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Tulalip Landfill Five-Year Review Report

Second Five-Year Review Report
for
Tulalip Landfill Superfund Site

Marysville
Snohomish County, Washington

April 2008

PREPARED BY:

U.S. Army Corps of Engineers, Seattle District

for

United States Environmental Protection Agency
Region 10
Seattle, Washington

Approved by: Date:

4/24/2008

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List of Acronyms

Acronym	Definition
ARARs	Applicable or Relevant and Appropriate Requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COCs	Contaminants of Concern
cy	Cubic yard
EPA	United States Environmental Protection Agency
USACE	United States Army Corps of Engineers
FCOR	Final Closeout Report
FS	Feasibility Study
FSP	Field Sampling Plan
MTCA	Model Toxics Control Act
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operations and Maintenance
PCB	Polychlorinated Biphenyls
PAH	Polyaromatic Hydrocarbons
PRPs	Potentially Responsible Parties
PSAPCA	Puget Sound Air Pollution Control Authority
PSCAA	Puget Sound Clean Air Agency
RAOs	Remedial Action Objectives
RI	Remedial Investigation
RD	Remedial Design
ROD	Record of Decision
RPM	Remedial Project Manager
TBC	To Be Considered
TEF	Toxicity Equivalent Factors
USFWS	United States Fish and Wildlife Service
WMI	Waste Management, Inc.

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Executive Summary

The 147-acre landfill is located on North Ebey Island within the Tulalip Tribes Indian Reservation in Marysville, Washington. The landfill was operated from 1964 until 1979 during which approximately four million tons of commercial and industrial waste was deposited in the landfill. Because contaminated leachate was seeping out into the nearby wetlands causing concerns for human health and the environment, the site was added to the National Priorities List (NPL) in April 1995. Workers constructed a seven layer cover system over the landfill from June 1998 through September 2000 which was intended to eliminate the seeps. Monitoring of the Tulalip Landfill began on February 20, 2001, and will continue for a minimum of 30 years due to contaminants left on-site. On September 18, 2002, the Environmental Protection Agency (EPA) finalized the deletion of the Tulalip Landfill Superfund Site from the NPL.

This report comprises the second five year review for this site. Based upon document review, site inspection, and interviews, the cap has been constructed and continues to operate in accordance with the Record of Decision (ROD). There have been no changes in the physical conditions of the site. However, several issues have been observed during the preparation of this second five-year review that raise questions regarding the protectiveness of the remedy as intended by the ROD. There has been no sampling and analysis of the leachate seeps or surface soils at seep locations since April 2002. In addition, no sampling and analyses has been conducted on the sediments at the point where the ground water discharges into Ebey and Steamboat Sloughs since the remedy was completed at the site (before September 2000). Monitoring at these locations is recommended to confirm that applicable or relevant and appropriate requirements (ARARs) continue to be met and that the remedy remains protective, and if not protective, to determine whether additional response actions are necessary.

Not all institutional controls (ICs) listed in the 1996 and 1998 RODs for this site are stated clearly, and do not ensure implementation of or compliance with those controls**.** The September 1998 ROD for the off-source remedy, for example, requires that signage warning of potential health effects related to consuming fish and shellfish be maintained and enforced at this site. While the warning signs have been maintained as required, it appears that no enforcement mechanism has been implemented by regulation or other means by the Tribes. In addition, no covenants restricting land use have been recorded.

A protectiveness determination of the remedy at the Tulalip Landfill Superfund Site cannot be made until sampling from the points of compliance has occurred, sampling data have been reviewed, and all institutional controls have been evaluated by EPA for protectiveness and fully implemented. When these actions are completed, a determination of protectiveness for the site will be made.

Based on the findings of this Five-Year Review and the need to defer a protectiveness determination until follow-up work is completed, the “Human Health Environmental Indicator” and “Ground Water Migration Under Control” status indicators for this site have been changed from “current human exposure controlled” and “groundwater migration under control”, respectively, to “insufficient data”. In addition, the OSWER “Cross Program Revitalization Measure” designation of this Site as “Protective for People under Current Conditions” has been

removed. EPA will update these status indicators when the protectiveness determination is made for Tulalip Landfill Superfund Site.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name ***(from WasteLAN)*****: Tulalip Landfill**		
EPA ID ***(from WasteLAN)*****: WAD980639256**		
Region: 10	**State: WA**	**City/County: Marysville/Snohomish**
SITE STATUS		
NPL status: ☐ Final ☒ **Deleted** ☐ Other (specify)		
Remediation status (choose all that apply): ☐ Under Construction ☐ Operating ☒ **Complete**		
Multiple OUs?* ☒ YES ☐ NO	**Construction completion date:** 9/28/00	
Has site been put into reuse? ☐ YES ☒ **NO**		
REVIEW STATUS		
Lead agency: ☒ **EPA** ☐ State ☐ Tribe ☐ Other Federal Agency _____		
Author name: Marlowe Laubach/Rick Garrison		
Author title: Chemical Engineer/Geologist	**Author affiliation: USACE Seattle District**	
Review period: 10/24/2007 to 04/24/2008		
Date of site inspection: 12/18/2007		
Type of review: ☒ **Post-SARA** ☐ Pre-SARA ☐ NPL-Removal only ☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐ Regional Discretion		
Review number: ☐ 1 (first) ☒ **2 (second)** ☐ 3 (third) ☐ Other (specify) _____		
Triggering action: ☐ Actual RA Onsite Construction at OU #____ ☐ Actual RA Start at OU#____ ☐ Construction Completion ☒ **Previous Five-Year Review Report** ☐ Other (specify)		
Triggering action date ***(from WasteLAN)*****:** 04/24/2003		
Due date ***(five years after triggering action date)*****:** 04/24/2008		

* [“OU” refers to operable unit.]

Five-Year Review Summary Form, cont'd.

Issues That May Affect Protectiveness

1. No sediment, soil or surface water sampling at compliance points described in the Record of Decision (ROD).
2. Not all institutional controls listed in the 1996 and 1998 RODs for this site are stated clearly, and do not ensure implementation of or compliance with those controls. (For example, fishing near the ground water discharge zone has been observed and the Tribes have no regulations to enforce the warning signs.)
3. It is unclear whether all deed notices or restrictions are on file with the Bureau of Indian Affairs and County for all portions of site.

Recommendations and Follow-up Actions For Issues That May Affect Protectiveness:

1. Leachate seep sampling and report of sample results to EPA for contaminants of concern at the points of compliance per the ROD.
2. Soil sampling and report of sample results to EPA at the seep locations for contaminants of concern.
3. Sediment sampling and report of sample results to EPA for contaminants of concern at the points of compliance (where ground water discharges into Ebey and Steamboat sloughs).
4. Evaluate the effectiveness of existing institutional controls for this site. Amend ICs, as appropriate, to ensure effectiveness of these controls. Ensure compliance with ICs by establishing authorities to implement and enforce ICs, as necessary.
5. Determine whether deed notices or restrictions are on file for all portions of site with the BIA, Tribes, and County. If deed notice or restrictions are missing, file notice with appropriate agencies.

Other Issues Identified for Site That Do Not Directly Affect Protectiveness

1. ROD is vague regarding points of compliance and receptors affected
2. Unknown if a geomembrane boot was installed to seal the piezometer casing to the geomembrane
3. Some water collection drain lines have no clean-out ports.
4. Potential ponding during heavy rain events
5. Existing signs are often under water during high tide. Additional signs would be helpful in warning people of dangers of eating fish from within posted area.
6. Proposal from Tulalip Tribes to place fill to smooth transition for the mower, from berm road onto the cap.
7. Proposal from Tulalip Tribes to mow with a high cut - 7-8 inches, instead of 3-4 inches as required in the O&M manual – in the summer and fall to protect the soil cover during the dry season
8. Proposal from Tulalip Tribes to flush drain lines with saline water from adjacent slough rather than using fresh water, as required. Additional proposal to flush the drains after the fall rains have begun to saturate the soils so the flush water does not simply soak into the ground.

Recommendations and Follow-up Actions For Issues That Do Not Directly Affect Protectiveness:

1. Clarify ROD Points of compliance and the receptors affected.
2. Check to see if a geomembrane boot was installed to seal the piezometer casing to the geomembrane; repair if necessary.
3. Add clean-out ports to drain lines, where needed.
4. Inspect slope panels A and S during/after heavy rain events. Review the performance of the landfill surface to determine if any local ponding has occurred.
5. Use higher posts for existing signs, and seek permission from State to add signs on adjacent state lands.
6. EPA to make a determination on proposal to place fill to smooth transition for the mower, from berm road onto the cap.
7. EPA to make a determination on proposal to mow with a high cut - 7-8 inches, instead of 3-4 inches as required in the O&M manual.
8. EPA to make a determination on proposal to flush drain lines with saline water from adjacent slough. Additional proposal to lush the drains after the fall rains.

Protectiveness Statement(s):

A protectiveness determination of the remedy for Operable Unit 1 off-source area (off-source area or surrounding wetlands) at the Tulalip Landfill Superfund Site is deferred.

A protectiveness determination of the remedy for Operable Unit 2 (on-source area or landfill area) at the Tulalip Landfill Superfund Site is deferred.

A protectiveness determination of the remedy at the Tulalip Landfill Superfund Site cannot be made until sampling from the points of compliance has occurred, sampling data have been reviewed, an evaluation of institutional controls has occurred, and those institutional controls have been fully implemented. When these actions are completed, a determination of protectiveness for both operable units, and for the entire site, will be made.

Other Comments:

Five-Year Review Report

I. Introduction

The purpose of Five-Year Reviews (FYR) is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports. In addition, FYR reports identify issues found during the review, if any, and recommendations to address them.

The U.S. Environmental Protection Agency (EPA) prepared this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) §121 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 judgement of the President that action is appropriate at such site in accordance with section [104] or [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.*

EPA interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) states:

> *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.*

EPA Region 10 has conducted a FYR of the remedial actions implemented at the Tulalip Landfill Superfund Site located near Marysville, Washington. This review was conducted for the entire site for the period from April 2003 to April 2008. This report documents the results of the review.

The U.S. Army Corps of Engineers (USACE) provided support to EPA in the data analysis and evaluation of remedy protectiveness for this Five-Year Review. The USACE and EPA also conducted a joint site inspection at the landfill in December 2007.

This is the second FYR for the Tulalip Landfill Superfund Site. The triggering action for this review was the first FYR completed on April 24, 2003. The FYR is required by statute because the Record of Decision (ROD) was signed after October 17, 1986 and hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

II. Site Chronology

Table 1: Chronology of Site Events	
Event	**Date**
Tulalip Landfill Operated	1964-1979
NPL Listing	April 25, 1995
Remedial Investigation/Feasibility Study Completed	March 1, 1996
Interim ROD Signature	March 1, 1996
Remedial Design Start	August 21, 1997
Consent Decree with Waste Management, Inc., and Tulalip Tribes	March 19, 1998
Remedial Design Completed	May 6, 1998
Remedial Action Start (Construction Start)	June 18, 1998
Final ROD	September 29, 1998
Remedial Action Report	February 22, 2001
Begin landfill monitoring	April 2001
Revised FSP	July 2002
Preliminary Close Out Report (PCOR) [Construction Complete]	September 28, 2000
Final Close Out Report (FCOR)	January 7, 2002
Deletion from NPL	September 18, 2002
First FYR	April 24, 2003
Responsibilities for O&M activities transferred from WMI to the Tribes	July 1, 2004

III. Background

The Tulalip Landfill is located within the Tulalip Indian Reservation on approximately 147 acres of North Ebey Island in the Snohomish River delta, between Marysville and Everett, Washington. North Ebey Island is bordered by Ebey Slough to the north and Steamboat Slough to the south. Figure 1 in Attachment 1 shows the site location. The Seattle Disposal Company operated the landfill from 1964 until 1979, under a lease from the Tulalip Tribes. The landfill occupied approximately 318 acres. The elevation at the top of the berm ranged from approximately 12 to 20 feet above National Geodetic Vertical Datum (NGVD). Topographic elevations on the landfill surface range from approximately 10 to 25 feet above NGVD. The landfill received primarily commercial and construction waste. Three to four million tons of waste are currently contained within the landfill; the landfill is considered the source area.

In 1979, the landfill was subsequently closed and a perimeter berm was constructed. The surface of the landfill was graded and cover soils were placed at thicknesses ranging from 1 to 12 feet. However, insufficient grading of this cover material resulted in poor drainage and allowed precipitation to collect and eventually infiltrate the landfill surface. As a result, a pool of contaminated ground water (leachate) formed within the landfill.

Rainwater would soak into the landfill and force the highly contaminated leachate down into the ground water and out of the landfill into the surrounding wetlands and tidal channels. As contaminants were discharged by these leachate seeps, they were received by the surrounding wetland areas of Ebey Island (off-source area). These wetland areas include approximately 160 acres of salt marsh and mudflats surrounding and west of the landfill.

EPA performed a background exceedance evaluation to compare concentrations of soil and sediment contamination in the off-source area with regional soil and sediment background concentrations. Contaminants in the off-source area found to exceed background concentrations include aluminum, arsenic, chromium, and manganese. Concentrations of metals in wetland soil were highest in the areas surrounding most of the leachate seeps adjacent to the landfill berm.

Most of the exceedances were found to be marginally above the background concentrations. However, regional sediment background concentrations of arsenic are relatively high and potentially pose unacceptable risks to human health. Regional soil background concentrations of chromium also potentially pose unacceptable risks to terrestrial ecological receptors.

IV. Remedial Actions

EPA proposed the site to the NPL on July 29, 1991, and added it to the final list on April 25, 1995. The site was divided into Operable Unit 1 off-source area (off-source area or surrounding wetlands) and Operable Unit 2 (on-source area or landfill area). In 1996, EPA signed the interim ROD for the Tulalip Landfill Source-area (the landfill). A presumptive remedy (landfill cover system) was selected which expedited the design and construction of the on-source remedy. In September 1998, EPA signed the *Final Record of Decision for the Tulalip Landfill Superfund Site On-source and Off-source Remedial Action*.

Remedial Action Objectives (RAOs)
The on-source RAOs as described in the ROD are as follows:

1. Zone 1 ground water (leachate): Eliminate migration of leachate that exceeds surface water applicable or relevant and appropriate requirements (ARARs) from, through, and under the source area berm.
2. Soil/landfill contents/on-source surface water: Prevent direct contact with, and ingestion of, landfill contents, contaminated soils, and contaminated surface water on the landfill surface.
3. Minimize infiltration: Minimize infiltration into the landfill wastes and resulting contaminant leaching to ground water.
4. Zone 2 ground water (native aquifer): Minimize migration of contaminated ground water at levels exceeding surface water ARARs, and prevent use of contaminated ground water.
5. Storm water runoff and erosion: Prevent detrimental impact to adjacent off-source wetlands and surface water bodies due to storm water runoff from the landfill cap surface.
6. Landfill gas: Prevent inhalation and release of landfill gas exceeding ambient air standards established by the Puget Sound Air Pollution Control Authority (PSAPCA – now known as PSCAA [Puget Sound Clean Air Agency]). Manage landfill gas to prevent stress on a cap system.
7. Wetlands: Minimize loss of off-source wetlands, and mitigate for any destruction of or damage to off-source wetlands from the remedial action.
8. Future land use: Provide final surface conditions suitable for all season subsistence (i.e., hunting and fishing), recreational, and light industrial and commercial use.

The off-source RAOs as described in the ROD are as follows:

1. Minimize human consumption of fish/shellfish-containing contaminants that result in an elevated potential risk.
2. Minimize potential for arsenic-contaminated soil surrounding the leachate seeps from acting as a continuing source of arsenic in the off-source sediment
3. Minimize potential for benthic organisms to contact sediment which exceeds cleanup screening levels (CSLs) without physically destroying wetland habitats.

4. Minimize potential for terrestrial ecological receptors to contact soil containing arsenic, manganese, and chromium at concentrations significantly greater than background concentrations
5. Minimize physical impacts to and loss of off-source wetlands.

Final Remedy Selection

In September 1998, EPA signed the *Final Record of Decision for the Tulalip Landfill Superfund Site On-source and Off-source Remedial Action*. This Record of Decision documented the selection of the final remedy for both the on-source and off-source areas of the site as described below:

On-source Remedy

The interim on-source remedy presented in the March 1, 1996, Record of Decision was adopted as the final remedy for the on-source area. Major elements of the interim remedy included:

- Capping the landfill in accordance with the Washington State Minimum Functional Standards for landfill closure.
- Installing a landfill gas collection system. If necessary, an active gas treatment system could also be installed.
- Measuring the leachate elevation within the landfill and monitoring the perimeter leachate seeps, and landfill gas to ensure the selected remedy is adequately containing the landfill wastes.
- Initiating restrictions to protect the landfill cap.
- Providing for operation and maintenance (O&M) to ensure the integrity of the cap system.

The selected on-source remedy was expected to stem the migration of contaminants from the landfill into the surrounding estuary. The remedy would minimize the amount of rain water infiltrating the wastes, thereby minimizing the generation of new leachate.

Off-source Remedy

The remedy for the off-source area (wetlands) selected in the final ROD was designed to protect human health and the environment through the use of institutional controls. The major element of the off-source remedy selected in this ROD is placing and maintaining an adequate number of signs to warn of the potential risk from the harvest and consumption of fish and shellfish from these areas. Natural attenuation would reduce concentrations of inorganics and organics in the seep soils and sediments. Periodic monitoring would document natural attenuation.

Contaminants of Concern
The following lists the contaminants of concern (COC) for each area and media.

On-source area
Surface Water: Pesticides, PCBs, metals (copper, lead, mercury, nickel, and zinc), Ammonia (as nitrogen).

Off-source area
Leachate seep soils: Arsenic, copper, lead, mercury, nickel, zinc, pesticides, and PCBs.
Sediment: Arsenic, copper, lead, mercury, nickel, zinc, pesticides, PCBs, and PAHs.

Remedial Construction Activities
On May 6, 1998, the remedial design for the on-source cover system was approved by EPA in consultation with the Tulalip Tribes. Waste Management, Inc. (WMI) was contracted to construct the cover system. Work began on June 18, 1998, and took slightly more than 2 years to complete. On October 17, 2000, EPA, in consultation with the Tribes, determined that the constructed remedy was operational and functional.

The following RA activities were performed according to design specifications set forth in the 1998 RD package:

- Regrading and preparing a crowned shaped sub-base over the entire site by excavating and relocating waste (approximately 440,000 cy) and importing a significant amount of clean fill (approximately 410,000 cy);
- Constructing a passive gas collection system in the waste so that a gas treatment system could easily be added later if necessary;
- Placing and compacting a 12" foundation layer (sand) over the sub-base and gas collection system (approximately 320,000 cy);
- Constructing a liner system (approximately 158 acres) over the foundation layer. The liner system includes a flexible membrane liner to minimize infiltration of water into the landfill, a geonet for drainage, and geotextile protective liner;
- Placing a 12" layer of topsoil (280,000 cy) over the liner system, construction of a surface water drainage system, and revegetating the landfill;
- Installing six piezometers to measure the leachate elevation; and
- Constructing a locked gate entrance to restrict the access of unauthorized persons and equipment, and posting appropriate warning signs.

The certificate of completion was issued on February 20, 2001. Operation and maintenance will be conducted for a minimum of 30 years from that date, the first four years by WMI and the next 26 years by the Tulalip Tribes. The Remedial Action Report prepared by WMI was approved on February 22, 2001.

Operation and Maintenance (O&M)
The O&M Plan was approved on June 6, 2001. O&M activities to be performed include monthly site inspections for the first year and then quarterly inspections thereafter. Items to be inspected include landfill grades (surveys), surface water control systems, erosion, vegetation, infiltration collection system, gas collection system, roads, piezometers, site security and signs. Other activities include routine mowing, flushing the drainage pipes and repairing them as necessary, weed control, and rodent control. To measure the effectiveness of the final cover system, a revised environmental monitoring program requires monthly monitoring of the landfill gas emissions and leachate levels, and quarterly monitoring of leachate seeps. A settlement survey is conducted annually. The survey monuments are tied to the membrane layer forming nine survey lines to check settlement to ensure slopes remain greater than two percent. Every five years, an aerial survey is flown to measure the slope of the cap. Five piezometers are also surveyed annually for any settlement. O&M activities were conducted by WMI and then transferred to the Tribes and PES on July 1, 2004, consistent with Consent Decree No. C97-1462.

Costs
The original estimated annual O&M costs were $183,410. This cost includes O&M for the on-source and off-source areas.

Table 2 shows the annual costs for the last five years.

Table 2: O&M costs for the last five years

Year	O&M costs
2003	$167,819
2004	$109,887
2005	$145,933
2006	$145,130
2007	$159,000

Tulalip Tribes assumed O&M work from WM on July 01, 2004. The 2004 costs reflect costs from July 1 to December 31, 2004.

V. Progress Since the Last Review

The first FYR stated, “The remedies for both operable units are protective of human health and the environment. All threats at the site have been addressed through containment of contaminated soil and ground water with the completion of the cover system and the placement of warning/fish advisory signs along the perimeter edge. Institutional controls are effective in controlling access and development to the capped landfill areas.”

Three recommendations were made in the April 24, 2003, FYR as listed in Table 3.

Table 3: Actions taken since the last five-year review

Issues from Previous Review	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Burrows in bermed areas on the cap	Frequent inspection for burrows during non-mowing season, with necessary repairs.	WMI & Tulalip Tribes	Ongoing activity	Backfill the burrows with a shovel, as they are located	Ongoing activity
Invasive weeds on capped area	Continue routine mowing	WMI & Tulalip Tribes	Ongoing activity	Hand-pulling Scot's Broom and bramble. Began using goats in 2007.	Ongoing activity
One warning sign missing	Replace warning sign	WMI & Tulalip Tribes	Summer 2003	Other signs became missing over the past five years. They have been replaced with plastic signs because of suspicion of theft for the reclamation value of aluminum.	Ongoing activity

Table 4: Issues that have occurred since 2003.

Issues	Action Taken and Outcome	Date of Action
Repeated vandalism and thefts	Arranged for Everett Police K9 Unit to use the flats for training for a short period. Site manager reports that the llama guarding the goats appears to be effective. Repainted Conex boxes and replaced with stouter locks. Due to implementation of these measures, vandalism and theft has reduced.	February 2007
• Loose guy lines supporting Gas Ventilation System No. 6. • Infiltration collection system – some obstructions in the drain pipe and damage to the anti-rodent screens. • Gates and posts settling due to subsidence.	Inspected for damage and repaired.	On going activity since 2005
Caps on wells not fitting properly due to settlement.	Top of wells were trimmed to fit, then noted during annual survey	2005
Proposal to place fill to smooth transition for the mower, from berm road onto the cap.	An engineering analysis was provided by Arcadis G&M, and included in the February 2007 Semi-Annual Memorandum.	Being proposed
Proposal to mow with a high cut - 7-8 inches, instead of 3-4 inches as required in the O&M manual – in the summer and fall to protect the soil cover during the dry season.	Mowing more often in spring and early summer, because taller grass bogs down the mower. Leaving grass taller in mid to late summer.	Being proposed

Issues	Action Taken and Outcome	Date of Action
Proposal to flush drain lines with saline water from adjacent slough rather than using fresh water, as required. Additional proposal to flush the drains after the fall rains have begun to saturate the soils so the flush water does not simply soak into the ground.	Awaiting decision from EPA	Being proposed

With the exception of the three recently proposed actions at the bottom of table 4, all the issues in tables 3 and 4, above, have been addressed or are on going activities at the site. These actions no longer need to be tracked as five year review issues, as ongoing actions have been incorporated into the O&M plan for the site. The three proposed actions in table 4 have been incorporated in the list of issues and recommendations in sections VIII and IX of this report.

Routine O&M inspections and monitoring were transferred from WMI to the Tribes on July 1, 2004 in accordance with Consent Decree No. C97-1462. The Tribes contracted with PES Environmental, Inc. of Bellevue, Washington to perform the inspections and monitoring requirements.

The Tribes contracted with ARCADIS G&M, Inc., of Richmond, California to perform an annual inspection on July 2006, and assess the settlement of the landfill surface based on survey data provided by Downing and Associates. The annual inspection evaluated if the landfill is performing as designed based on visual inspection of the site. Their report concluded that the landfill is performing excellently as anticipated by the design. The survey data shows that the rate of settlement increased since 2005, but within predicted settlement range. ARCADIS recommended special inspections during periods of heavy rainfalls to check the performance of the landfill surface and determine if any local ponding is occurring.

In 2007, the Tribes began using goats to supplement vegetation control (mowing). The goats effectively minimized weeds and brambles at the perimeter of the landfill. Using goats also reduced the amount of labor for mowing.

VI. Five-Year Review Process

Administrative Components

EPA published an announcement in The Herald, an Everett, Washington newspaper, on December 7, 2007, inviting the public to provide comments to EPA for the five-year review of the site. The Tulalip Five-Year Review team was lead by Denise Baker-Kircher of Region 10, EPA Remedial Project Manager for the Tulalip Site, and included personnel from the U.S. Army Corps of Engineers, Seattle District, with experience in hydrogeology, chemistry and risk assessment. Marlowe Laubach and Richard Garrison, both with USACE, Seattle District, assisted in the review as representatives for the support agency. By November 9, 2007, the review team had been formed and established the review schedule and its major components including:

- Document Collection and Review;
- Data Assessment/Analysis;
- Site Inspection;
- Community Notification
- Five-Year Review Report Development and Review.

The Five Year Review has a statutory completion date of April 24, 2008. A copy of this completed report will be available through the EPA Region 10 Superfund Records Center located in Seattle and from the information repository at the Marysville Library.

Community Notification-
Generally, the O&M of the on-site landfill cover system was not of great interest to the public. The Tulalip Tribes received some public interest on the care of the goats used for grass and weed control. EPA receives occasional inquiries about the site from students and others, but has received no comments or concerns about the site since the last 5 year review.

A display ad was placed in the Everett Herald on December 7, 2007 (see Attachment 5), requesting comments on the 5-year review. No comments were received. EPA will provide notice to those on the site mailing list notifying the public that this Five-Year Review has been completed. This notice will also provide a list of outstanding issues that need to be addressed on the site.

Institutional Controls

What ICs are in place?

Institutional controls (ICs) were established in the 1996 and 1998 Records of Decision for this site to assure continued effectiveness of the remedy and to prevent human exposure to contamination remaining at the Site at concentrations above health-based risk levels.

1996 ROD Institutional Controls. The Institutional Controls contained in the March 1,1996, Record of Decision (on-source area) included land use restrictions to limit or prohibit activities that could interfere with performance of the selected remedy. In addition, ground water use restrictions were to be implemented to prevent the use of contaminated ground water.

The land use and ground water use restrictions were imposed as covenants running with the land by protecting in perpetuity the remedial actions which have been taken at the Site. The covenants, conditions and restrictions accomplished the following objectives:

- Preserved existing “access roadways” as points of access to the landfill ;
- Defined, established and maintained an “environmental buffer zone” on the surface of the landfill cover;

- Placed and maintained in perpetuity a clearly visible sign summarizing the activities that could occur on the landfill cover. The sign was to also summarize the restrictions on the use of the landfill;
- Ensured compliance with the "Routine Use of Tulalip ('Big Flats') Landfill" document.

1998 ROD Institutional Controls. The institutional control in the September 29, 1998 Record of Decision (off-source area) was intended to protect human health by warning of the potential dangers associated with the eating of fish and shellfish from the affected area. This control consisted of maintaining existing signs, and as necessary, posting new signs along the perimeter of the sloughs and landfill warning of the potential risk from harvesting and eating fish and shellfish. Signs would be located approximately every 300 to 600 feet along Steamboat Slough and Ebey Slough. Inspections of the site would be performed to ensure the warning signs were still in place and readable. The Tulalip Tribes would be responsible for maintenance and enforcement of the signs.

What ICs are currently functioning as planned?

The Tulalip Tribes do not have plans for any specific future use of the site.

The Tribes have placed signs warning of potential risks to the consumption of fish and shellfish in the nearby wetlands. The Tribes have signed a consent decree which prevents activities that may disturb the integrity of the cap. The following land use restrictions imposed as part of the 1996 ROD have been incorporated into the "Routine Use of Tulalip ('Big Flats') Landfill" document: existing “access roadways” are preserved as points of access to the landfill; a defined, established and maintained “environmental buffer zone” on the surface of the landfill cover; and a clearly visible sign has been created summarizing the activities that could occur on the landfill cover. The sign also summarizes the restrictions on the use of the landfill.

A deed search was conducted by the team using the Snohomish County on-line property search. Restrictive covenants are in place regarding the wetland properties.

Document Review

This five-year review consisted of a review of relevant documents including monitoring data. These documents are listed in Attachment 2.

Data Review and Monitoring Results

Visual inspection will continue to be conducted quarterly for leachate seeps, and monthly for leachate levels and landfill gas. Detailed monitoring information can be found in the quarterly "*Post Closure Monitoring Reports*," currently being submitted to EPA by the Tulalip Tribes. A discussion of the existing sampling data follows.

Leachate Seep Discharge Rates and Monitoring
The Record of Decision indicated that the selected remedy is expected to attain surface water ARARs by stemming the flow of contaminants from the landfill. The remedy would cut off infiltration of rain water through the waste, thus minimizing the generation of new leachate. As the existing leachate mound within the waste dissipates, the perimeter seeps were expected to cease flowing within approximately two years.

During the Remedial Investigation in 1994, eleven seeps were identified. These seeps were sampled and measured six times over the course of a year. Individual seep flow rates ranged from 4.5 gallons/minute (gal/min) to approximately 0.1 gal/min. Generally, flow rates were highest during the winter and spring. Historically, the average total site flow rate was approximately 7-8 gal/min. Data collected from the same locations after construction of the cover system indicated most of the time these seeps had no flow. One old seep occasionally had a flow of less than 0.1 gal/min but no concentrations above detection limits for the contaminants of concern.

The leachate seeps were sampled for one year after the completion of the cap. The samples were analyzed for pesticides, PCBs, ammonia (as nitrogen), total cyanide, and metals (copper, lead, mercury, nickel, and zinc). In 2001, it was concluded that the remedy had reduced or eliminated the leachate seeps and that there was limited value from continuing seep sampling. Thus, EPA provided a letter, dated April 10, 2002, approving the removal of the leachate seep sampling from the monitoring program. However, visual inspections of the seeps were to continue to verify whether seeps were still present.

In the past five years, only SP-14 has had nearly continuous seepage, with a range of flow from 0.25 to more than one gallon per minute (gpm). In 2003, there was nearly continuous seepage from SP-15, measured at 0.25 to more than 1 gpm. These flows have been attributed to surface water runoff or bank drainage during ebb tide. In all cases, the seepage was observed to be clear water based on visual checks. Seep locations are shown in Attachment 1, Figure 2c.

Leachate Levels
It is stated in the ROD that, "by minimizing infiltration of rain water into the landfill, the height of the leachate elevation in Zone 1 will fall." During the feasibility study (FS), it was estimated that the leachate seeps would be significantly reduced if the leachate elevation dropped 2 feet. Five piezometers were installed to monitor the height of the leachate elevation. In a review of the monitoring data, all piezometers displayed a reduction in leachate levels in 2001 of up to seven feet, during and following construction of the cap. In 2002, the leachate mound fell another 1 to 3 feet with the rate of reduction slowing thereafter. Since 2004, the reduction of the leachate levels has decreased by less than 0.5 feet. This rate of reduction may still be within the bounds of the modeling results showing that leachate will be gone in about 30 years.

Landfill Gas Monitoring
Landfill gas is monitored at the six landfill gas venting structures (GVS-1 through GVS-6). Locations are shown in Attachment 1, Figure 2a. Monitoring parameters include field measurements of primary gas composition, select trace gas compounds, temperature, pressure,

and flow from each of the landfill vents. Site conditions also noted include air temperature, wind, barometric pressure, and tide elevations.

Landfill gas production during the current five year review period has been similar over those years and similar to the results prior to 2003. The predominant composition is methane and carbon dioxide in nearly similar proportions. In combination, they comprise 70 to 100 per cent of the total gases. The flow from each vent ranges from 0 to about 3 cubic feet per minute, with velocities ranging from zero to about 500 feet per minute.

The ROD states that air emissions will not exceed ambient air standards established by the PSAPCA without noting the action level. In November 2000, a letter from SCS Engineers to WMI documents compliance with the Puget Sound Air Pollution Control Authority (now known as the Puget Sound Clean Air Agency [PSCAA]) requirements. This letter states that there is "no basis for which the Tulalip Landfill would be required to modify its existing passive collection and venting system under PSCAA guidelines or regulations".

Settlement Survey

A settlement survey is conducted annually, using 18 selected slope panels (see Figure 3), to check that the landfill surface slope remains greater than two percent, as required. The survey is comprised of 9 panels in the upper cap and 9 panels in the lower cap. Panel areas and monument locations are shown in Attachment 1, Figure 4. Because significant settlement of the landfill was anticipated in the design, the cover was constructed with a minimum slope of 2.5 percent in the upper part of the cover, and with a minimum slope of 2.2 percent in the lower part of the cover.

Sixteen of the 18 survey panels show that the slopes of the cap remain close to their constructed grades. The two exceptions are located on the lower part of the cap in the north section of the landfill. Panels A and S have been calculated at 1.6 to 1.9 percent since the survey began in 2000. It is recommended that these areas be inspected during heavy rainfalls to review the performance of the landfill surface and to determine if any local ponding is occurring. There is no evidence of differential settlement leading to cracks or degradation.

Table 5: Annual Survey of Cap Slope (in percent)

	Upper Cap							Lower Cap						
Slope Panel	2000	2001	2002	2003	2004	2005	2006	2000	2001	2002	2003	2004	2005	2006
A	**2.4**	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**1.9**	**1.9**	**1.9**	**1.8**	**1.9**	**1.9**	**1.9**
C	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.6**	**2.6**	**2.5**	**2.9**	**3.0**	**2.8**	**3.0**	**3.0**	**3.0**
S	**2.1**	**2.1**	**2.0**	**2.0**	**2.0**	**2.0**	**1.9**	**1.9**	**1.8**	**1.8**	**1.9**	**1.6**	**1.6**	**1.6**
Q	**2.6**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.2**	**2.2**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**
D	**2.2**	**2.5**	**2.5**	**2.4**	**2.5**	**2.5**	**2.5**	**2.2**	**2.2**	**2.1**	**2.1**	**2.1**	**2.1**	**2.0**
E	**2.4**	**2.3**	**2.3**	**2.2**	**2.2**	**2.2**	**2.2**	**2.1**	**2.3**	**2.4**	**2.2**	**2.4**	**2.4**	**2.4**
H	**2.3**	**2.3**	**2.3**	**2.2**	**2.2**	**2.2**	**2.2**	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**

I	**2.5**	**2.4**	**2.4**	**2.3**	**2.3**	**2.3**	**2.3**	**2.2**	**2.2**	**2.2**	**2.1**	**2.1**	**2.1**	**2.1**
O	**2.3**	**2.1**	**2.1**	**2.0**	**2.0**	**2.0**	**2.0**	**2.2**	**2.2**	**2.2**	**2.1**	**2.2**	**2.2**	**2.2**

Cap penetrations (landfill vents and piezometers) may have been affected by overall settlement of the cap. At each penetration, a geomembrane "boot" was probably installed to seal the casing to the geomembrane. With overall settlements ranging from 1.6 to 3 feet, the geomembrane boot or seal may be damaged with possible failures of the geomembrane in these locations.

Landfill Observations

In addition to monitoring as described above, quarterly site inspections are conducted to assess and photograph the conditions and performance of the landfill. The inspections documented are component specific using an inspection form copied from the O&M Plan. The inspections were conducted by WMI from the beginning of the O&M activities until July 1, 2004. Thereafter, the responsibilities were transferred to the Tribes. An additional inspection was provided by Arcadis G&M in 2006. As of 2007, the site was performing as designed with minor problems related to burrows, vandalism, and missing warning signs. The previous Five-Year Report states "that all parties agree that the seeps have been virtually eliminated. Wetlands that were stressed have grown back to the edge of the landfill perimeter wall and now appear to be healthy. Certain areas that were very soft and un-walkable are now firmer indicating that the seeps are under control."

Natural attenuation monitoring

No monitoring of the leachate seep soils has occurred since April 2002, and no monitoring of sediments has occurred since the completion of the landfill cap. It is currently unknown whether COC concentrations in leachate seep soils and sediments have decreased since the construction of the on-source remedy.

Site Inspection

A site inspection was conducted on 18 December 2007. The inspection team, led by Foley Cleveland, Site Manager for the Tulalip Tribes, included Denise Baker, EPA Project Manager; and the USACE five-year review team. The list of attendees and details of the inspection findings, including the Site Inspection Checklist, are provided as Attachment 3. The inspection consisted of a site visit, where the team observed landfill features and existing institutional controls, and a meeting to clarify the remedy rationale, landfill construction, and other potential issues. The following summarizes observations made during the site inspection.

- Signs surrounding the landfill were intact although some were below the water level because the site inspection was conducted during high tide.
- The access gate and lock were intact.
- The landfill cover appeared to be in good condition. The vegetative cover was intact and ponding was not observed.
- The seeps were underwater; however, the seep location markers were observed.
- Drainage piping appeared to be in good condition with no or little silting.
- Mr. Cleveland stated there are a few drainage pipe branches with no cleanout ports. Therefore, these branches are not cleaned.

The site inspection confirmed that the condition of the cap is operating as intended by the ROD. Attachment 4 provides photo documentation of existing conditions.

Interviews
Mr. Cleveland was interviewed during the site inspection. No additional interviews were conducted due to the low community interest of the site.

VII. Technical Assessment

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

The components of the remedy have been constructed and/or implemented. These include:
- Landfill cap
- Landfill gas collection system
- Monitoring of leachate mound within landfill, perimeter leachate seeps, and landfill gas
- Providing O&M to ensure integrity of the cap system
- Maintenance of existing signs and the installation of new signs

The following describes the condition of the remedy components.
- Despite continuing settlement, the landfill surface is maintaining a greater than two percent slope, as required – except in two locations (see *Settlement Survey*, above).
- Landfill gases are venting at low volumes and in low enough concentrations of methane and carbon dioxide to meet air requirements.
- There appears to be no more seepage from the landfill as observed along the perimeter. Any flow observed from the seepage drains, is reported to be attributable to bank drainage during ebb tides.
- Signs, fencing and other security measures are in place and have been improved since the last Five Year Review. However, the site manager reports fishing near the discharge zones continue, despite the warnings. There currently are no Tribal regulations or requirements enforcing no fishing/no shellfish harvesting.

However, no chemical analysis of the sediment, soil, or surface water has been performed at the site. There is no data to confirm that applicable or relevant and appropriate requirements (ARARs) described in the ROD continue to be met and that the remedy remains protective.

The revised Field Sampling Plan (FSP) discontinued sampling requirements at the seepage points because of low COC concentrations in seepage water and a low volume of discharge. This discontinued sampling eliminated the only means of gauging whether or not the remedy is meeting the ARARs, as required in the ROD. Another point of compliance described in the ROD is where the Zone 2 ground water discharges to surface water (see Attachment 1, Figure 5). However, the ROD concluded that the remedy should achieve surface water ARARs rendering additional monitoring or evaluation of the Zone 2 pathway unnecessary. The 1996 Interim ROD for the Tulalip Landfill also states that periodic monitoring of the impacted sediment and seep

soil is required. This periodic monitoring has never been conducted since the completion of the landfill cover.

Institutional Controls.

What ICs are not yet functioning as planned in the 1996 and 1998 RODs?

- In response to the ROD requirement that "The land use and ground water use restrictions were to be imposed on all property that comprised the Site as covenants running with the land", on March 23, 1998, the Tribe delivered a copy of the March 19, 1998, Consent Decree with Waste Management, Inc., and Tulalip Tribes, Consent Decree No. C97-1462, to the Portland Area Bureau of Indian Affairs (BIA) office, U.S. Department of Interior (DOI). BIA stamped and receipted the document and recorded the Consent Decree in the land records of the DOI Title Plant. The limitations and prohibitions in the land records are those contained in the Consent Decree:

  > "48. …The Routine Use of Tulalip Landfill document shall, at a minimum, delineate routine site uses that may occur on the surface of the landfill cover and uses that shall not occur, in accordance with the land use restrictions established in the Interim ROD. Any land use and ground water use restrictions will be imposed on all necessary portions of property that comprises the Site as covenants running with the land for the purpose of protecting human health and the environment by protecting in perpetuity the Interim Remedial Action and other response actions taken at the Site under this Decree. The land use and ground water use restrictions shall be created by the Tulalip Tribes as covenants running with the land no later than 120 days from the date the "Routine Use of Tulalip Landfill document has been finalized by EPA and the Tulalip Tribes. Such restriction may include, but will not necessarily be limited to, items such as preserving existing access roadways to the landfill, maintenance of the "environmental buffer zone" which will be created on the surface of the landfill cover, and signage at the Site which summarizes the activities which may occur on the landfill cover as well as restrictions on use of the landfill cover and the location of the 'environmental buffer zone.'"

  Issue #1: Filing and recording a copy of the 1998 consent decree do not meet the institutional control requirements in that consent decree. The creation of a "Routine Use of Tulalip Landfill" document was expected to delineate uses that may, and uses that may not, occur on the site. It was expected that after these uses were spelled out, this information would be used to create and record covenants running with the land.

  Issue #2: There are no specific ground water use restrictions mentioned in the 1996 ROD, and none in the 1998 ROD. ICs for ground water use need to be evaluated and, if appropriate, implemented.

- The September 1998 ROD for the off-source remedy requires that signage warning of potential health effects related to consuming fish and shellfish be maintained and

enforced at this site. While the warning signs have been maintained as required, it appears that no enforcement mechanism has been implemented by regulation or other means by the Tribes.

- The last objective of the land use restrictions listed in the 1996 ROD required that: "Site users shall comply with the "Routine Use of Tulalip ('Big Flats') Landfill" document…" There is no mention of the Routine Use of Tulalip Landfill document in Tulalip Tribal Ordinance 49. Unless the document is mentioned in the ordinance, and provision is made for enforcement of that document, effectiveness of the IC is questionable, and needs to be evaluated.

- A deed search was conducted by the team using the Snohomish County on-line property search. A copy of the March 19, 1998, Consent Decree with Waste Management, Inc., and Tulalip Tribes, Consent Decree No. C97-1462, was filed with the property associated with this site. A more comprehensive records search is needed to determine whether deed notices or restrictions are on file for all portions of site with the Bureau of Indian Affairs, Tribes and County.

Would ICs be effective and the remedy protective if all the selected ICs were in place?

It is not possible to say, at this time, if the site continues to be protective without conducting sampling of the seeps, soils, and sediments (as described above) to confirm that applicable or relevant and appropriate requirements (ARARs) continue to be met and that the remedy remains protective, and if not protective, to determine whether additional response actions are necessary.

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

ARARs and To Be Considered (TBC)

The standards described in the ROD are still applicable or relevant and appropriate to this site. Several ARARs have changed since remedy selection and the last five year review. However, these changes do not affect whether the remedy remains protective, as the contaminant levels at the site are still below these ARARs or are compared to background levels at the site.

Table 6 compares the chemical specific ARARs identified in the ROD to current standards.

Table 6: Comparison of ROD ARAR to Current Standards

Compound	**ROD ARAR**	**Changes in ARAR**
Surface water ARARs	**(mg/L)**	
1,1-Dichloroethane	0.0032[a]	NV
Benzene	0.071[a]	0.051
Chlorobenzene	0.129[b]	1.6
Chloroform	0.47[a]	NC
Chloromethane	6.4[b]	NV

Compound	ROD ARAR	Changes in ARAR
Ethylbenzene	0.43[b]	2.1
Methylene chloride	1.6[a]	0.59
Toluene	5[b]	15
Trichloroethene	0.081[a]	0.03
1,2-Dichlorobenzene	1.97[b]	1.3
1,3-Dichlorbenzene	1.97[b]	0.96
1,4-Dichlorobenzene	1.97[b]	0.19
2-Methylnaphthalene	0.3[b]	Not on list
2,4-Dichlorophenol	0.97[a]	0.29
3,3-Dichlorobenzidine	0.000077[a]	0.000028
Acenaphthylene	0.3[b]	NV
Ancenapthene	0.71[b]	0.99
Anthracene	0.3[b]	40
Benzo(a)anthracene	0.000031[a]	0.000018
Benzo(a)pyrene	0.000031[a]	0.000018
Benzo(b)fluoranthene	0.000031[a]	0.000018
Benzo(g,h,i)perylene	0.3[b]	NV
Benzo(k)fluoranthene	0.000031[a]	0.000018
Bis(2-chloroethyl)ether	0.0014[a]	0.00053
Bis(2-ethylhexyl)phthalate	0.0059[a]	0.0022
Chrysene	0.000031[a]	0.000018
Di-n-butylphthalate	12[a]	4.5
Dibenzo(a,h)anthracene	0.000031[a]	0.000018
Diethylephthalate	120[a]	44
Fluoranthene	0.016[b]	1.4
Fluorene	0.3[a]	5.3
n-Nitrosdiphenylamine	0.016[a]	0.003
Naphthalene	2.35[b]	NV
Pentachlorophenol	0.0079[b]	0.013
Phenanthrene	0.0046[b]	NV
Phenol	5.8[b]	1700
Pyrene	0.3[b]	4
4,4-DDD	0.00000084[a]	0.00000031
4,4-DDE	0.00000059[a]	0.00000022
4,4-DDT	0.00000059[a]	0.00000022
Aldrin	0.00000014[a]	0.00000005
Alpha-BHC	0.000013[a]	0.0000049
Arochlor-1016	0.000000045[a]	0.000000064
Arochlor-1232	0.000000045[a]	0.000000064
Arochlor-1245	0.000000045[a]	0.000000064
Arochlor-1248	0.000000045[a]	0.000000064
Arochlor-1254	0.000000045[a]	0.000000064
Arochlor-1260	0.000000045[a]	0.000000064
Beta-BHC	0.000046[a]	0.000017

Compound	ROD ARAR	Changes in ARAR
Chlordane	0.00000059[a]	0.00000081
Delta-BHC	0.00034[b]	NV
Dieldrin	0.00000014[a]	0.000000054
Endosulfan I	0.0000087[b]	0.000034
Endosulfan II	0.0000087[b]	0.000034
Endosulfan Sulfate	0.002[a]	0.089
Endrin	0.0000023[b]	NC
Endrin aldehyde	0.00081[a]	0.0003
Gamma-BHC (Lindane)	0.000063[a]	0.0018
Heptachlor	0.00000021[a]	0.000000079
Heptachlor epoxide	0.00000011[a]	0.000000039
Methoxychlor	0.00003[b]	No longer listed
Antimony	0.5[a]	0.64
Arsenic	0.00014[a]	NC
Cadmium	0.0093[c]	NC
Chromium (VI)	0.05[c]	NC
Copper	0.0024/0.0029[b/c]	0.0048/
Cyanide	0.001[c]	NC
Lead	0.0056/0.0085[b/c]	0.21
Mercury	0.000025[b]	0.0018
Nickel	0.0079/0.0083[b/c]	0.074
Selenium	0.071[b]	0.29
Silver	0.0023[b]	0.0019
Thallium	0.0065[a]	0.00047
Zinc	0.076/0.086[b/c]	0.09/
Ammonia6	0.032[c]	*
Seep Soil ARARs	***mg/kg***	
Arsenic	22[d]	NC
Sediment ARARs	***mg/kg dry weight***	
Arsenic	57/93[e]	NC
4-methylphenol	670	NC
Fluoranthene	160/1200[f]	NC
Pyrene	1000/1400[f]	NC

a- Human Health Federal Fish Consumption Water Quality Criteria (40 CFR Part 131) ROD cited 1992/1995 edition.
b- Ecological Marine Ambient Water Quality Criteria (AWQC) acute (40 CFR Part 131)
c- Washington State Marine Chronic (WAC 173-201A)
d- Regional Background Concentrations (National Background Soil Metals Concentrations in Washington State). This value represents the 90 percentile for arsenic in the Puget Sound area.
e f-Washington Sediment Management Standards (WAC 173-204). The first value represents the Sediment Quality Standards and second value represents the Sediment Impact Zone Maximum Level and the Sediment Cleanup Screening Level/Miminum Cleanup Level. For fluoranthene and pyrene, the values are "normalized", or expressed, on a total organic carbon basis.
* - value dependent on pH and temperature.
NC- No change in ARARs from last five-year review or ROD
NV- No value listed

Table 7 shows changes in To Be Considered (TBC) requirements. These requirements reflect only the change in authority within a specific area of shoreline. These requirements do not affect whether the remedy remains protective.

Table 7: Changes in To Be Considered (TBC)

TBC	Requirement		Citation/Year
State of Washington Shoreline Management Act	Previous	Policies include the encouragement of water-dependent uses, protect shoreline natural resources, and promote public access.	SMA 1971
	New	Now also includes specific jurisdiction of this act.	SMA 2007

Exposure Pathways
Land use, future land use, and exposure pathways have not changed since remedy selection and the last five year review.

Toxicity and Other Contaminant Characteristics
Toxicity factors have not changed since the remedy selection and the last five year review.

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

Vandalism and theft are reported to have been occasional problems. In the February 2007 Semi-Annual Report, the site manager attributes the recent absence of these problems during a short period that the Everett Police Department used the field for K9 training. During the site visit, the site manager stated that the presence of a llama, used to protect the goats, appears to have also reduced the incidents of trespassing.

Technical Assessment Summary
Based upon document review and the site inspection, the landfill cap has been constructed and maintained as intended by the Final ROD. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. However, there has been no monitoring of the surface water, soil or sediments at the points of compliance to assess whether ARARs are being met. Not all institutional controls listed in the 1996 and 1998 RODs for this site are stated clearly, and do not ensure implementation of or compliance with those controls.

VIII. Issues

Several issues were identified that may affect the remedy's ability to achieve the performance standards specified in the ROD, and therefore, its future protectiveness. These issues include:

Table 8: Issues That May Affect Protectiveness

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
#1. No sediment, soil, or surface water sampling at compliance points described in the Record of Decision (ROD).	**Y**	**Y**
#2. Not all institutional controls listed in the 1996 and 1998 RODs for this site are stated clearly, and do not ensure implementation of or compliance with those controls. (For example, fishing near the ground water discharge zone has been observed and the Tribes have no regulations to enforce the warning signs.)	**Y**	**Y**
#3. It is unclear whether all deed notices or restrictions are on file with the Bureau of Indian Affairs and the County for all portions of the site.	**Y**	**Y**

Other issues have been identified in this five year review that do not directly affect future protectiveness, but should be tracked and remedied. These issues are:

Table 9: Other Issues Identified for Site That Do Not Directly Affect Protectiveness

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
#1. ROD is vague regarding points of compliance and receptors affected.	**N**	**N**
#2. Unknown if a geomembrane boot was installed to seal the piezometer casing to the geomembrane.	**N**	**N**
#3. Some water collection drain lines have no clean-out ports.	**N**	**N**
#4. Potential ponding during heavy rain events.	**N**	**N**
#5. Existing signs are often under water during high tide. Additional signs would be helpful in alerting people to not fish within posted area.	**N**	**N**
#6. Proposal from Tulalip Tribes to place fill to smooth transition for the mower, from berm road onto the cap.	**N**	**N**
#7. Proposal from Tulalip Tribes to mow with a high cut - 7-8 inches, instead of 3-4 inches as required in the O&M manual – in the summer and fall to protect the soil cover during the dry season	**N**	**N**
#8. Proposal from Tulalip Tribes to flush drain lines with saline water from adjacent slough rather than using fresh water, as required. Additional proposal to flush the drains after the fall rains have begun to saturate the soils so the flush water does not simply soak into the ground.	**N**	**N**

With the exception of the three recently proposed actions at the bottom of the table immediately above, all the issues in tables 3 and 4 in Section V of this report have been addressed or are on going activities at the site and will continue as part of the regular operation and maintenance at the site. These actions no longer need to be tracked as five year review issues, as ongoing actions have been incorporated into the O&M plan for the site.

IX. Recommendations and Follow-up Actions

The following recommend actions address the issues identified in Section VIII.

Table 10: Recommendations and Follow-up Actions For Issues That May Affect Protectiveness

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
#1. No contaminant sampling	Leachate seep sampling and report of sample results to EPA for contaminants of concern at the points of compliance per the ROD	Tulalip Tribes	EPA	April 24, 2009	Y	Y
	Soil sampling and report of sample results to EPA at the seep locations for contaminants of concern.	Tulalip Tribes	EPA	April 24, 2009	Y	Y
	Sediment sampling and report of sample results to EPA for contaminants of concern at the points of compliance (where ground water discharges into Ebey and Steamboat sloughs).	Tulalip Tribes	EPA	April 24, 2009	Y	Y
#2. Institutional Controls	Evaluate the effectiveness of existing institutional controls for this site. Amend ICs, as appropriate, to ensure effectiveness of these controls. Ensure compliance with ICs by establishing authorities to implement and enforce ICs, as necessary.	Tulalip Tribes/EPA	EPA	April 24, 2009	Y	Y
#3. Deed notice on file	Determine whether deed notices or restrictions are on file for all portions of site with the BIA, Tribes, and County. If deed notice or restrictions are missing, file notice with appropriate agencies.	Tulalip Tribes/EPA	EPA	April 24, 2009	Y	Y

Table 11: Recommendations and Follow-up Actions For Issues That Do Not Directly Affect Protectiveness

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
#1. ROD is vague regarding points of compliance and receptors affected.	Clarify Points of compliance and the receptors affected.	Tulalip Tribes	EPA	April 24, 2009	N	N
#2. Piezometer sealed to geomembrane	Check to see if a geomembrane boot was installed to seal the piezometer casing to the geomembrane; repair if necessary.	Tulalip Tribes	EPA	April 24, 2009	N	N
#3. No clean-out ports	Add clean-out ports to drain lines, where needed.	Tulalip Tribes	EPA	April 24, 2009	N	N
#4. Potential ponding during heavy rain events	Inspect slope panels A and S during/after heavy rain events. Review the performance of the landfill surface to determine if any local ponding has occurred.	Tulalip Tribes	EPA	April 24, 2009	N	N
#5. Signs	Use higher posts for existing signs, and seek permission from State to add signs on adjacent state lands.	Tulalip Tribes/EPA	EPA	April 24, 2009	N	N
#6. Proposal to place fill to smooth transition for the mower, from berm road onto the cap.	EPA will make a determination on proposal and respond in writing to Tulalip Tribes. If proposal accepted, change will be recorded as an amendment to existing Tulalip Landfill Operation and Maintenance Plan.	EPA		September 30, 2008	N	N
#7. Proposal to mow with a high cut - 7-8 inches, instead of 3-4 inches as required in the O&M manual – in the summer and fall to protect the soil cover during the dry season	EPA will make a determination on proposal and respond in writing to Tulalip Tribes. If proposal accepted, change will be recorded as an amendment to existing Tulalip Landfill Operation and Maintenance Plan.	EPA		September 30, 2008	N	N

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
#8. Proposal from Tulalip Tribes to flush drain lines with saline water from adjacent slough rather than using fresh water, as required. Additional proposal to flush the drains after the fall rains have begun to saturate the soils so the flush water does not simply soak into the ground.	**EPA will make a determination on proposal and respond in writing to Tulalip Tribes. If proposal accepted, change will be recorded as an amendment to existing Tulalip Landfill Operation and Maintenance Plan.**	**EPA**		**September 30, 2008**	**N**	**N**

X. Protectiveness Statement(s)

A protectiveness determination of the remedy for Operable Unit 1 off-source area (off-source area or surrounding wetlands) at the Tulalip Landfill Superfund Site is deferred.

A protectiveness determination of the remedy for Operable Unit 2 (on-source area or landfill area) at the Tulalip Landfill Superfund Site is deferred.

A protectiveness determination of the remedy at the Tulalip Landfill Superfund Site cannot be made until sampling from the points of compliance has occurred, sampling data have been reviewed, and all institutional controls have been evaluated by EPA for protectiveness and fully implemented. When these actions are completed, a determination of protectiveness for the site will be made.

XI. Next Review

The next Five-Year Review for the Tulalip Landfill Superfund Site is required by April 24, 2013, five years from the date of this review.

Attachment 1

Figures

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Attachment 2
List of Documents Reviewed

- *Annual Site Review*, Arcadis G&M, Inc.
  2002 Report, April 2, 2003
  2006 Report, December 26, 2006

- *As-Built Construction Drawings*, 1998 – 2000. CD labeled *David Evans & Associates, Record Drawings, submitted June 30, 1994*.

- *Compliance with Puget Sound Clean Air Agency - Tulalip Landfill Closure Project*, letter from SCS Engineers to Waste Management Inc., dated November 27, 2000. In CD labeled *OM Manual Monitoring Plan 1&2, June 2004*.

- *Environmental Monitoring Plan - Post Closure Care*, Tulalip Landfill, April 6, 2001, Prepared for Washington Waste Hauling & Recycling, Inc. by SCS Engineers. In CD labeled *OM Manual Monitoring Plan 1&2, June 2004*.

- *Revised Feasibility Study for Source Area Containment (SAC-4) Tulalip Landfill Remedial Investigation/Feasibility Study*, May 4, 1995, Prepared for The Tulalips PRP Group by Golder Associates Inc.

- *Remedial Investigation Report*, Tulalip Landfill, Snohomish County, Washington, May 4, 1995, prepared for The Tulalips Responding Parties by Harding Lawson Associates, Volumes 1-3.

- *Final Close-Out Report Tulalip Landfill*, Marysville, Washington, December 3, 2001, U.S. Environmental Protection Agency Region 10.

- *Final Comprehensive Baseline Risk Assessment for the "Off-Source" Area*, August 1997, prepared by Roy F. Weston, Inc.

- *Final Tulalip Landfill Risk Assessment for Interim Remedial Action*, August 1995, U.S. Environmental Protection Agency Region 10.

- *Final Record of Decision*, Tulalip Landfill Superfund Site On-source and Off-source Remedial Action, Marysville, Washington, September 1998, U.S. Environmental Protection Agency Region 10.

- *Institutional Control Tracking System*, U.S. Environmental Protection Agency Region 10, May 2004.

Operation and Maintenance Costs, Washington Waste Hauling & Recycling, Inc.
February 2002 – February 2003
February 2003 – February 2004

- *Operation and Maintenance Manual, Post Closure Care*, Tulalip Landfill, April 6, 2001, Prepared for Washington Waste Hauling & Recycling, Inc. by SCS Engineers. In CD labeled *OM Manual Monitoring Plan 1&2, June 2004*.

- *Post Closure Monitoring Report Tulalip Landfill*, Prepared for Washington Waste Hauling & Recycling, Inc. by SCS Engineers.
  2003: All four quarters

- *Post Closure Monitoring Report Tulalip Landfill*, Prepared for the Tulalip Tribes by PES Environmental, Inc.
  4th Quarter, January 31, 2005
  2005: 1st Quarter, July 15, 2005
  2nd Quarter, August 9, 2005
  3rd Quarter, December 1, 2005
  4th Quarter, December 15, 2005

  2006: 1st Quarter, May 8, 2006
  2nd Quarter, August 2, 2006
  3rd Quarter, November 7, 2006
  4th Quarter, February 6, 2007

  2007: 1st Quarter, May 9, 2007
  2nd Quarter, August 9, 2007

- *Post Closure Care Routine Operation and Maintenance Inspection*, Prepared for the Tulalip Tribes by PES Environmental, Inc.
  2004: 4th Quarter, January 19, 2005

  2005: 1st Quarter, March 28, 2005
  2nd Quarter, July 2005

  2006: 1st Quarter, May 8, 2006
  2nd Quarter, August 2, 2006
  3rd Quarter, November 8, 2006
  4th Quarter, February 6, 2007

  2007: 1st Quarter, May 9, 2007
  2nd Quarter, August 9, 2007

- *Remedial Action Report – Landfill Cover System*, Tulalip Landfill Superfund Project, November 29, 2000, Prepared for Washington Waste Hauling & Recycling, Inc. by SCS Engineers.

- *Record of Decision*, Tulalip Landfill Superfund Site Interim Remedial Action, Marysville, Washington, March 1996, U.S. Environmental Protection Agency Region 10.

- *Consent Decree with Waste Management, Inc., and Tulalip Tribes*, Consent Decree No. C97-1462, March 19, 1998.

- Tulalip Landfill Off-Source Area Technical Evaluation of Potential Remedial Alternatives, EPA Region X, May 1998.

- Tulalip Landfill Superfund Project Operations and Maintenance Semi-Annual Report, January 2003 - June 2003, Mathis Support Services (CD).

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Attachment 3

Five-Year Review Site Inspection Checklist

Site Inspection Checklist

I. SITE INFORMATION	
Site name: Tulalip Landfill	**Date of inspection:** December 18, 2007
Location and Region: Tulalip Reservation near Marysville, WA EPA Region 10	**EPA ID:** WAD980639256
Agency, office, or company leading the five-year review: EPA Region 10	**Weather/temperature:** On/off showers, slight wind, 40 F

Remedy Includes: (Check all that apply)

- ☒ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☐ Ground water pump and treatment
- ☒ Surface water collection
- ☐ Other_____
- ☐ Monitored natural attenuation
- ☐ Ground water containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection team roster attached ☒ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager:** Foley Cleveland, Project Manager for Big Flats, Tulalip Tribes

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

2. **O&M staff** ___NONE_____ _____ _____
   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. **N/A**

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

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

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

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

4. **Other interviews** (optional) ☐ 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: *As-built drawings for the landfill cover are available. However no new construction has occurred on-site since the cover construction in 2000. Maintenance logs are in the form of reports sent to EPA on a quarterly and annual basis.*

2.	**Site-Specific Health and Safety Plan**	☒ Readily available	☐ Up to date	☐ N/A
	☐ Contingency plan/emergency response plan	☐ Readily available	☐ Up to date	☒ N/A
	Remarks_____			
3.	**O&M and OSHA Training Records**	☒ Readily available	☐ Up to date	☐ N/A
	Remarks_____			
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**	☒ Readily available	☒Up to date	☐ N/A
	Remarks: *Gas sampling records are included as part of quarterly and annual reports submitted to EPA.*			
6.	**Settlement Monument Records**	☒ Readily available	☒Up to date	☐N/A
	Remarks: *Settlement monument records are included as part of annual reports submitted to EPA.*			
7.	**Ground water Monitoring Records**	☒Readily available	☐Up to date	☐ N/A
	Remarks: *Ground water monitoring records are included as part of quarterly and annual reports submitted to EPA. These reports record only leachate water levels as no chemical analyses are being performed.*			
8.	**Leachate Extraction Records**	☐Readily available	☐Up to date	☒N/A
	Remarks:			
9.	**Discharge Compliance Records**			
	Air	☐Readily available	☐Up to date	☒ N/A
	Water (effluent)	☐Readily available	☐Up to date	☒ N/A
	Remarks: *No compliance monitoring was required as amended at the end of 2001.*			
10.	**Daily Access/Security Logs**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks: *Landfill on Tribal property. Only Tribal members/employee/contractors have access to landfill.*			

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: *Tulalip Tribes manages the maintenance of landfill cover. This includes Tribal members and goats to maintain cover and contractors to maintain and inspect gas vents and drainage/infiltration piping.*

2. **O&M Cost Records**
☒ 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: *Fencing only at the gates. The landfill is surrounded by wetlands and 2 sloughs so accessibility by automobile is only through the access gates. Gate locks have been cut by vandals for access to materials on-site. However, during site inspection fencing and locks were intact.*

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks: *Signs are installed around landfill notifying people the presence of the landfill and not to eat shellfish in the surrounding area. Some of these signs are submerged during high tide. A project sign is located on the entrance gate.*

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) : *Drive-bys*
Frequency:
Responsible party/agency: *Tulalip Tribes*
Contact: F*oley Cleveland, Big Flats Project Manage* ,

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
As part of the Institutional Controls, the Tulalip Tribe is required to maintain signage and ensure no one is collecting shellfish/fish for consumption. However these measures, although required as part of the Consent Decree, are not officially incorporated in Tribal regulations. Because of this, there is no recourse for the Tribe should they find someone not obeying the signs.

2. **Adequacy** ☐ ICs are adequate ☒ ICs are inadequate ☐N/A
Remarks_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks: *Vandalism has occurred in the past. People have typically stolen materials on-site that have monetary value (metal parts). However, because of the goats used to maintain the cover height and the daily visits by the Tribal project manager for the landfill, vandalism has not been evident.*

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

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

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐Location shown on site map ☒ Roads adequate ☐ N/A
Remarks: *A road was built on the perimeter of the landfill and one that traverses the landfill for maintenance purposes. The roads appear to be in good condition.*

B. Other Site Conditions

Remarks _____

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐Location shown on site map ☒ Settlement not evident
Areal extent_____ Depth_____
Remarks: *No settlement was evident during the site inspection. Annual settlement measurements are taken to determine extent of settlement, if any.*

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

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

4. **Holes** ☐ Location shown on site map ☒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: *Vegetative cover is primarily grass and is nicely established. Invasive plants (blackberries and Scot's Broom) were noticed however because of the goats, these plants are kept to small plants in limited extent.*

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
Remarks: *Riprap is used surrounding the landfill perimeter as protection from tidal influences. The riprap appeared to be in good condition.*

7. **Bulges** ☐ Location shown on site map ☒ 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: *No ponding or seeps were observed during the site inspection. Mr. Cleveland stated that some ponding does occur on the cover but is quickly absorbed. Seep monitoring locations were observed as shown on the as-builts. However, the site inspection occurred during high tide and these locations were submerged preventing thorough inspection.*

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

B. Benches ☐ Applicable ☒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 ☒ 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 ☒ Applicable ☐ N/A

2. **Gas Monitoring Probes**
☒ Properly secured/locked ☒ Functioning ☒Routinely sampled ☒Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks: *These are gas vents which are installed below the membrane cover. A sample port was observed plumbed into the vent. Mr. Cleveland stated that these are routine sampled but was not sure of the frequency. These vents were installed such that if gas treatment was required, the system could be installed in-line. To date gas treatment has not been required.*

3. **Monitoring Wells** (within surface area of landfill)
☒ Properly secured/locked ☒Functioning ☒ Routinely sampled ☒ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks: *These are piezometers used to measure water levels within the landfill. These piezometers are located within the fenced and locked enclosure also enclosing the gas vent pipes. These appeared to be in good condition.*

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

5. **Settlement Monuments** ☒ Located ☒ Routinely surveyed ☐ N/A
Remarks: *Several settlement monuments are located throughout the cover. All were identified by cones as these are flush with the surface of the cover.*

E. Gas Collection and Treatment ☐ Applicable ☒ 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 ☒ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☒ Functioning ☐ N/A
Remarks: *Drainage pipes are located throughout the cover. Pipes are cleaned annually. Clean-out locations are used for pipe cleaning. However, some piping branches have no clean-out ports. Mr. Cleveland is requesting that ports be installed at these locations.*

2. **Outlet Rock Inspected** ☒Functioning ☐ N/A
Remarks: *Drainage pipe outlets are within the rip rap on the perimeter of the landfill. The rocks appear to be in good condition within no erosion or removal due to tidal influences.*

G. Detention/Sedimentation Ponds ☐ Applicable ☒ 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 ☐ 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 ☐ 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 ☒ 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_____
_____

X. GROUND WATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

A. Ground water 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 G Needs to be provided
Remarks_____
_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ **Applicable** ☒ **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 ☒ 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 ground water 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 suggests: *Leachate levels within landfill are decreasing*
☐ Ground water plume is effectively contained ☐ Contaminant concentrations are declining

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 remedy was intended to contain landfill contents and leachate that would potentially contaminate adjacent water bodies. Land use controls by way of signage and fencing appear in good condition. However, vandalism in the past has been a problem. The landfill appeared to be in good condition with installed mechanisms in good working condition. Seeps that served as indicators of potential leachate movement within the landfill have not been observed, which is considered one indicator of remedy efficacy. The remedy was designed such that the pressures from the adjacent sloughs would keep leachate from leaching out of the landfill. However, no occurrence of on-going sampling and analysis to determine whether leachate is being contained below ground water surface. Only the water level sampling of peizometers has been performed to demonstrate remedy effectiveness.*
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. *O&M procedures appear to be sound. Mr. Cleveland has been instrumental in providing innovative O&M procedures that satisfy O&M requirements (e.g. using goats to maintain the vegetative cover). The procedures in place are effectively providing current and long-term protectiveness of the remedy.*
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. *No potential remedy problems were observed during the site inspection.*
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. *There are a few items that are recommended to ensure protectiveness of the remedy. These are:* *1) Enacting of Tribal regulations requiring the maintenance of signs and enforcement of no fishing/no shellfish harvesting in the vicinity of the landfill.* *2) Performing regular sampling and analysis of soil, sediment, and/or ground water at the point of compliance (as defined in the ROD).* *3) Installation of clean-outs in drainage pipe branches that have none. This will ensure all drainage piping is kept free of debris/silt.* *4) Ensuring that land use controls are in place (e.g. deed restrictions).* *5) Additional signage on adjacent property (provided approval of property owners) and/or higher posts for more visibility.*

List of Site Inspection Attendees

Name	**Title**	**Office**	**Telephone**
Denise Baker-Kircher	EPA RPM	EPA Region 10	(206) 553-4303
Foley Cleveland	Site Manager	Tulalip Tribes	(360) 654-2602
Marlowe Laubach	Chemical Engineer	USACE, Seattle	(206) 764-4480
Rick Garrison	Geologist	USACE, Seattle	(206) 764-3312

Attachment 4

Photos Documenting Site Conditions

Figure 1. Entrance gate

Figure 2. Landfill cover facing northwest

Figure 3. Landfill cover facing west

Figure 4. Surface water system culverts

Figure 5. Infiltration collection system drain pipe at high tide

Figure 6. Close-up of infiltration collection system drain pipe

Figure 7. Typical seep pipe

Figure 8. Typical piezometer

Figure 9. Typical gas vent structure

Figure 10. Mower used to maintain vegetative cover

Figure 11. Goat houses

Figure 12. Storage containers on-site

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Attachment 5
Public Notice of Five Year Review

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DEC 27 2007
Environmental
Cleanup Office

EPA Invites Your Comments Through January 7, 2008 on the Cleanup of the Tulalip Landfill Site, Marysville, Washington

The U.S. Environmental Protection Agency (EPA) does regular five-year checkups on certain cleanup sites. We invite your comments on the second five-year review for the Tulalip Landfill. The review will make sure that the landfill cover is effective and continues to protect people and the environment.

How can I help? You may know something that can help the review team decide if the site is still safe. If you have information or comments about the landfill, please write or call the EPA project manager by **January 7, 2008:**

Denise Baker Kircher, U.S. Environmental Protection Agency,
1200 Sixth Avenue, Suite 900, ECL-115, Seattle, Washington 98101
e-mail: baker.denise@epa.gov, phone: 206-553-4303 or 1-800-424-4372, extension 4303. *TTY users: Call the Federal Relay Service at 1-800-877-8339 and give the operator Denise Baker Kircher's phone number.*

What happens after the review? EPA will prepare a report about the site and cleanup background, the review, and the results. People on the site mailing list will be notified when the finished report is available.

For more information: Visit the EPA Superfund Records Center, 1200 Sixth Avenue, Seattle, Washington, 206-553-4494 or the Marysville Public Library, 6120 Grove, Marysville, Washington, 360-658-5000

Or visit the EPA regional website: www.epa.gov/r10earth. Click on "Index," then "T," and then "Tulalip Landfill." If you have questions or would like to be added to the site mailing list, please contact Denise Baker Kircher (see above) or Community Involvement Coordinator Cindy Schuster at schuster.cindy@epa.gov, 206-553-1815, or 800-424-4372, x. 1815.

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