for these areas. The landfill cap, which remains intact, was determined to be sufficient to prevent wildlife contact with the landfill wastes and to provide adequate protection from upland exposure conditions. No changes have been identified regarding terrestrial wildlife exposure or toxicity assumptions.

The Washington State Sediment Management Standards [WAC 173-204] were referenced in the RI/FS and ROD with respect to protection levels for benthic organisms. These standards have not changed, nor did they set the RAO for PCBs (see next "Exposure Assumptions" section for discussion).

The landfill cap, hydraulic cutoff system, and shoreline protection system were designed to achieve seep cleanup levels immediately to provide protection to the marine environment. Once seep monitoring occurs, compliance with cleanup levels can be determined. The RAO for reduction in concentration of metals, PCBs, and 2,4-dimethylphenol to below cleanup levels for sediments in the biologically active zone (0 to 10 centimeter depth) should also have been achieved immediately upon construction because the thickness of the sediment cap placed (more than six inches) was greater than the biologically active zone (approximately four inches). Once seep, sediment, and tissue monitoring has occurred (scheduled for late 2004/early 2005), compliance with the RAOs can be fully evaluated.

Exposure Assumptions for Shellfish Consumption

As indicated in Section 6.6, the original shellfish consumption rate used in the RI/FS to calculate the potential risk to subsistence-level shellfishers was less than the 95^{th} percentile consumption rate recently provided in the Suquamish Tribe's 2000 *Fish Consumption Survey* [Suquamish Tribe, 2000]. In the RI/FS, sediment PCB cleanup goals corresponding to a $1x10^{-5}$ incremental lifetime cancer rate were derived by considering subsistence shellfish consumption rates provided informally by the Suquamish Tribe at that time. The goal derived was 40 µg/kg-dry in sediments. Table 6 below shows a comparison of the consumption rates from the recent Suquamish 2000 survey to those listed in the RI/FS. The last row of Table 6 provides ratios of the rates in the 2000 survey to those in the RI/FS.

Table 6. Comparison of Consumption Rates of Shellfish (grams per day per individual)

Scenario: Subsistence Fishers[1]	**Reasonable Maximum Exposure (RME)** (95th percentile)	**Central Tendency** (50th percentile)
Suquamish Fish Consumption Survey (FCS, 2000)		
	Adults (Assume 81 kg body weight)	
Group E Shellfish[2] **-** Average (Male and Female)	336.9	66.0
All Shellfish - Average (Male and Female)	337.9	68.1
	Children (Assume 14 kg body weight)	
All Shellfish - Children	35.0	5.6
	All Fishers	
Exposure Conditions in the RI[3]	64.0	40.5
Ratio = RME (Adults, All Shellfish) – FCS, 2000 / RME (All Fishers) – RI, 1996	**Ratio of Exposures**	
	5.3	**1.7**

1- All values except ratios have been adjusted by a 0.5 area use factor (i.e., half the diet is from shellfish caught in Clam Bay).
2 – According to the FCS, Group E shellfish include clams, geoducks, cockles, oysters, mussels, snails, shrimp, crab, scallops, squid, sea urchin and sea cucumber.
3- Information from Rich Brooks, Suquamish Tribe, cited in the RI. This included geoduck ingestion as well as intertidal clams.

This comparison suggests that the RI may have underestimated the potential risks from high-quantity tribal subsistence consumption of shellfish by a factor of 1.7 (central tendency (CT)) to 5.3 (RME). Accordingly, at these higher consumption rates, the ROD remedial action objective of 40 µg/kg-dry PCBs in sediment could correspond to a potential cancer risk above $1x10^{-5}$. Because there is a current restriction on tribal gathering of shellfish from the intertidal area, and because sediment and tissue monitoring data has not yet been collected, it is premature to discuss long-term cleanup level attainment at the Manchester site. The compliance monitoring plan, which will be completed and implemented during fiscal year 2005, will address the status of contaminants such as PCBs in seeps, sediments, and intertidal clam tissue in Clam Bay. This information will be useful for decision-making by EPA, the Washington State Department of Health, and the Suquamish Tribe in terms of managing the fishery. The information will also be useful for the next five-year review.

Toxicity Values for TPH

As noted in Table 7 below, the soil cleanup level for diesel under the Model Toxics Control Act has increased. The ROD stated that soil cleanup goal for TPH (as diesel) was established for the FFTA based on the MTCA Method A routine cleanup level. At that time (1997), the cleanup level was 200 mg/kg. In 2001, the cleanup level was changed to 2000 mg/kg [WAC173-340-900, Table 740-1]. Because the ROD had already determined that the TPH-impacted soil presented minimal risk to human health and the environment, the change has no impact on the remedy's protectiveness.

Table 7. Changes to Chemical-specific Standards

Contaminant	**Media**	**Cleanup Level**		**Cleanup Goal**		**Citation (Year)**	**Impact on Remedy?**
TPH as diesel	Soil	Previous:	N/A[1]	Previous:	200 mg/kg	WAC173-340-900 (1990)	None
		New:	*2000 mg/kg*	*New:*	--	WAC173-340-900 (2001)	

1- Site-specific risk assessment and leachability testing indicated only a low risk associated with TPH; consequently, no chemical-specific cleanup level was necessary, according to the ROD.

Cleanup Levels for Polychlorinated Dioxins and Furans

The Cancer Potency Factor for 2,3,7,8-tetrachloro-dibenzo-p-dioxin (2,3,7,8-TCDD) has not changed in Ecology's Cleanup Levels and Risk Calculations (CLARC, version 3.1. history worksheet). The 2001 revision to MTCA retained the former 1989 Toxicity Equivalent Concentration method for calculating equivalent toxicities for 2,3,7,8-TCDD and 2,3,7,8 tetrachloro-dibenzo-furan (2,3,7,8-TCDF). Thus, there is no basis for a change in the protectiveness of the remedy.

Upon completion of excavation of surface and subsurface soils in the FFTA, REMTECH, a USACE contractor, took four confirmatory samples for dioxins and furans. Using the higher-value estimating approach that reports non-detected values as one-half of the sample-specific detection limit, the values ranged from 71 to 259 ng/kg, with a mean of 152 ng/kg, which were well below the cleanup level. Thus, the remedy is still protective at the FFTA.

7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Aside from the fish consumption survey data provided by Denice Taylor, no other information was introduced during this first five-year review that relates to the protectiveness of the remedy regarding human health or the environment. Deficiencies and data gaps noted in the preceding sections of this report have been summarized in Section 8 below, and will be addressed to ensure that the remedy is fully compliant with the requirements of the ROD.

8 ISSUES, RECOMMENDATIONS, AND FOLLOW-UP ACTIONS

Issues and assumptions that affect the protectiveness of the remedy for the Manchester site are presented in Table 8. Additional tasks that should be carried out, but do not necessarily affect the protectiveness of the remedy, are also included in Table 8. Corresponding recommendations and follow-up actions are included in Table 9.

Table 8. Issues

Issue		Affects Current Protectiveness[1] (Y/N/U)?	Affects Future Protectiveness (Y/N/U)?
1.	An institutional control plan should be completed as soon as practicable. Items 2, 3, and 4, below describe elements that should be addressed.	N	N
2.	Institutional controls do not appear to be in place for possible new "discoveries" of subsurface TPH-contaminated soil in the FFTA. These could be encountered during construction-related excavation at the NOAA facility.	U (uncertain as to presence of such soil)	U (uncertain as to presence of such soil)
3.	Deed covenants required by the ROD to be drafted have not been done–these would address any future (unplanned) transfer of the property out of federal ownership.	N	N (such transfer is not anticipated)

Table 8 continued

Issue		Affects Current Protectiveness[1] (Y/N/U)?	Affects Future Protectiveness (Y/N/U)?
4.	A subsistence-level fishing restriction for bivalves is in place for the Suquamish Tribe, though it was intended only to be a temporary measure.	N (currently no clam fishing exists over capped area)	U (depends on sediment and tissue monitoring results)
5.	Initial cap placement - Monitoring of sediments did not occur immediately after cap placement (a data gap). In addition, silver was inadvertently omitted from chemical analysis of the cap material prior to placement. Post remedial action – monitoring of shellfish for PCBs in accordance with the CMP (drafted in 1999) also needs to occur four years after cap placement, which would be 2004.	N	U (depends on sediment monitoring implementation and results)
6.	Monitoring of seeps in accordance with the CMP has not been occurring (personal comm. with John Nielsen, GSA, on 7/14/04).	U (depends on if seeps are occurring and contaminated)	U (depends on if seeps are occurring and contaminated)
7.	Unwanted vegetation (scotch broom, alder, and blackberries) is growing on the landfill cap and may have roots that could damage the liner.	N	Y (presuming unchecked vegetative growth)
8.	Annual reports of I&M activities are not being produced by the USACE and distributed to the EPA.	N	N
9.	A final report summarizing the findings of the cultural resources investigation during construction was not produced or provided to the Suquamish Tribe.	N	N
10.	Soil excavated during drainage swale repair (2004) is still sitting in a pile on-site.	N	N
11.	Miscellaneous items (hay bales, drum, bucket, stakes) leftover from the 2000/2001 remediation are still sitting on an FFTA concrete pad.	N	N
12.	The draft remedial action report has not been finalized.	N	N
13.	Final documents (RI/FS, RD, as-builts, etc.) were not received by NMFS personnel or the Suquamish Tribe.	N	N
14.	An open concrete vault was discovered next to Building 1 on NOAA's property.	N	N
15.	A weathered "hazardous area" sign still remains at the beach area.	N	N

1- Many protectiveness determinations cannot be made until further data are available; thus, "U" means that the determination is "uncertain" at this time.

Table 9. Recommendations and Follow-up Actions

Issue	Recommendations/ Follow-up Actions	Responsible Party	Milestone Date[1]	Affects Protectiveness (Y/N?)	
				Current?	Future?
1.	Complete and implement final institutional control plan	USACE, in coordination with EPA/NOAA	12/31/04	N	N
2.	Will be achieved upon completion of item 1	--	--	N	N
3.	Will be achieved upon completion of item 1	--	--	N	N

Table 9 continued

Issue	Recommendations/ Follow-up Actions	Responsible Party	Milestone Date[1]	Affects Protectiveness (Y/N?)	
				Current?	Future?
4.	Coordinate with the Suquamish Tribe (and other state and federal agencies as appropriate) to evaluate the continued need for a shellfishing restriction.	USACE in coordination with Suquamish Tribe	As soon as practicable	N (currently no clam fishing exists over capped area)	U (depends on sediment and tissue monitoring results)
5.	Update CMP and ensure that the monitoring in the CMP is implemented; provide CMP to the Suquamish Tribe. • Starting in early 2005, collect and test sediment samples for PCBs to determine compliance with cleanup levels. Also test for silver to verify compliance with Ecology's sediment quality standards. • Starting in early 2005, collect and test clam tissue samples for PCBs to determine compliance with cleanup levels.	USACE	Draft CMP by 12/31/04; Monitoring in early 2005	N	U (depends on proper implemen-tation of monitoring)
6.	Visually inspect shoreline area for presence of seeps and document the results (i.e., found/not found). If seeps are found, test seeps in accordance with the CMP and evaluate for further remedial action.	USACE	During next round of I&M monitoring (October 2004)	U (depends on if seeps are occurring and contaminated)	U (depends on if seeps are occurring and contaminated)
7.	Pursue aggressive eradication of all unwanted vegetation on the landfill cap. Update I&M procedures accordingly.	USACE	During next round of I&M monitoring (October 2004)	N	Y (presuming unchecked vegetative growth)
8.	Produce and distribute annual reports of I&M activities to EPA (and other interested parties). Review I&M procedures to ensure adequacy and modify procedures if necessary.	USACE	Yearly; report on 12/31/04	N	N
9.	Complete a report of findings from the archeological investigation that occurred during remedial construction and provide to the Suquamish Tribe.	USACE	3/31/05	N	N
10.	Replace soil from swale excavation on-site or dispose of it properly off-site. The I&M manual does not specify how to handle soil excavated from the landfill area – update I&M manual to correct this deficiency.	USACE	3/31/05	N	N
11.	Remove and appropriately dispose of miscellaneous items left on FFTA concrete pad.	USACE	3/31/05	N	N
12.	Finalize draft remedial action report.	USACE	3/31/05	N	N
13.	Provide final documents to NMFS personnel (RI/FS, RD, and as-builts) and to the Suquamish Tribe (RI/FS and final RAR).	USACE	3/31/05	N	N
14.	Investigate current/past use of vault to determine the function of this vault.	NOAA to coordinate with USACE	3/31/05	N	N
15.	Remove the weathered "Hazardous Area" sign,	EPA	3/31/05	N	N

Table 9 continued

Issue	Recommendations/ Follow-up Actions	Responsible Party	Milestone Date[1]	Affects Protectiveness (Y/N?)	
				Current?	Future?
	as all hazardous material has been either removed from the site or contained under the landfill cap.				

1 – All follow-up actions and dates for completion by USACE are subject to the availability of funds.

9 PROTECTIVENESS STATEMENT(S)

The remedy was determined to be protective of human health in the short-term because a restriction on subsistence-level harvesting of intertidal bivalve organisms is in place, the landfill cap and shoreline protection system are intact, and the cleanup requirements for the FFTA have been met. The shellfishing restriction, however, was intended only as a temporary measure during the initial recovery period. Seep, sediment, and tissue sampling data are necessary to evaluate the current status and the long-term protectiveness of the actions implemented for the landfill and Clam Bay. New information was also provided to EPA and the USACE in the Suquamish Tribe's 2000 *Fish Consumption Survey*, which indicated that tribal shellfishers consume clams at a rate several times greater than originally estimated in the RI/FS and ROD during the determination of a sediment cleanup level for PCBs. At this time, it is considered premature to revisit the attainment of cleanup levels. Instead, the compliance monitoring plan, which will be completed and implemented during fiscal year 2005 (subject to the availability of funds), will address the status of contaminants such as PCBs in sediment and tissue in Clam Bay.

The protectiveness of the remedy for the environment (flora and fauna on land and in the marine environment) could only be partially determined during the five-year review, due to the lack of monitoring data. The landfill cap was determined to be sufficient to prevent wildlife contact with the landfill wastes, to provide adequate protection from upland exposure conditions, and to prevent infiltration of precipitation into the landfill. The protectiveness of the remedy regarding marine intertidal fauna, however, cannot be determined until seep, sediment, and tissue monitoring and sampling occur. These activities will be undertaken as soon as funds are available following the five-year review. Once data are available, a protectiveness determination can be made.

Other issues found with respect to the requirements of the ROD were as follows: (1) a final institutional control plan has not been implemented; (2) the presence of landfill seeps has not been systematically sought during normal inspection and maintenance activities; and (3) maintenance on the landfill cap does not appear to be aggressive enough to prevent unwanted vegetation, with roots that could potentially damage the liner, from growing on the landfill cap.

To ensure that the remedy complies with the requirements of the ROD and provides long-term protection of human health and the environment, the following measures should be taken: (1) a final institutional control plan should be implemented; (2) the presence of any landfill seeps should be actively sought and documented; and (3) unwanted vegetation such as blackberries, alders, and scotch broom present on the landfill cap should be aggressively removed to prevent possible future damage to the cap.

10 NEXT REVIEW

The next five-year review should be completed by September 30, 2009.

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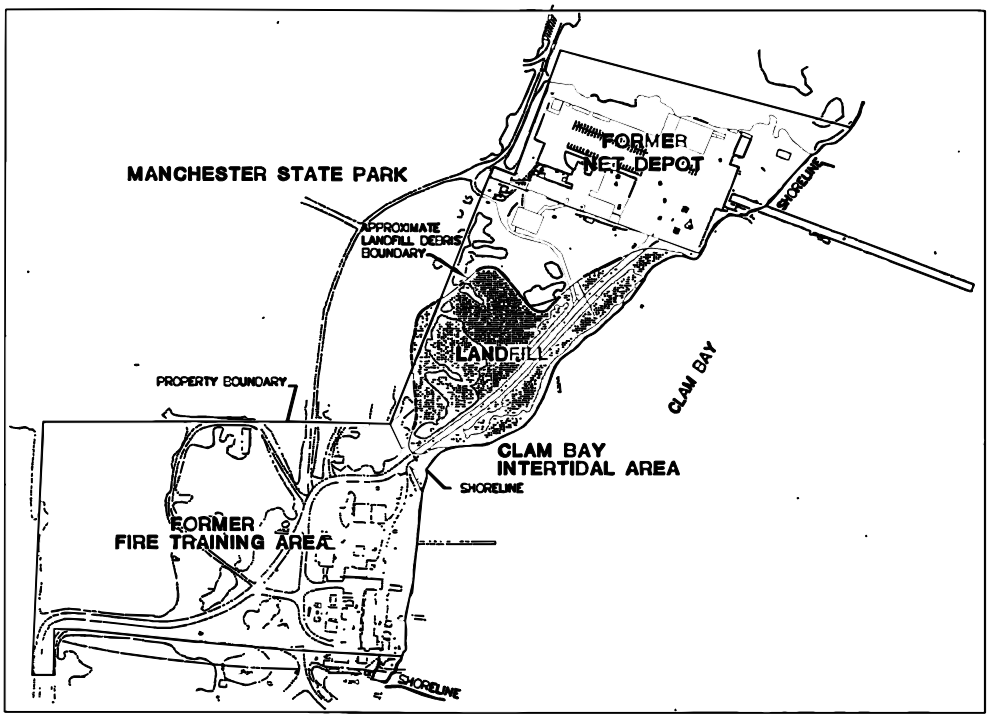
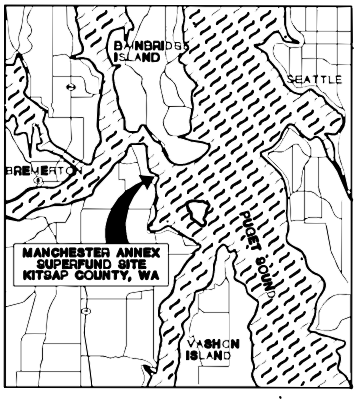
Attachment A – Site Map

Manchester Annex

Vicinity and Site Map



SITE MAP
NOT TO SCALE



VICINITY MAP
NOT TO SCALE

Source: Hart Crowser, 1999. *Cultural Resources Construction Management Plan.*

Attachment B – Regulatory Requirements, Guidance, and "To-Be-Considered" (TBC) Documents

Medium/ Authority	ARAR, Guidance, or TBC	Status	Requirement Synopsis	Cited in:
Soil, groundwater, and surface water/ MTCA	Model Toxics Control Act (MTCA) of the Washington State Department of Ecology (Ecology) [WAC173-340]	Applicable	Establishes cleanup levels for soil, groundwater, and surface water	ROD
Surface Water/ CWA	Ecology's Surface Water Quality Standards [WAC173-201A] and Federal Clean Water Act (CWA) [40CFR131]	Applicable	Establishes chemical-specific cleanup levels for surface water discharges (including tidal seeps)	ROD
Sediment/CWA	Federal Clean Water Act [40CFR330] and Rivers and Harbors Act [33CFR320-330]	Applicable	Protects marine life from unacceptable adverse effects during dredging activities	ROD
Sediment/ WAC	Ecology's Sediment Management Standards [WAC173-204]	Applicable	Establishes chemical-specific cleanup standards to protect biota.	ROD
Air/ RCW	Ecology's Clean Air Act [70.94 RCW]; WAC173-460; WAC 173-400-040; WAC173-403[1]	Applicable	Establishes requirements for ambient concentrations of air contaminants, and for control of fugitive dusts and other emissions during remedial actions	ROD
Soil, water, fish/shellfish tissue / TSCA	Federal Toxic Substances Control Act [40CFR671]	Applicable	Establishes storage and disposal requirements for wastes containing PCBs greater than 50 ppm that are taken outside of an existing area of contamination. Note: No PCB concentrations at Manchester were > 500 ppm.	ROD
Hazardous waste/WAC	Ecology's Dangerous Waste Regulations [WAC173-303]	Applicable	Guides the management of hazardous waste that is moved from its current location	ROD
--	Ecology's Underground Storage Tank Regulations [WAC173-360]	Applicable	Establishes requirements for permanent closure of USTs (such as those found in the FFTA)	ROD
Sediment/ WAC	Kitsap County Shoreline Master Plan [WAC173-19-2604]	Relevant and Appropriate	Covers fill, dredging and other remedial activities that occur within 200 feet of the Clam Bay shoreline	ROD
--	State of Washington (WISHA) and Federal (OSHA) Safety and Health Standards [WAC296-62 Part P; 29CFR1910]	Applicable	Establishes safe operating procedures and requirements for conducting remedial actions	ROD
Hazardous waste / CERCLA/RCRA	CERCLA off-site disposal rule and RCRA [40CFR300.440 and 40CFR-Part268]	Applicable	Regulates off-site disposal actions and land disposal restrictions	ROD
--	State of Washington Minimal Functional Standards for Solid Waste Handling [WAC173-	Relevant and Appropriate	Provides standards for the design of landfill containment and long-term operations and maintenance	ROD

Medium/ Authority	ARAR, Guidance, or TBC	Status	Requirement Synopsis	Cited in:
	340]		requirements within the landfill cap area	
--	State of Washington Hydraulic Code Rules [WAC220-110]	Relevant and Appropriate	Defines when removal or filling actions waterward of the ordinary high water line can occur	ROD
--	Endangered Species Act [16USC35, 1531-544]	Applicable	Conserves threatened or endangered species	ROD
--	Executive Orders 11990 and 11988 [40CFR6, Appendix A]	TBC	Provides guidance to prevent negative impacts to floodplains and wetlands	ROD
--	Puget Sound Dredge Disposal Analysis (USACE/EPA)	TBC	Requirements and guidelines for evaluating dredged material, disposal site management, disposal site monitoring, and data management	ROD
Seafood tissue	Critical toxicity values (acceptable daily intake levels, carcinogenic potency factor) and U.S. Food and Drug Administration action levels for concentrations of mercury and PCBs in edible seafood tissue.	TBC	--	ROD
Wetlands	EPA Wetlands Action Plan (1989)	TBC	Describes primary goal of "no net loss" of wetlands	ROD
Surface Water	Puget Sound Storm Water Management Program [40CFR122-24; RCW 90.48]	TBC	Discusses NPDES requirements and storm water management	ROD
--	Puget Sound Estuary Program Protocols (1987)	TBC	Provides guidance on sampling collection, laboratory analysis, and QA/QC procedure.	ROD
Sediment/ NHPA	National Historic Preservation Act	Relevant and Appropriate	Provides guidance on how to handle cultural resources if found	CRCMP
Sediment/ NAGPRA	Native American Graves Protection and Repatriation Act	Relevant and Appropriate	Provides guidance on how to handle cultural resources if found	CRCMP
Sediment/RCW	Indian Graves and Records [Revised Code of Washington (RCW) 27.44]	Relevant and Appropriate	Provides guidance on how to handle cultural resources if found	CRCMP
Sediment/ ARPA	Archaeological Resources Protection Act	Relevant and Appropriate	Provides guidance on how to handle archeological resources if found	CRCMP

1 – WAC173-403, "Implementation of Regulations for Air Contaminant Sources," was repealed in 1991 and the information was incorporated into WAC173-400, "General Regulations for Air Pollution Sources."

Attachment C – Site Inspection Checklist

I. SITE INFORMATION	
Site name: *Old Navy Dump/Manchester Laboratory (USEPA/NOAA); also known as Manchester Annex Superfund Site*	**Date of inspection:** *July 20, 2004*
Location and Region: *Manchester, WA*	**EPA ID:** *WA8680030931*
Agency, office, or company leading the five-year review: *U.S. Army Corps of Engineers*	**Weather/temperature:** *Sunny, low 70s*

Remedy Includes: (Check all that apply)

X Landfill cover/containment
Access controls
X Institutional controls
Groundwater pump and treatment
Surface water collection and treatment
Other_____
_____

X Monitored enhanced natural attenuation
X Groundwater containment
Vertical barrier walls

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** _____ _____ _____
Name Title Date
Interviewed at site at office by phone Phone no. _____
Problems, suggestions; Report attached _____

There are no specific O&M managers at the site. However Desmond Maynard from the NMFS and Mark Ader from the EPA Manchester Lab are facility managers. Their observations of site conditions are included in the Site Interview (Section 6.6.)

2. **O&M staff** _____ _____ _____
Name Title Date

Interviewed at site at office by phone Phone no. _____
Problems, suggestions; Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency *U.S Environmental Protection Agency*
Contact *Bob Kievit* *Regional Program Manager* *7/20/04* *(360) 753-9014*
Name Title Date Phone no.
Problems; suggestions; Report attached _____

Agency *Suquamish Tribe*
Contact *Denice Taylor* *Environmental Scientist* *7/20/04* *(360) 394-8449*
Name Title Date Phone no.
Problems; suggestions; Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; Report attached _____

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

O&M manual	Readily available	Up to date	N/A
As-built drawings	Readily available	Up to date	N/A
Maintenance logs	Readily available	Up to date	N/A

Remarks: *None of these documents were available on-site. An I&M manual, as well as I&M reports from the contractors performing the I&M work, are available at the USACE office.*

2. **Site-Specific Health and Safety Plan** Readily available Up to date **X N/A**
Contingency plan/emergency response plan Readily available Up to date **X N/A**

Remarks: _____

3. **O&M and OSHA Training Records** Readily available Up to date N/A
Remarks: *The existence of these records was not verified because there are no systems to operate as part of this remedy.*

4. **Permits and Service Agreements**

Air discharge permit	Readily available	Up to date	**N/A**
Effluent discharge	Readily available	Up to date	**N/A**
Waste disposal, POTW	Readily available	Up to date	**N/A**
Other permits_____	Readily available	Up to date	**N/A**

Remarks_____

5. **Gas Generation Records** **X Readily available** Up to date N/A
Remarks: *Gas monitoring is performed and recording on inspection logs as part of the I&M maintenance work being performed by GSA.*

6. **Settlement Monument Records** Readily available Up to date **X N/A**
Remarks_____

7.	**Groundwater Monitoring Records**	Readily available	Up to date	**X N/A**
	Remarks_____			
8.	**Leachate Extraction Records**	Readily available	Up to date	**X N/A**
	Remarks_____			
9.	**Discharge Compliance Records**			
	Air	Readily available	Up to date	**X N/A**
	Water (effluent)	Readily available	Up to date	N/A
	Remarks_____			
10.	**Daily Access/Security Logs**	Readily available	Up to date	**X N/A**
	Remarks_____			

IV. O&M COSTS

1. **O&M Organization**

State in-house Contractor for State
PRP in-house Contractor for PRP
Federal Facility in-house **Contractor for Federal Facility**
Other_____

2. **O&M Cost Records** ***See Section 4.3 in text for a discussion of O&M costs***

Readily available Up to date Funding mechanism/agreement in place

Original O&M cost estimate: _____ Breakdown attached

Total annual cost by year for review period if available

From_____	To_____	_____	Breakdown attached
Date	Date	Total cost	
From_____	To_____	_____	Breakdown attached
Date	Date	Total cost	
From_____	To_____	_____	Breakdown attached
Date	Date	Total cost	
From_____	To_____	_____	Breakdown attached
Date	Date	Total cost	
From_____	To_____	_____	Breakdown attached
Date	Date	Total cost	

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: _____
_____

V. ACCESS AND INSTITUTIONAL CONTROLS Applicable N/A

A. Fencing

1. **Fencing damaged** Location shown on site map gates secured N/A
Remarks: *A barbed-wire fence in good condition exists between Manchester State Park and the landfill cap.*

B. Other Access Restrictions

1. **Signs and other security measures** Location shown on site map N/A
Remarks: *A sign prohibiting fishing is located on the pier. A weathered "hazardous area" sign exists on the beach and should probably be replaced. Another sign prohibiting fishing of all kinds should probably be located in the beach area as well. "No trespassing" signs face Manchester State Park.*

C. Institutional Controls (ICs)

1. **Implementation and enforcement**
Site conditions imply ICs not properly implemented **Yes** No N/A
Site conditions imply ICs not being fully enforced **Yes** No N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date Yes No N/A
Reports are verified by the lead agency Yes No N/A

Specific requirements in deed or decision documents have been met Yes No N/A
Violations have been reported Yes No N/A
Other problems or suggestions: Report attached

An institutional control plan needs to be finalized and implemented at the site to ensure that the remedy remains protective.

2. **Adequacy** ICs are adequate ICs are inadequate N/A
Remarks: *See answer above.*

D. General

1. **Vandalism/trespassing** Location shown on site map **X No vandalism evident**
Remarks_____
_____

2. **Land use changes on site** **X N/A**
Remarks_____
_____

3. **Land use changes off site** **X N/A**
Remarks_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads Applicable N/A

1. **Roads damaged** Location shown on site map **X Roads adequate** N/A
Remarks_____
_____

B. Other Site Conditions

Remarks _____

VII. LANDFILL COVERS **X Applicable** N/A

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map **X Settlement not evident**
Areal extent_____ Depth_____
Remarks_____

2. **Cracks** Location shown on site map **X Cracking not evident**
Lengths_____ Widths_____ Depths_____
Remarks_____

3. **Erosion** Location shown on site map **X Erosion not evident**
Areal extent_____ Depth_____
Remarks_____

4. **Holes** Location shown on site map **X Holes not evident**
Areal extent_____ Depth_____
Remarks_____

5. **Vegetative Cover** Grass Cover properly established No signs of stress
Trees/Shrubs (indicate size and locations on a diagram)

Remarks: *Alder and scotch broom are persistent problems on the landfill cover and need to be eradicated.*

6. **Alternative Cover (armored rock, concrete, etc.)** **X N/A**
Remarks_____
_____

7. **Bulges** Location shown on site map **X Bulges not evident**
Areal extent_____ Height_____
Remarks_____
_____

8. **Wet Areas/Water Damage** Wet areas/water damage not evident
Wet areas Location shown on site map Areal extent_____
Ponding Location shown on site map Areal extent_____
Seeps Location shown on site map Areal extent_____
Soft subgrade Location shown on site map Areal extent_____
Remarks: *Ponding has been noted during past I&M inspections but was not present during the site visit (due to dry conditions). Repairs were made to the drainage structures in May/June 2004; the ability of the repairs to prevent ponding during the wet season needs to be closely monitored (fall through spring).*

9. **Slope Instability** Slides Location shown on site map **X No evidence of slope instability**
Areal extent_____
Remarks_____
_____

B. Benches Applicable **X N/A**
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** Location shown on site map N/A or okay
Remarks_____
_____

2. **Bench Breached** Location shown on site map N/A or okay
Remarks_____
_____

3. **Bench Overtopped** Location shown on site map N/A or okay
Remarks_____
_____

C. Letdown Channels Applicable **X N/A**
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** Location shown on site map No evidence of settlement
Areal extent_____ Depth_____
Remarks_____
_____

2. **Material Degradation** Location shown on site map No evidence of degradation
Material type_____ Areal extent_____
Remarks_____
_____

3. **Erosion** Location shown on site map No evidence of erosion
Areal extent_____ Depth_____
Remarks_____
_____

4. **Undercutting** Location shown on site map No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. **Obstructions** Type_____ No obstructions
Location shown on site map Areal extent_____
Size_____
Remarks_____
_____

6. **Excessive Vegetative Growth** Type_____
No evidence of excessive growth
Vegetation in channels does not obstruct flow
Location shown on site map Areal extent_____
Remarks_____
_____

D. Cover Penetrations **X Applicable** N/A

1. **Gas Vents** Active Passive
Properly secured/locked Functioning **X Routinely sampled** Good condition
Evidence of leakage at penetration Needs Maintenance
N/A
Remarks_____
_____

2. **Gas Monitoring Probes**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance **X N/A**
Remarks_____
_____

3. **Monitoring Wells** (within surface area of landfill)
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance **X N/A**
Remarks_____
_____

4. **Leachate Extraction Wells**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance **X N/A**
Remarks_____
_____

5. **Settlement Monuments** Located Routinely surveyed **X N/A**
Remarks_____
_____

E. Gas Collection and Treatment Applicable **X N/A**

1. **Gas Treatment Facilities**
Flaring Thermal destruction Collection for reuse
Good condition Needs Maintenance
Remarks_____
_____

2. **Gas Collection Wells, Manifolds and Piping**
Good condition Needs Maintenance
Remarks_____
_____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
Good condition Needs Maintenance N/A
Remarks_____
_____

F. Cover Drainage Layer **X Applicable** N/A

1. **Outlet Pipes Inspected** Functioning N/A
Remarks_____
_____

2. **Outlet Rock Inspected** Functioning N/A
Remarks: *Drainage rock was recently placed and is free of invasive plants; it is not clear how well the rock prevents ponding. This issue will need to be monitored during the wet season.*

G. Detention/Sedimentation Ponds Applicable **X N/A**

1. **Siltation** Areal extent_____ Depth_____ N/A
Siltation not evident
Remarks_____
_____

2. **Erosion** Areal extent_____ Depth_____
Erosion not evident
Remarks_____
_____

3. **Outlet Works** Functioning N/A
Remarks_____
_____

4. **Dam** Functioning N/A
Remarks_____
_____

H. Retaining Walls Applicable **X N/A**

1. **Deformations** Location shown on site map Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks_____
_____

2. **Degradation** Location shown on site map Degradation not evident
Remarks_____
_____

I. Perimeter Ditches/Off-Site Discharge Applicable **X N/A**

1. **Siltation** Location shown on site map Siltation not evident
Areal extent_____ Depth_____
Remarks_____
_____

2. **Vegetative Growth** Location shown on site map N/A
Vegetation does not impede flow
Areal extent_____ Type_____
Remarks_____
_____

3. **Erosion** Location shown on site map Erosion not evident
Areal extent_____ Depth_____
Remarks_____
_____

4. **Discharge Structure** Functioning N/A
Remarks_____
_____

VIII. VERTICAL BARRIER WALLS Applicable **X N/A**

1. **Settlement** Location shown on site map Settlement not evident
Areal extent_____ Depth_____
Remarks_____
_____

2. **Performance Monitoring** Type of monitoring_____
Performance not monitored
Frequency_____ Evidence of breaching
Head differential_____
Remarks_____
_____

IX. GROUNDWATER/SURFACE WATER REMEDIES Applicable **X N/A**	
A. Groundwater Extraction Wells, Pumps, and Pipelines Applicable N/A	
1. **Pumps, Wellhead Plumbing, and Electrical** Good condition All required wells properly operating Needs Maintenance N/A Remarks_____	
2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances** Good condition Needs Maintenance Remarks_____	
3. **Spare Parts and Equipment** Readily available Good condition Requires upgrade Needs to be provided Remarks_____	
B. Surface Water Collection Structures, Pumps, and Pipelines Applicable **X N/A**	
1. **Collection Structures, Pumps, and Electrical** Good condition Needs Maintenance Remarks_____	
2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances** Good condition Needs Maintenance Remarks_____	
3. **Spare Parts and Equipment** Readily available Good condition Requires upgrade Needs to be provided Remarks_____	

C. Treatment System Applicable **X N/A**

1. **Treatment Train** (Check components that apply)
   Metals removal Oil/water separation Bioremediation
   Air stripping Carbon adsorbers
   Filters_____
   Additive (*e.g.*, chelation agent, flocculent) _____
   Others_____
   Good condition Needs Maintenance
   Sampling ports properly marked and functional
   Sampling/maintenance log displayed and up to date
   Equipment properly identified
   Quantity of Groundwater treated annually_____
   Quantity of surface water treated annually_____
   Remarks_____
   _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   N/A Good condition Needs Maintenance
   Remarks_____
   _____

3. **Tanks, Vaults, Storage Vessels**
   N/A Good condition Proper secondary containment Needs Maintenance
   Remarks_____
   _____

4. **Discharge Structure and Appurtenances**
   N/A Good condition Needs Maintenance
   Remarks_____
   _____

5. **Treatment Building(s)**
   N/A Good condition (esp. roof and doorways) Needs repair
   Chemicals and equipment properly stored
   Remarks_____
   _____

6. **Monitoring Wells** (pump and treatment remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks_____
   _____

D. Monitoring Data

1. **Monitoring Data**
   Is routinely submitted on time Is of acceptable quality

2. Monitoring data suggest:

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks_____
   _____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The remedial action objectives are presented in Section 3.4. The terrestrial aspects of the remedy are functioning to prevent human and wildlife contact with contaminants; however, an ICP needs to be in place to address the TPH-contaminated soil left in-place at the FFTA. Scotch broom and alder on the landfill cap also need to be aggressively removed to ensure that the integrity of the landfill cap is maintained. The presence of groundwater seeps needs to be determined to evaluate if the remedy is functioning as intended for the marine environment.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

More aggressive eradication of scotch broom and alder is required. I&M inspections need to be conducted at regularly-spaced intervals (i.e., adhere to quarterly requirement).

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

The only repair identified to date was the excavation and backfill of a previous drain line in the landfill cap area. Although the area has been filled with drain rock to preventing ponding, the efficacy has yet to be confirmed (wet season dependent).

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

Attachment D – Site Photos

SITE VISIT PHOTOS

Photo 1. Scotch broom surviving herbicide control (green shoots)

Photo 2. Alder growing on landfill cap

Photo 3. Shoreline protection system with minimal loose riprap

Photo 4. No trespassing signs on landfill cap

Photo 5. Fishing, crabbing, and shellfish harvesting restriction sign

Photo 6. Weathered hazardous area sign

Photo 7. Soil left over from swale drainage repair (April/May 2004)

Photo 8. Hay bales left over from remedial construction

Photo 9. Drum left over from remedial construction

Photo 10. Decon bucket (assumed) left over from remedial construction

Photo 11. Depression in gravelly area at FFTA

Photo 12. Decommissioned well that is no longer flush with the pavement