THIRD FIVE-YEAR REVIEW REPORT FOR TULALIP LANDFILL SUPERFUND SITE
Snohomish County, Washington

Prepared by

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Date

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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 United States Environmental Protection Agency (EPA) Region 10 has conducted a five year review of the remedial actions implemented at the Tulalip Landfill Superfund Site located near Marysville, Washington. This review is for both Operable Unit 1 off-source area (off-source area or surrounding wetlands) and for Operable Unit 2 (on-source area or landfill area) of the Site. This report comprises the third five year review for this site. The review period is from April 2008 to April 2013. This report documents the results of the review.

Based upon document review, site interview and inspection, the remedy has been constructed and continues to operate in accordance with the Record of Decision (ROD). 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 groundwater with the completion of the cover system and the implementation, monitoring and enforcement of effective Institutional Controls. Because the remedial actions at all OUs are protective, the site is protective of human health and the environment. There have been no changes in the physical conditions of the site.

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 EPA finalized the deletion of the Tulalip Landfill Superfund Site from the NPL.

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FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: **Tulalip Landfill**		
EPA ID: **WAD980639256**		
Region: 10	**State:** WA	**City/County:** **Marysville/Snohomish**

SITE STATUS	
NPL Status: Deleted	
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: EPA **If "Other Federal Agency" was selected above, enter Agency name:** Click here to enter text.
Author name (Federal or State Project Manager): Denise Baker-Kircher
Author affiliation: Remedial Project Manager
Review period: 4/25/2008 - 04/24/2013
Date of site inspection: 03/13/2013
Type of review: Statutory
Review number: 3
Triggering action date: 04/24/2008
Due date *(five years after triggering action date)*: 04/24/2013

Five-Year Review Summary Form (continued)

Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU1 – the off-source area (wetlands) **OU2 – the on-source area (landfill)**

Issues and Recommendations Identified in the Five-Year Review:

OU(s): NA	**Issue Category: None**			
	Issue: None			
	Recommendation: None			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Not Applicable (NA)	NA	NA	NA	NA

Protectiveness Statement(s)

Include each individual OU protectiveness determination and statement. If you need to add more protectiveness determinations and statements for additional OUs, copy and paste the table below as many times as necessary to complete for each OU evaluated in the FYR report.

Operable Unit: OU1 - Wetlands	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: 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 groundwater with the completion of the cover system and the implementation, monitoring and enforcement of effective Institutional Controls.		

Five-Year Review Summary Form (continued)

Operable Unit: OU2 - Landfill	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: 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 groundwater with the completion of the cover system and the implementation, monitoring and enforcement of effective Institutional Controls.		

Sitewide Protectiveness Statement (if applicable)	
For sites that have achieved construction completion, enter a sitewide protectiveness determination and statement.	
Protectiveness Determination: Protective	*Addendum Due Date (if applicable):* NA
Protectiveness Statement: 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 groundwater with the completion of the cover system and the implementation, monitoring and enforcement of effective Institutional Controls. Because the remedial actions at all OUs are protective, the site is protective of human health and the environment.	

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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 judgment 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 is for both Operable Unit 1 off-source area (off-source area or surrounding wetlands) and for Operable Unit 2 (on-source area or landfill area) of the Site. The review period is from April 2008 to April 2013. This report documents the results of the review.

The Tulalip Five-Year Review was conducted by Denise Baker-Kircher of Region 10, EPA Remedial Project Manager for the Tulalip Site. CH2M HILL (CH) provided support to EPA in the data analysis and evaluation of remedy protectiveness for this Five-Year Review. The review period began on October 30, 2012, and ended on April 1, 2013. EPA also conducted a site inspection at the landfill on March 13, 2013.

This is the third FYR for the Tulalip Landfill Superfund Site. The triggering action for this review was the second FYR completed on April 24, 2008. 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
Second FYR	April 24, 2008

III. Background

The Tulalip Landfill Site 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 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 groundwater (leachate) formed within the landfill.

Rainwater would soak into the landfill and force the highly contaminated leachate down into the groundwater 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 groundwater (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 groundwater.
4. Zone 2 groundwater (native aquifer): Minimize migration of contaminated groundwater at levels exceeding surface water ARARs, and prevent use of contaminated groundwater.
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* (ROD). This ROD 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, ROD 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 1998 ROD is Institutional Controls, to protect human health in conjunction with completion of the on-source remedy. The ICs selected in this ROD include placing and maintaining an adequate number of signs to warn of the potential risk from the harvest and consumption of resident fish and shellfish in the vicinity of the site. Natural attenuation was expected to reduce concentrations of inorganics and organics in the seep soils and sediments.

Contaminants of Concern
The following lists the primary contaminants of concern (COC) for each area and media. Cleanup Levels selected in the ROD are shown on Table 8 of this FYR.

On-source area
Surface Water: Pesticides, PCBs, Metals (copper, lead, mercury, nickel, and zinc), and 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
2008	$182,500
2009	$189,500
2010	$204,500
2011	$208,000
2012	$208,000

V. Progress Since Last Review

<u>The following are the protectiveness statements provided in the 2008 Five-Year Review:</u>

- "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."

The following issues that may affect protectiveness, and recommendations on how to address them, were identified in the April 24, 2008 FYR:

Table 3: Issues (Identified in 2008 FYR) That May Affect Protectiveness

Issue	Recommendations and Follow-up Actions
#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
	Soil sampling and report of sample results to EPA at the seep locations for contaminants of concern.
	Sediment sampling and report of sample results to EPA for contaminants of concern at the points of compliance (where groundwater discharges into Ebey and Steamboat sloughs).
#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.
#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.

Actions Taken Since the 2008 Five-Year Review to Address Issues That May Affect Protectiveness

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

The ROD calls for leachate seeps around the perimeter of the Tulalip Landfill to be monitored once per calendar quarter (quarterly).

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.

Per the April 10, 2002, amendment to the Tulalip Landfill Field Sampling Plan, quarterly leachate seep monitoring would consist of a general inspection of the landfill perimeter, location of monitoring points, inspection for occurrence of seepage, and if appropriate, estimation of the flow rates at each location.

In response to the issues identified in the 2008 FYR that may affect protectiveness, leachate seeps were sampled in June 2008 and again in September 2009. Only two of the sixteen inspection locations (SP-13 and SP-14) yielded enough flow for sampling. The June 2008 and September 2009 sampling results were similar to 2001 sampling results and consistent with historical seep sampling trends at the site. PCBs, pesticides, cyanide and dissolved metals (copper, lead, mercury, and zinc) were non-detected except for zinc in SP-14. Low concentrations of total metals (copper, lead, mercury, and zinc) and ammonia as nitrogen were detected in both samples. All detections reflect low concentrations.

#1. No contaminant sampling	Soil sampling and report of sample results to EPA at the seep locations for contaminants of concern.

AND

#1. No contaminant sampling	Sediment sampling and report of sample results to EPA for contaminants of concern at the points of compliance (where groundwater discharges into Ebey and Steamboat sloughs).

The 2008 FYR ***incorrectly*** reported that: "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."

The recommendations and follow-up actions carried out to date to address Issue #1 (soil and sediment sampling) from the 2008 FYR are adequate and no additional follow-up actions other than those required for O&M are necessary.

Discussion:
Section 10.1.5 of the 1996 Interim ROD, which addresses the landfill portion of the site (also known as the on-source area or Operable Unit #2), requires sampling and monitoring of the perimeter leachate seeps and monitoring of the landfill gas and leachate levels. Sampling was conducted in the seeps on Operable Unit #2 until they were considered no longer necessary [see Leachate seep sampling discussion above]. There is no requirement in the 1996 ROD (or in the 1998 ROD) to conduct monitoring of groundwater or sediments in the wetlands portion of the site (also known as the off-source area of the site, Zone 2 or Operable Unit #1). Section 10.1.5 states that "…Because the selected remedy is expected to effectively contain the landfill wastes by minimizing the migration of leachate away from the landfill, and because, based on current information, EPA does not expect that additional, future actions will be necessary to remediate Zone 2 groundwater, EPA concludes that post-construction data collection from the Zone 2 aquifer is unnecessary.

Section 1.1 “Physical Description of the Landfill (Source Area),” in the 1998 ROD explains that: “Groundwater beneath the site is brackish and therefore unusable as a potable water source. Site studies indicate that contaminated groundwater from the landfill migrates to the wetlands and sloughs surrounding the site and does not pose a threat to groundwater drinking water sources located across the sloughs.”

Section 6.3, “Assessment of Site,” in the 1996 ROD describes the results of sampling conducted in all the media at the Site – the leachate, surface water, groundwater, soils, sediments and fish tissue. The sampling demonstrated that: “The presence of … concentrations above the comparison numbers indicates that there are releases of hazardous substances that pose actual or potential threats to animal and plant life in wetland areas around Tulalip landfill. In addition, data collected during the [Remedial Investigation] show the presence of chemical of concern (for example, cadmium, chromium, and nickel) in sculpin (a species of fish) found in the tributaries surrounding the Site.

In addition, the presence of COCs in sculpin (a species of fish that are considered “bottom feeders”) made the pathway plausible (different than causative), which was evidence to support the presumptive remedy of effective source control of those pathways. There was no determination in the Remedial Investigation that this was a contaminated sediment site due to the Tulalip Landfill. In addition, the presumptive remedy for this site required some loss of adjacent wetlands to support the cap design. This would ameliorate the potential for exposures because wetlands sequester/trap/bind contaminants and those closest to the pre-cap leachate discharge were capped.

Sediments and fish tissue have been shown to be contaminated up and down gradient from the landfill from off-site sources. In addition, a new four-lane, fixed span bridge is being constructed just upstream from the landfill. The new construction included the demolition of an existing bridge, installation of temporary work trestles, five new piers, and new bridge superstructure. Since sediments have been disturbed in the construction of this new roadway, and sediment sampling was not conducted in the wetlands and sloughs since 1998, it would be nearly impossible to attribute which sediments found in the sloughs adjacent to the landfill have been affected by the Tulalip landfill. Therefore, EPA has concluded that not a lot can be gained from sampling the soils, sediments and fish in the wetlands surrounding the Tulalip Landfill that would contribute reliable information as to the site being responsible for contamination found in sediments and fish.

The recommendations and follow-up actions carried out to date to address Issue #1 from the 2008 FYR are adequate and no additional follow-up actions other than those required for O&M are necessary.

#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.

The institutional controls section of the 1996 ROD requires land use restrictions to limit or prohibit activities that could interfere with performance of the selected remedy, and groundwater use restrictions to prevent use of contaminated groundwater. Pursuant to the 1996 and 1998 ROD, these land and groundwater use restrictions were to be effectuated through covenants that run with the land. In addition, the 1996 ROD requires development and approval of a document titled, "Routine Use of Tulalip ('Big Flats') Landfill," the purpose of which is to identify future land uses of the Site that are consistent with maintaining the integrity of the cover system and off-source areas of the Site.

The 1996 ROD requires covenants, conditions and restrictions that achieve the following objectives: 1) preserve existing access roadways, 2) create and maintain an environmental buffer zone on the surface of the landfill cover in accordance with ROD specifications, 3) placement and maintenance of a sign at the landfill entrance that summarizes the activities that may occur on the landfill cover and the restrictions on use as described in the Routine Use Document. 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 the Site.

The Tribe has taken several steps to comply with ROD requirements for institutional controls:

1. <u>Development of the Routine Use of Tulalip ('Big Flats') Landfill document</u>.
A document entitled, "The Tulalip Landfill Site (Big Flats): Analysis of Future Land Use" (also known at the Big Flats Land Use Program), was finalized on July 10, 1994. Section 4.1 (Comprehensive Plan and Zoning) of the document states:

> The Tribe zoned the Big Flats site "industrial" in the early 1970's under the Tribe's federally approved zoning ordinance (Ordinance No. 35). This zoning continues in effect and is expected to be the future zoning of the site.
>
> On January 21, 1994, pursuant to its federally approved planning and zoning ordinance (Ordinance No. 56), the Tribe enacted Ordinance No. 78, subsequently approved by the Secretary of Interior, adopting a new comprehensive plan for the Tulalip Indian Reservation.
>
> Use of the limited reservation lands must be undertaken within the guidelines of reservation ordinances, and with consultation and approval of the tribal government.
>
> The 1994 Tulalip Comprehensive Plan designates the on-source portion of Big Flats as "Industrial". The off-source wetlands area of the site, westward of the berm, is designated as "Conservation.

The 1994 plan establishes the "Conservation" land use category, as follows:

> "A designated conservation area is one that should be left in its natural state, because it is so unique to the reservation that it would be difficult to replace if damaged …No development is allowed in an area designated as conservation with the exception of utility crossings."

In addition, on February 5, 2002, the Tulalip Tribes transmitted the "Routine Use of Tulalip Landfill" to EPA. The Tribes stated its intention to leave the site idle so that the remediation may mature. The document provided a process the Tribes would follow to identify future land use in order to secure EPA's written approval for any change in use.

2. The Tribes have met the objectives of institutional controls set forth in the ROD.

1) Preservation of existing access roadways – Road repairs have been conducted on a regular basis since 2009. The Tribes plan to continue upgrades each year until all the roads have been repaired/replaced.

2) Maintenance of environmental buffer zone – Grazing animals have been introduced to the landfill to help maintain the landfill and berms. The animals (llamas and goats) are much less destructive to the landfill berms than heavy equipment would be. The animals are very effective at keeping weeds from overtaking the bermed areas. In addition, the presence of the llamas on the site has significantly reduced the number of vandals from attempting to enter the site via the buffer zone. Before the llamas were introduced to the landfill, vandals entered the site just about every 2 months. In the last five years (since the llamas were introduced), vandals have attempted to enter the site once.

3) Maintenance and updating of signage – Warning signs have been posted and maintained by the Tribe as required. In addition, in April, 2013, the Tribe passed a resolution providing for enforcement against any person who enters the Site without proper authorization from the Tribe, or who engages in prohibited activities as posted on the Site.

In furtherance of its responsibility to fulfill the requirements of the ROD regarding access and institutional controls, on March 20, 1998, the Tribe submitted a copy of the March 19, 1998, Consent Decree entered into by EPA, 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). The Consent Decree includes the same institutional control requirements that appear in the ROD. The Tribe filed this document with the BIA recording office in order to provide public notice of access and institutional control requirements at the Site. BIA recorded the Consent Decree in the land records of the DOI Title Plant.

The institutional controls described above are protective of human health and the environment. Although the ROD requires land use and groundwater use restrictions imposed on all property that comprises the Site as covenants running with the land to be in place, EPA believes such covenants are not necessary. The institutional controls currently in place are adequate and appropriate for the purpose of protecting human health and the environment by protecting the

remedial actions which have been and will be taken for this tribal land. EPA will be including in the administrative record for the Site a Memorandum Documenting Non-Significant Change to the Tulalip Landfill ROD that will document the deletion of the requirement to put in place restrictive covenants at the Site.

#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.

As explained in response to Issue #2, above, the institutional controls described above are protective of human health and the environment. Although the ROD requires land use and groundwater use restrictions imposed on all property that comprises the Site as covenants running with the land to be in place, EPA believes such covenants are not necessary. The institutional controls currently in place are adequate and appropriate for the purpose of protecting human health and the environment by protecting the remedial actions which have been and will be taken for this tribal land. EPA will be including in the administrative record for the Site a Memorandum Documenting Non-Significant Change to the Tulalip Landfill ROD that will document the deletion of the requirement to put in place restrictive covenants at the Site.

Several issues were identified in the 2008 FYR that do not directly affect protectiveness but should be tracked and remedied. Here is a summary of those issues and the recommendations provided on how to address them:

Table 4: Issues (Indentified in 2008 FYR) That That Do Not Directly Affect Protectiveness

Issue	Recommendations and Follow-up Actions
#1. ROD is vague regarding points of compliance and receptors affected.	Clarify Points of compliance and the receptors affected.
#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.
#3. No clean-out ports	Add clean-out ports to drain lines, where needed.
#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.
#5. Signs	Use higher posts for existing signs, and seek permission from State to add signs on adjacent state lands.
#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.
#7. Proposal to mow with a high cut - 7-8 inches, instead of 3-4 inches as required in the O&M manual –	EPA will make a determination on proposal and respond in writing to Tulalip Tribes. If proposal accepted,

in the summer and fall to protect the soil cover during the dry season	change will be recorded as an amendment to existing Tulalip Landfill Operation and Maintenance Plan.
#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.

Actions Taken Since the 2008 Five-Year Review to Address Issues That Do Not Directly Affect Protectiveness

#1. ROD is vague regarding points of compliance and receptors affected.

The 1996 ROD defines points of compliance as follows:
"The point of compliance for contaminated groundwater and leachate is the location where groundwater discharges to surface water. For Zone 1 groundwater (i.e. leachate seeps). The point of compliance shall be the location at which leachate exits the exterior face of the perimeter landfill berm. For Zone 2 groundwater, the point of compliance shall be the location where Zone 2 groundwater discharges to surface water."

The 1996 ROD explains that: "Because current information indicates that the interim remedial action, if properly constructed, will achieve the surface water ARARs where Zone 2 groundwater discharges to the sloughs, additional monitoring or evaluation of the Zone 2 pathway for compliance purposes is unnecessary."

The 1998 ROD goes on to explain that sampling of groundwater and sediments is not required to meet the Remedial Action Objectives for Operable Unit #1 (also known as the off-source area, Zone 2, or wetlands). The selected remedy for the off-source area (wetlands) is institutional controls.

Since the 1996 and 1998 RODs do not require sampling of groundwater and sediments in the wetlands, no further clarification is needed for these points of compliance. No further action is necessary on this issue.

#2. Piezometer sealed to geomembrane

During conversation with Baker-Kircher on 3/13/2013, Tom McKinsey, the Tulalip Tribes' Big Water Project Manager, reported that he observed the installation of piezometers on the site in 1998, 1999 and 2000. McKenzie confirmed that the cap penetrations (landfill vents and piezometers) were installed in a casing wrapped in a geomembrane "boot." The boots were sealed to the geomembrane over the landfill.

#3. No clean-out ports
#4. Potential ponding during heavy rain events
#5. Signs
#6. Proposal to place fill to smooth transition for the mower, from berm road onto the cap.
#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
#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

The 2008 FYR identified Operation and Maintenance Issues #3-#8 that did not affect protectiveness but warranted some attention. Most of these issues have been completed. The others not fully addressed are slated to be completed as the Tribes continue updating and repairs on drain lines and roads on different portions of the site each year.

In addition to the actions taken in response to issues from the 2008 FYR, several other actions were taken at the Site in the five year reporting period (2008-2013):

Table 5: Other Actions Taken at the Site since 2008 FYR

Issues	Action Taken and Outcome	Date of Action
The gas collection system rotor vanes on all the vents were showing signs of age and were not functioning as they should.	The vanes were replaced on all venting structures (GVS-1 through GVS-6). The system is now working correctly. All gas flows remained within the historical ranges associated with this passive landfill gas system.	Fall 2009
The handle on the GVS-4 valve needed to be replaced.	The PVC valve on GVS-4 was replaced; could not find a source for handle so the entire valve was replaced. Valve working great now.	Fall 2009
Line in the infiltration collection system blocked.	Repair was completed on line L-3 east of SM-03. The blockage in the line was located by removing the soil cap, and then digging the last six inches by hand so as not to damage the cover. The blockage in the pipe appeared to be caused by mineral deposits and not by something foreign or damage to the pipe. The repaired area was about 250 feet long. Line L-3 works fine now.	Fall 2010
Grass is growing in gravel areas on landfill roads. Roads sometimes need to be mowed. Roads are also getting ruts in them.	Have added gravel to sections of landfill roads each year. Started by applying approximately 2,000 cubic feet of gravel on the eastern perimeter road in 2009, as it was in worst shape, Each year a new section is addressed. At this rate, the entire landfill road system to be resurfaced in about seven years. The road sections where gravel has been added are looking good, are smooth and amount of grass growing through gravel is much more easily managed. In 2011, the Tribes also purchased a grader box to maintain the roads and they also present a good image to the public.	Ongoing activity; 2009 to present

Issues	Action Taken and Outcome	Date of Action
Seep location poles were getting hard to locate due to weather and time.	Professional Land surveyor was contracted to perform a survey to locate the seep locations. All seep locations have been identified and marked.	April 2011

VI. Five-Year Review Process

Administrative Components
EPA published an announcement in The Herald, an Everett, Washington newspaper, on March 1, 2013, inviting the public to provide comments to EPA for the FYR of the site.

The Tulalip Landfill FYR was conducted by Denise Baker-Kircher of Region 10, EPA Remedial Project Manager for the Tulalip Site, and supported by CH personnel with experience in landfills, hazardous waste, chemistry and risk assessment. Evan C. Griffiths, Ph.D. PE, Senior Technologist and Carolyn Kossik, Regulatory Specialist, assisted in the review. The major components of the review included:

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

The FYR has a statutory completion date of April 24, 2013. 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 two communications about the Tulalip Landfill in the last five years: one on the care of the llama on the landfill, and one from a middle school teacher wanting to share more about the Superfund process to her students.

A display ad was placed in the Everett Herald on March 1, 2011 (see Attachment 4), requesting comments on the FYR. One comment was received from a nearby wood waste composting operation on March 26, 2013, in response to the ad. The commenter expressed concern that the Tulalip Landfill may be a source of nuisance odors in the area. Nuisance odor issues are out the FYR purview as they are not remedy performance issues or a protectiveness issue. Therefore, EPA will not discuss nuisance odors further in this report. However, EPA will be sure to share

the comments provided by the commenter with the Puget Sound Clean Air Agency (PSCAA). PSCAA has begun a one year study of odors in the Everett/Marysville area. This study will provide around-the-clock data that is designed learn more about the odor environment of the region.

EPA will provide notice to those on the site mailing list notifying the public that this FYR has been completed. This notice will also provide a list of outstanding issues that need to be addressed on the site.

Site Inspection

A site inspection was conducted on March 13, 2013. The inspection was led by Foley Cleveland, Site Manager for the Tulalip Tribes, and included Denise Baker, EPA Project Manager. The details of the inspection findings, including the Site Inspection Checklist, are provided as Attachment 2. The inspection consisted of a site visit, where landfill features and existing institutional controls were observed, and a meeting was held 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.
- 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 and seep location markers were observed.
- Drainage piping appeared to be in good condition with no or little silting.
- Mr. Cleveland stated there are still a few drainage pipe branches with no cleanout ports.

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.

Site Interviews

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

Document Review

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

Data Review and Monitoring Results

This section of the FYR summarizes the status of the following components of the remedy implemented at the Tulalip Landfill:

- Institutional Controls
- Leachate Seep Discharge Rates and Monitoring

- Landfill Gas Monitoring
- Settlement Survey
- Landfill Observations
- Natural Attenuation Monitoring

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 ICs contained in the March 1, 1996, ROD (on-source area) included land use restrictions to limit or prohibit activities that could interfere with performance of the selected remedy. In addition, groundwater use restrictions were to be implemented to prevent the use of contaminated groundwater. The ICs 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 IC established in the September 29, 1998 ROD (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. On April 4, the Tulalip Tribal Board approved Directive #55, which provides language to enforce the signage required under the institutional controls. This new Directive will become Resolution #2013-168, and will be part of the Tulalip Tribes Regulations that apply to the Tulalip Landfill.

What ICs are currently functioning as planned?

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.

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.

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

As described above in Section V., “Progress since Last Review,” Issue #2, Institutional Controls, the institutional controls described above are protective of human health and the environment. Although the ROD requires land use and groundwater use restrictions imposed on all property that comprises the Site as covenants running with the land to be in place, EPA believes such covenants are not necessary. The institutional controls currently in place are adequate and appropriate for the purpose of protecting human health and the environment by protecting the remedial actions which have been and will be taken for this tribal land. EPA will be including in the administrative record for the Site a Memorandum Documenting Non-Significant Change to the Tulalip Landfill ROD that will document the deletion of the requirement to put in place restrictive covenants at the Site.

Leachate Seep Discharge Rates and Monitoring

The ROD 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, 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. Per the April 10, 2002, amendment to the Tulalip Landfill Field Sampling Plan, quarterly leachate seep monitoring would consist of a general inspection of the landfill perimeter, location of monitoring points, inspection for occurrence of seepage, and if appropriate, estimation of the flow rates at each location.

In response to the issues identified in the 2008 FYR that may affect protectiveness, leachate seeps were sampled in June 2008 and again in September 2009. Only two of the sixteen inspection locations (SP-13 and SP-14) yielded enough flow for sampling. The June 2008 and September 2009 sampling results were similar to 2001 sampling results and consistent with historical seep sampling trends at the site. PCBs, pesticides, cyanide and dissolved metals (copper, lead, mercury, and zinc) were non-detected except for zinc in SP-14. Low concentrations of total metals (copper, lead, mercury, and zinc) and ammonia as nitrogen were detected in both samples. All detections reflect low concentrations.

During the 2008-2013 FYR reporting period, only seep locations SP-13, SP-14 and SP-16 showed any measurable amounts of seepage during monitoring cycles. The rest of the 13 seeps on the site are dry. In 2012, only seep SP-14 showed any measurable amount of seepage, flowing at a rate of .25 gallons per minute (gpm). In all cases, the seepage was observed to be clear water based on visual checks. These results represent about a 98-99% reduction in total site flow rates of the seeps. Leachate Seep Monitoring Locations are shown in Figure #3, "Site Plan with Post Closure Monitoring Locations."

Based on the results of the sampling conducted in June 2008 and in September 2009, and measured amounts of seepage in the last FYR period, EPA agrees that seep sampling need not be continued as the remedy has indeed reduced or eliminated the leachate seeps at the site. No further seep sampling is warranted to demonstrate that the remedy is effectively reducing the volume of and contaminants contained in the discharge from the seeps. We agree with the direction provided in the April 10, 2002 amendment to the Tulalip Landfill Field Sampling Plan: quarterly leachate seep monitoring should consist of general inspection of the landfill perimeter, location of monitoring points, inspection for occurrence of seepage, and if appropriate, estimation of the flow rates at each location.

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.

The results of the leachate level monitoring indicate that leachate elevations in the landfill piezometers were consistent with the historical trends, which have generally decreased since monitoring began in November 2000. The results are consistent with an overall decrease in storm water infiltration into the waste materials since the construction of the cover system.

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 0.5 to 1 foot. A table showing decreasing leachate levels is provided in Figure #4, "Historical Leachate Elevations." 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

During the last five years, contractors for the Tulalip Tribes continued to monitor landfill gas by obtaining monthly field measurements of primary gas composition, temperature, pressure, and flow from each of the landfill gas vent structures installed at the landfill (GVs-1 through GVS-6). Landfill Gas Monitoring Locations are shown in Figure #3, "Site Plan with Post Closure Monitoring Locations." Select trace gas compounds were monitored once per quarter concurrent with one of the monthly monitoring events. This information was used to provide an assessment of the landfill gas conditions at the site.

Historically, the total gas flow has been well below any regulatory limits and has not posed any safety concerns relative to the design of the gas vent structures. Recorded flow as within historical and typical ranges associated with a passive system under declining gas productions.

Gas composition results from November and December of 2012 indicate that landfill gas (expressed as combined methane and carbon dioxide) is generally present most of the time in all landfill gas vent structures. The methane and carbon dioxide concentrations continue to be within the typical ranges associated with declining gas production.

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 to check that the landfill surface slope remains greater than two percent, as required. A total of nine lines of settlement monuments were installed and surveyed in October 2000; each line consists of four monuments, two monuments on the outer "cut" area of the landfill and two monuments on the inner "fill" area of the landfill. Along each line, the monuments were spaced as widely as possible in order to provide as much coverage of the landfill surface as possible. Settlement Analysis Fill Areas and Settlement Monument Locations are shown in Figure #5. This review separates the 2012 settlement data into the fill areas and the cut areas, as the settlement curves only apply to the fill areas. The measured slopes from the 2000 through 2012 surveys are shown on the tables below. 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.

Fill areas: Except for the measured slopes in Panels O and S, all slopes are within the predicted settlement range. The slopes on Panels O and S are unchanged from the previous survey, and both panels are flatter than the minimum 2 percent as described in Washington State Landfill Regulations (WAC-173-304, which has been replaced by WAC-173-351).

Cut areas: The slopes on Panels A and S are less than the 2 percent regulatory minimum, but were unchanged from the previous survey. The slopes on all other panels are at or above the long-term target slope, and are unchanged from the previous survey.

The slopes on the landfill were all constructed with a greater than 2 percent slope and most were around 2.5 percent. A minimum slope was required by WAC 173-304 MFS regulations that were in force at the time. A minimum slope is still required under the revised Washington State Landfill Closure regulations (WAC-173-351), which replaced the MFS described under WAC-173-304. The intent of these landfill regulations are that slopes be initially constructed with a minimum of a 2% slope so they can accommodate drainage as the landfill settles over time. Therefore, if the flatter slopes that are present still allow runoff, a massive construction effort is not warranted to rebuild the slopes to greater than 2 percent. However, it is recommended that a monitoring and maintenance program be continued to look for localized ponding, to fill any areas where ponding has occurred and to grade the filled areas to promote drainage off the cap.

In addition to regular maintenance and inspections, survey data also provides an excellent means for monitoring the performance of the site closure. Due to the small differences in elevation being measured during the surveys, the most important part of reviewing the survey data is to determine whether any trends are developing that may affect the long-term integrity of the closure. The settlement trends follow the expected pattern of greater settlement following construction, gradually decreasing over time. Since 2005, the amount of settlement has generally been less than 0.1 foot per year across the site.

Based on review of the 2012 survey data, the rate of settlement increase slightly over the last year and it is recommended that the survey continue to be performed annually. Also during periods of heavy rainfall, special inspections should be made on Panels A and S 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 6: Annual Survey of Fill Area Slopes

Fill Area Slopes									
Survey Year	Northeast Area			Central Area		Southwest Area			
Slope Panel	A	C	S	D	Q	E	H	I	O
2000	2.4	2.5	2.1	2.5	2.6	2.4	2.3	2.5	2.3
2001	2.3	2.5	2.1	2.5	2.5	2.3	2.3	2.4	2.1
2002	2.3	2.5	2.0	2.5	2.5	2.3	2.3	2.4	2.1
2003	2.3	2.5	2.0	2.4	2.5	2.2	2.2	2.3	2.0
2004	2.3	2.5	2.0	2.5	2.5	2.2	2.2	2.3	2.0
2005	2.3	2.6	2.0	2.5	2.5	2.2	2.2	2.3	2.0
2006	2.3	2.6	1.9	2.5	2.5	2.2	2.2	2.3	2.0
2007	2.3	2.6	2.0	2.5	2.5	2.2	2.2	2.3	2.0
2008	2.3	2.6	2.0	2.5	2.5	2.2	2.2	2.3	2.0
2009	2.3	2.6	1.9	2.5	2.5	2.2	2.2	2.3	2.0
2010	2.3	2.6	1.9	2.5	2.5	2.2	2.2	2.3	2.0
2011	2.2	2.5	1.9	2.5	2.4	2.1	2.1	2.3	1.9
2012	2.2	2.5	1.9	2.5	2.4	2.1	2.1	2.3	1.9

Table 7: Annual Survey of Cut Area Slopes

Fill Area Slopes									
Survey Year	Northeast Area			Central Area		Southwest Area			
Slope Panel	A	C	S	D	Q	E	H	I	O
2000	1.9	2.5	1.9	2.2	2.2	2.1	2.4	2.2	2.2
2001	1.9	2.9	1.8	2.2	2.2	2.3	2.4	2.2	2.2
2002	1.9	3.0	1.8	2.1	2.1	2.4	2.4	2.2	2.2
2003	1.8	2.8	1.9	2.1	2.1	2.2	2.2	2.1	2.1
2004	1.9	3.0	1.6	2.1	2.1	2.4	2.4	2.1	2.2
2005	1.9	3.0	1.6	2.1	2.1	2.4	2.4	2.1	2.2
2006	1.9	3.0	1.6	2.0	2.1	2.2	2.4	2.1	2.2
2007	1.9	3.0	1.6	2.0	2.1	2.2	2.4	2.1	2.2
2008	1.9	3.0	1.6	2.0	2.1	2.4	2.4	2.1	2.2
2009	1.9	3.0	1.5	2.0	2.1	2.4	2.4	2.0	2.1
2010	1.9	3.0	1.5	2.0	2.1	2.4	2.4	2.0	2.1
2011	1.8	2.8	1.5	2.0	2.0	2.2	2.1	2.0	2.1
2012	1.8	2.8	1.5	2.0	2.0	2.2	2.1	2.0	2.1

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 during the FYR reporting period by contractors for the Tulalip Tribes. As of 2012, the site was performing as designed with minor problems related to small animals burrowing into landfill cap, vandalism, and missing warning signs. As stated in the 2008 FYR report, 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 in the wetlands and un-walkable are now firmer indicating that the seeps are under control.

Natural attenuation monitoring
In the 2008 FYR, it was reported that: "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."

As reported in *Leachate Seep Discharge Rates and Monitoring above*, leachate seeps were sampled in June 2008 and again in September 2009. The results of the June 2008 and September 2009 sampling were similar to 2001 sampling results and consistent with historical seep sampling trends at the site. All detections reflect low concentrations.

Also explained above, in *Actions Taken Since the 2008 FYR to Address Issues That Do Not Directly Affect Protectiveness*, sampling of groundwater and sediments is not required to meet the Remedial Action Objectives for Operable Unit #1 (also known as the off-source area, Zone 2, or wetlands). The selected remedy for the off-source area (wetlands) is institutional controls.

VII. Technical Assessment

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

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

<u>The following describes the condition of the remedy components</u>.
- 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 very little 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 (see *Issues that may affect protectiveness*, *Actions taken since last FYR*, above)
- Signs, fencing and other security measures are in place and continue to be maintained regularly.

This review of the documents listed in Attachment 1 and the results of the seep sampling and site inspection indicates that the remedy is functioning as intended by the 1996 and 1998 RODs. Capping the landfill has reduced the continued leaching of COCs and the seeps have been virtually eliminated. The capping of the contaminated wastes has achieved the remedial objectives to minimize the migration of contaminants to groundwater and prevent direct contact with contaminants in the landfill.

As explained in the 1998 ROD, natural attenuation was expected to reduce concentrations of inorganics and organics in the seep soils and sediments. Sampling conducted in leachate seeps in June 2008 and again in September 2009, demonstrated that results were consistent with historical sample results: PCBs, Pesticides, Cyanide and dissolved metals (copper, lead, mercury, and zinc) were below detection limits with the exception of dissolved zinc at one location. Low concentrations of total metals (copper, lead, nickel and zinc) and ammonia as nitrogen were detected.

The Tulalip Tribes have maintained the site exceptionally well during the 2008-2013 FYR period. The cover system is being maintained for cap integrity. Drain lines and infiltration collection system lines have been repaired as needed, and others are slated to be repaired/replaced to keep the landfill cap in ideal working order. Roads have been improved each year, and additional road repairs are scheduled for the next seven years until all the roads are repaired on the landfill.

Heavy rain during spring and early summer seasons has caused grass to grow at an accelerated rate, and has made mowing the site a bit challenging. One year, the grass on the landfill could not be mowed down until the first part of August. [The landfill is not mowed when landfill soils are saturated and the cap geomembrane is more prone to damage from the use of mowing equipment.] Large mowers that can more effectively cut down high grass on the site are not used on the site until the landfill soils are dry. High grass provides places for animals to hide and burrow. There is some evidence of minor problems with burrowing animal(s) that will need to be watched. Very few deep-rooted plants have established themselves on the cap. These weeds will be mowed down as soon as mowers can recommence operation this spring/early summer.

The Tulalip Tribes Site Manager is evaluating whether to re-introduce goats (or other grazing animals) onto the landfill to help keep weeds and grass more easily managed through each growing season.

In 2003, the state of Washington issued new rules for solid waste facilities, WAC 173-350 Solid Waste Handling Standards and WAC 173-351 Criteria for Municipal Solid Waste Landfills, which apply to all new facilities. Facilities permitted under the older Minimum Functional Standards for Solid Waste Handling (WAC 173-304) either were closed under the timeframes allotted or were phased into the new rule requirements. Since the Tulalip landfill was closed prior to 2003, the WAC 173-350 and -351rules are not applicable. As operations and maintenance (O&M) for closure will be ongoing for many years at the landfill, the WAC 173-350, -351 contents should be reviewed to determine if there are any O&M items which would enhance the existing O&M plan for the landfill.

Access to the landfill is controlled by a security gate and institutional controls, and enforced very well by resident llamas and daily visits to the landfill by the Tulalip Tribes Site Manager. The llamas have been very effective in keeping vandals from getting onto the site. (Before the llamas were brought onto the site, vandals entered the site nearly once every other month. After the llamas were introduced to the Tulalip Landfill, vandals entered the site only once in 5 years.)

As described above in Section V., "Progress since Last Review," Issue #2, Institutional Controls, effective ICs have been put in place at the site and are protective of human health and the environment. Although the ROD requires land use and groundwater use restrictions imposed on all property that comprises the Site as covenants running with the land to be in place, EPA believes such covenants are not necessary. The institutional controls currently in place are adequate and appropriate for the purpose of protecting human health and the environment by protecting the remedial actions which have been and will be taken for this tribal land. EPA will be including in the administrative record for the Site a Memorandum Documenting Non-Significant Change to the Tulalip Landfill ROD that will document the deletion of the requirement to put in place restrictive covenants at the Site.

Given the current site conditions, effective ICs, environmental data showing seep volumes continuing to decline, seep concentrations measured at below detection limits or hovering just at ARARs, and the Tribes excellent management of the site, the Tulalip Landfill remedy is indeed functioning as intended by the decision documents.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid? **NO.**

ARARs and To Be Considered (TBC)

The standards described in the ROD are still applicable or relevant and appropriate to this site, but some of the exposure assumptions or toxicity data have changed for limited constituents since the remedy selection. 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 8 compares the chemical specific ARARs identified in the ROD to current standards.

Table 8: Comparison of ROD Clean-up Levels to Current Values

Compound	**ROD Chemical ARAR**	**Current Standards**
Surface water ARARs	**(mg/L)**	***(mg/l)***
1,1-Dichloroethane	0.0032[a]	NV
Benzene	0.071[a]	0,071[a]
Chlorobenzene	0.129[b1]	NV
Chloroform	0.47[a]	NC
Chloromethane	6.4[b1]	NV
Ethylbenzene	0.43[b2]	NV
Methylene chloride	1.6[a]	1.6[a]
Toluene	5[b1]	NV
Trichloroethene	0.081[a]	0.081[a]
1,2-Dichlorobenzene	1.97[b2]	NV
1,3-Dichlorbenzene	1.97[b2]	NV
1,4-Dichlorobenzene	1.97[b2]	NV
2-Methylnaphthalene	0.3[b2]	Not on list
2,4-Dichlorophenol	0.97[a]	0.79[a] **
3,3-Dichlorobenzidine	0.000077[a]	0.000077[a]

Compound	ROD Chemical ARAR	Current Standards
Acenaphthylene	0.3[b2]	NV
Acenapthene	0.71[b1]	NV
Anthracene	0.3[b2]	NV
Benzo(a)anthracene	0.000031[a]	0.000031[a]
Benzo(a)pyrene	0.000031[a]	0.000031[a]
Benzo(b)fluoranthene	0.000031[a]	0.000031[a]
Benzo(g,h,i)perylene	0.3[b2]	NV
Benzo(k)fluoranthene	0.000031[a]	0.000031[a]
Bis(2-chloroethyl)ether	0.0014[a]	0.0014[a]
Bis(2-ethylhexyl)phthalate	0.0059[a]	0.0059[a]
Chrysene	0.000031[a]	0.000031[a]
Di-n-butylphthalate	12[a]	12[a]
Dibenzo(a,h)anthracene	0.000031[a]	0.000031[a]
Diethylephthalate	120[a]	120[a]
Fluoranthene	0.016[b1]	NV
Fluorene	0.3[b2]	NV
n-Nitrosdiphenylamine	0.016[a]	0.016[a]
Naphthalene	2.35[b2]	NV
Pentachlorophenol	0.0079[c1]	0.0079[c1]
Phenanthrene	0.0046[b1]	NV
Phenol	5.8[b2]	NV
Pyrene	0.3[b2]	NV
4,4-DDD	0.00000084[a]	0.00000084[a]
4,4-DDE	0.00000059[a]	0.00000059[a]
4,4-DDT	0.00000059[a]	0.00000059[a]
Aldrin	0.00000014[a]	0.00000014[a]
Alpha-BHC	0.000013[a]	0.000013[a]
Arochlor-1016	0.000000045[a]	0.000000064[a2]
Arochlor-1232	0.000000045[a]	0.000000064[a2]
Arochlor-1242	0.000000045[a]	0.000000064[a2]
Arochlor-1248	0.000000045[a]	0.000000064[a2]
Arochlor-1254	0.000000045[a]	0.000000064[a2]
Arochlor-1260	0.000000045[a]	0.000000064[a2]
Beta-BHC	0.000046[a]	0.000046[a]
Chlordane	0.00000059[a]	0.00000081[a2]
Delta-BHC	0.00034[b2]	NV
Dieldrin	0.00000014[a]	0.00000014[a]
Endosulfan I	0.0000087[b1]	0.0000087[b1]
Endosulfan II	0.0000087[b1]	0.0000087[b1]
Endosulfan Sulfate	0.002[a]	0.002[a]
Endrin	0.0000023[b1]	NC
Endrin aldehyde	0.00081[a]	0.00081[a]
Gamma-BHC (Lindane)	0.000063[a]	0.000063[a]
Heptachlor	0.00000021[a]	0.00000021[a]

Compound	ROD Chemical ARAR	Current Standards
Heptachlor epoxide	0.00000011[a]	0.00000011[a]
Methoxychlor	0.00003[b1]	0.00003[b3]
Antimony	0.5[b1]	0.64
Arsenic	0.00014[a]	NC
Cadmium	0.0093[c1]	NC
Chromium (VI)	0.05[c1]	NC
Copper	0.0024[b1]/0.0029[/c2]	0.0048[c2]
Cyanide	0.001[c1]	NC
Lead	0.0056/0.0085[b1]	0.0081
Mercury	0.000025[b1]	0.000025
Nickel	0.0079/0.0083[b1]	0.0082
Selenium	0.071[b1]	0.071
Silver	0.0023[b2]	0.0019
Thallium	0.0065[a]	0.00047[a2]
Zinc	0.076/0.086[c1]	0.081
Ammonia	0.035[c1]	*
Seep Soil ARARs	***mg/kg***	
Arsenic	22[d]	7
Sediment ARARs	***mg/kg dry weight***	
Arsenic	57[e] /93[f]	NC
4-methylphenol	670[e]/670[f]	NC
Fluoranthene	160[e] /1200[f]	NC
Pyrene	1000[e] /1400[f]	NC

a- Human Health Federal Fish Consumption Water Quality Criteria (40 CFR Part 131) ROD cited 1992/1995 edition, organism only
A2 – National Recommended Water Quality Criteria – Human Health Criteria Table, organism only
b1- Ecological Marine Ambient Water Quality Criteria (AWQC) (40 CFR Part 131) – chronic value
b2 - Ecological Marine Ambient Water Quality Criteria (AWQC) (40 CFR Part 131) – acute value
b3 – National Recommended Water Quality Criteria – Aquatic Life Criteria Table
c1- Washington State Water Quality Standards for Surface Waters (WAC 173-201A) – marine water chronic value
c2 - Washington State Marine (WAC 173-201A) – marine water acute value
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/Minimum 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 FYR or ROD
NV- No value listed
Note – AWQC for inorganics are the same for dissolved or total metals except where a slash is indicted otherwise. The first value is the dissolved criteria value.
**- the ARAR for 2,4-Dichlorophenol has always been 0.79. The ROD mistakenly listed 0.97 as the value for this compound. EPA will include a change in the Tulalip Landfill administrative record to address this typographic error in the ROD.

On September 1, 2013, the State of Washington Sediment Management Standards (SMS) (WAC 173-204) revisions will be effective. The four sediment chemical ARARs numerical values provided in Table 8 remain the same in the revised SMS rule.

Table 9 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 9: 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
	New	Snohomish County Shoreline Management Plan (SMP) Update approved addressing 2003 guidance requirements.	

Washington's Shoreline Management Act (SMA) was passed by the State Legislature in 1971. The 1996 ROD identified this State Law as a To Be Considered (TBC) condition. The goal of the SMA is "to prevent the inherent harm to the state's shorelines." Under the SMA, each city and county with shorelines must prepare and adopt a Shoreline Master Program (SMP). In 2003, a negotiated settlement agreement between Ecology and interested parties resulted in Guidance requirements adopted by Ecology to comprehensively update SMPs. On July 13, 2012, the Department of Ecology approved Snohomish County's SMP comprehensive update. This update significantly improves environmental protection and land use management provided by the County's previous SMP. The Tulalip Landfill is located nearest to the vicinity of Snohomish County.

The application of the County's updated SMP to land within the Tulalip Indian reservation is not subject to any law or court decision. EPA has not delegated administration of the Clean Water Act, the Clean Air Act or any other federal environmental program within any Indian reservation to the State of Washington (except under specific federal legislation pertaining to the Puyallup Reservation). However, Ecology urges local governments to work with Indian tribes to cooperatively coordinate applicable SMP regulations.

There are not changes in the conditions of the site since the construction completion that would affect the protectiveness of the remedy.

- Are there any Changes in Standards to be Considered?
  There have been no changes that would impact the remedy. Implementation of the remedy was based upon a presumptive remedy. The discharge (seeps) to the wetlands has been eliminated. In addition, the ROD specifically indicates that no groundwater monitoring for contamination is required.

- Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics?
  Land use, future land use, and exposure pathways have not changed since remedy selection and the last FYR. Toxicity factors have not changed since the remedy selection and the last FYR.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy? **NO.**

- Vandalism continues to be a slight problem at the Site and will be continue to be monitored. The resident llamas on the Site appear to have reduced the incidents of trespassing and vandalism.

Technical Assessment Summary

According to the data reviewed, the site inspection, the interview, and samples collected at the site, the landfill cap has been constructed and maintained as intended by the Final ROD, and adequate Institutional Controls have been implanted, are being monitored, and enforcement mechanisms are in place. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. There have been some changes in AWQC from the values selected as cleanup levels in the 1996 ROD but none that are significant enough to warrant changes to the cleanup levels or call into question the protectiveness of the remedy, and there have been no other changes in exposure assumptions standards or toxicity factors for the COCs that affect the protectiveness of the remedy. There is no other information that has come to light that affects the protectiveness of the remedy. The site has been exceptionally well maintained during the 2008-2013 FYR period.

VIII. Issues

As discussed in section V., all issues of significance identified in the 2008 FYR as potentially affecting protectiveness have been resolved such that no further follow-up is necessary and a protectiveness determination can be made in this FYR."

No issues were identified in this FYR which call into question the current or potential future protectiveness of the remedy. While not affecting protectiveness, in the course of this review EPA identified the following minor O&M-type issues which are listed here to ensure they receive adequate attention and follow-up:

Minor Issues Not Affecting Protectiveness

- A few burrowing animals have left minor tunnels in the bermed surface areas on the capped area.
- Invasive weeds continue to be a concern on the capped areas but they are kept under control through routine mowing.
- The rate of the landfill cap settlement has increased slightly over the last year.
- A few drainage pipe branches have no cleanout ports.
- Covenants and groundwater restrictions called for in the 1996 ROD are unnecessary; ICs are currently in place that accomplish the same goals.

IX. Recommendations and Follow-up Actions

No issues were identified in this FYR which call into question the current or potential future protectiveness of the remedy; therefore there are no recommendations or follow-up actions. While not affecting protectiveness, in the course of this review EPA identified minor O&M-type issues.

The following recommended actions address the minor issues identified in Section VII, none of which affect or are expected to affect protectiveness. Most of these actions will be addressed during routine maintenance activities.

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date
#1. Burrowing animals have left minor tunnels in the bermed surface areas on the capped area.	Inspections for burrowing animals need to be continued during the non-mowing season. As necessary, minor repairs need to be made to areas with tunnels or damage.	Tulalip Tribes	EPA	Ongoing
#2. Invasive weeds continue to be a concern on the capped areas.	Ongoing O&M activities need to be continued. Routine mowing has helped to control weeds and burrowing animals.	Tulalip Tribes	EPA	Ongoing
#3. The rate of the landfill cap settlement has increased slightly over the last year.	Continue landfill cap surveys annually. Also during periods of heavy rainfall, special inspections should be made on Panels A and S to review the performance of the landfill surface and to determine if any local ponding is occurring beyond what is normally seen on the site..	Tulalip Tribes	EPA	Ongoing
#4. A few drainage pipe branches have no cleanout ports.	The maintenance of the drainage pipes should be continued as necessary based on observations of the performance of the drainage systems.	Tulalip Tribes	EPA	Ongoing
#5. Covenants and groundwater restrictions called for in the 1996 ROD are unnecessary.	EPA needs to document a non-significant change to the remedy to clarify that the ICs implemented satisfy the RAOs and that the covenants and groundwater restrictions called for in the 1996 ROD are unnecessary.	EPA	EPA	Dec 2013

X. Protectiveness Statement(s)

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 groundwater with the completion of the cover system and the implementation, monitoring and enforcement of effective Institutional Controls. Because the remedial actions at all OUs are protective, the site is protective of human health and the environment.

XI. Next Review

The next FYR for the Tulalip Landfill Superfund Site is required by April 24, 2018, five years from the date of this review.

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Attachments

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Attachment 1
List of Documents Reviewed

- *Annual Site Review*, Arcadis G&M, Inc.
  2008 Report, January 27, 2009

- *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.

- *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 the Tulalip Tribes by PES Environmental, Inc.

2008: 1st Quarter, May 23. 2008
2nd Quarter, August 13, 2008
3rd Quarter, January 16, 2009
4th Quarter, January 30, 2009

2009: 1st Quarter, April 21, 2009
2nd Quarter, July 30, 2009
3rd Quarter, December 23, 2009
4th Quarter, January 28, 2009

2010: 1st Quarter, May 10, 2010
2nd Quarter, August 9, 2010
3rd Quarter, November 3, 2010
4th Quarter, February 8, 2010

2011: 1st Quarter, April 13, 2011
2nd Quarter, July 27, 2011
3rd Quarter, October 25, 2011
4th Quarter, December 21, 2011

2012: 1st Quarter, April 5, 2012
2nd Quarter, July 17, 2012
3rd Quarter, October 5, 2012
4th Quarter, January 4, 2013

- *Post Closure Care Routine Operation and Maintenance Inspection*, Prepared for the Tulalip Tribes by PES Environmental, Inc.

2008: 1st Quarter, May 23. 2008
2nd Quarter, August 5, 2008
3rd Quarter, January 16, 2009
4th Quarter, January 30, 2009

2009: 1st Quarter, April 21, 2009
2nd Quarter, July 30, 2009
3rd Quarter, December 23, 2009

4th Quarter, January 28, 2009

2010: 1st Quarter, May 10, 2010
2nd Quarter, August 10, 2010
3rd Quarter, November 3, 2010
4th Quarter, February 8, 2010

2011: 1st Quarter, April 13, 2011
2nd Quarter, July 27, 2011
3rd Quarter, October 25, 2011
4th Quarter, December 21, 2011

2012: 1st Quarter, April 2, 2012
2nd Quarter, July 17, 2012
3rd Quarter, October 5, 2012
4th Quarter, January 2, 2013

- *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.

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

- *Routine Use of Tulalip Landfill*, February 5, 2002, document prepared by the Tulalip Tribes

- *Tulalip Landfill Site (Big Flats): Analysis of Future Land Use* (also known at the Big Flats Land Use Program), Tulalip Landfill Remedial Investigation and Feasibility Study, July 10, 1994, prepared by the Tulalip Tribes of Washington.

- *Big Flats: Future Use Statement*, Memorandum, April 7, 1993 to the U.S. Environmental Protection Agency, from the Tulalip Tribes of Washington.

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Attachment 2
Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: Tulalip Landfill	**Date of inspection:** March 13, 2013
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:** Overcast, showers, slight wind, 53° 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 _____
_____

4. **Other interviews** (optional) ☐ Report attached. **N/A**

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; 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: *Health and Safety person on Tribal Staff should any safety issues arise at the Tulalip Landfill*

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 seep sampling to demonstrate compliance has been required on or off-source since 2002, pursuant to April 10, 2002, amendment to the Tulalip Field Sampling Plan. Sampling was conducted in June 2008, however, in response to recommendations in 2008 five-year review. Results of that seep sampling was provided by Contractor for Tulalip Tribes as part of quarterly and annual reports submitted to EPA.*

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. EPA empoloyees have access to landfill only when accompanied by Tribal members/employees.*

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. Tribal members maintain cover, and Tribal Contractors 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 **$183,410** ☐Breakdown attached

Total annual cost by year for review period if available

From	Jan/2008 To Dec/2008		$182,500	☐ Breakdown attached
	Date	Date	Total cost	
From	Jan/2009 To Dec/2009		$189,500	☐ Breakdown attached
	Date	Date	Total cost	
From	Jan/2010 To Dec/2010		$204,500	☐ Breakdown attached
	Date	Date	Total cost	
From	Jan/2011 To Dec/2011		$208,000	☐ Breakdown attached
	Date	Date	Total cost	
From	Jan/2012 To Dec/2012		$208,000	☐ Breakdown attached
	Date	Date	Total cost	

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: *In addition to the normal monitoring, inspection and maintenance costs for landfill, the Tribes have instituted road repairs and to poorly working landfill drainage lines.*

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 were in good working order and fencing intact during site inspection.*

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. Signage on entry fence had been painted over by vandals. Mr. Cleveland stated that a replacement sign will be installed this spring.*

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 Manager,*

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. On April 4, the Tulalip Tribal Board approved Directive #55, which provides language to enforce the signage required under the institutional controls. This new Directive will become Resolution #2013-168, and will be part of the Tulalip Tribes Regulations that apply to the Tulalip Landfill.

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: In the past, v*andalism has occurred at the site and people have typically stolen materials on-site that have monetary value (metal parts). However, because of the presence of the resident llamas on the site and the daily visits by the Tribal project manager for the landfill, only one episode of graffiti was reported in the last 5 year period, and only one attempted break in on site has occurred..*

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. Each year new gravel is being applied to a portion of the roads on the site, and the roads appear in very 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: *Burrowing animals occasionally dig holes in landfill. When holes are found, Tribal maintenance crew immediately fill holes with sand.*

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. Keeping the grass and weeds under control is a constant issue. Mr. Cleveland and Ms. Baker-Kircher discussed re-introducing goats (or possibly alpackas) to help maintain the grass cover and to help keep blackberries and Scot's Broom under control for more of the growing season.*

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 (usually within a day of a heavy rain). Seep monitoring locations were observed as shown on the as-builts*

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: _____

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 has requested 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. The landfill appeared to be in good condition with installed mechanisms in good working condition. Seeps were sampled in 2008, and results were consistent with historical seep sampling trends at the site. All detections reflect low concentrations of contaminants of concern.*
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 and llamas 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) Installation of clean-outs in drainage pipe branches that have none. This will ensure all drainage piping is kept free of debris/silt.*

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

Attachment 3
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

Figure 13. Resident llamas

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Attachment 4
Public Notice of Five Year Review

EPA United States Environmental Protection Agency

Comments Requested on Review of Environmental Cleanup of Tulalip Landfill, Marysville

The U.S. Environmental Protection Agency is preparing the third Five-Year Review of the Tulalip Landfill Site cleanup near Marysville, Washington. The review will make sure that the landfill cover continues to protect people and the environment.

You Can Help!

You may know things about the landfill that can help the review team decide if the site is still safe. If you have information about problems or have other comments to share about the landfill, please respond **by March 29, 2013.** Contact Denise Baker Kircher, EPA Project Manager, at baker.denise@epa.gov or at 800-424-4372, extension 4303 or 206-553-4303.

What Happens After the Review?

The EPA will prepare a report that includes background information about the site and cleanup, describes the review, and explains the results.

Where Can I Get More Information?

Find information about the Tulalip Landfill at:

Marysville Public Library
6120 Grove
Marysville, Washington
360-658-5000

EPA Superfund Records Center
1200 6th Avenue
Seattle, WA 98101
800-424-4372 for appointment

Information is also available on the EPA regional website at: http://go.usa.gov/2qf4

0001811667-01

TDD or TTY users please call the Federal Relay Service at 1-800-877-8339 and give the operator Denise Baker Kircher's phone number.

Bottle what founder

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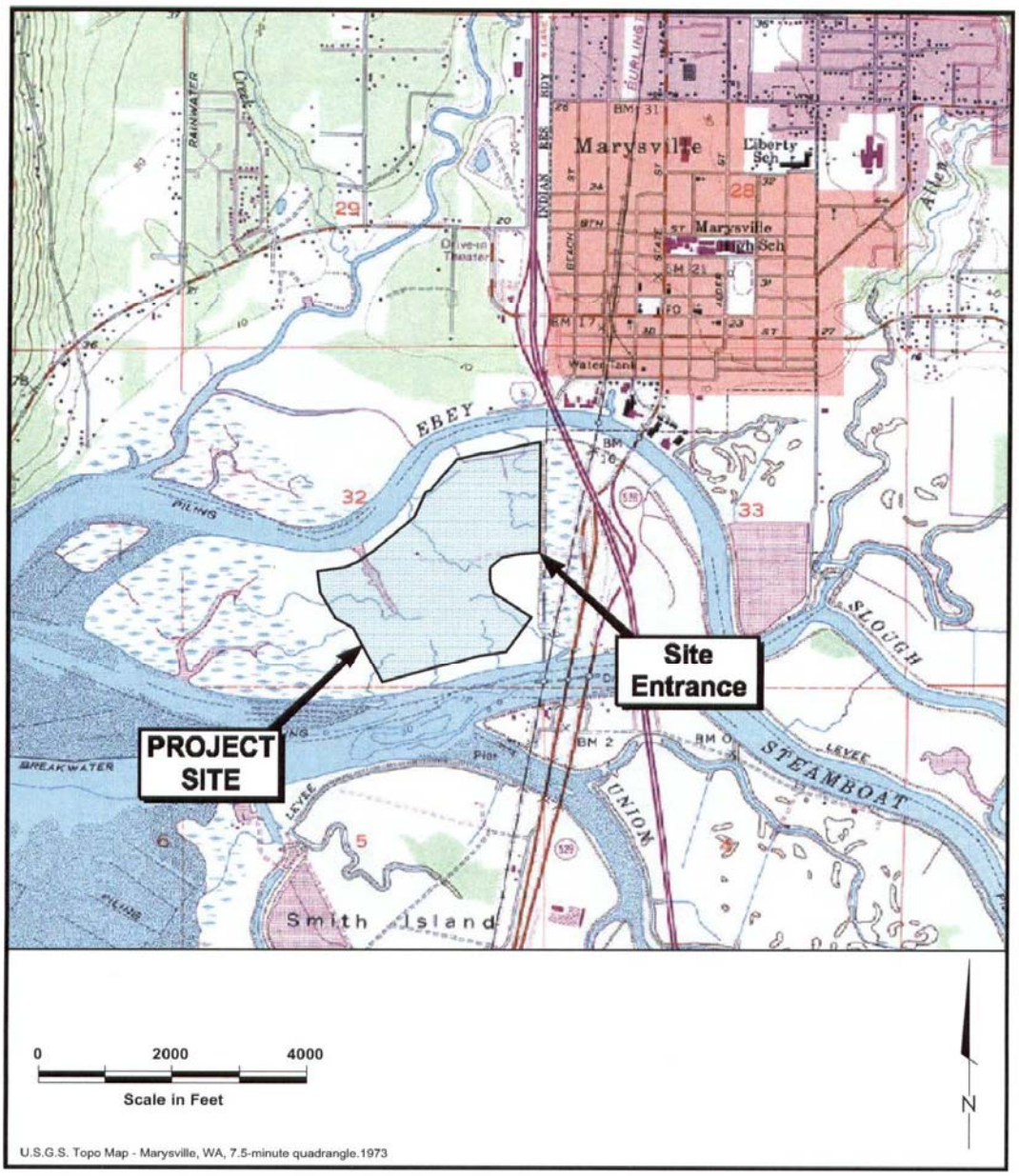
Figures

Figure #1: Site Location map



PES Environmental, Inc.
Engineering & Environmental Services

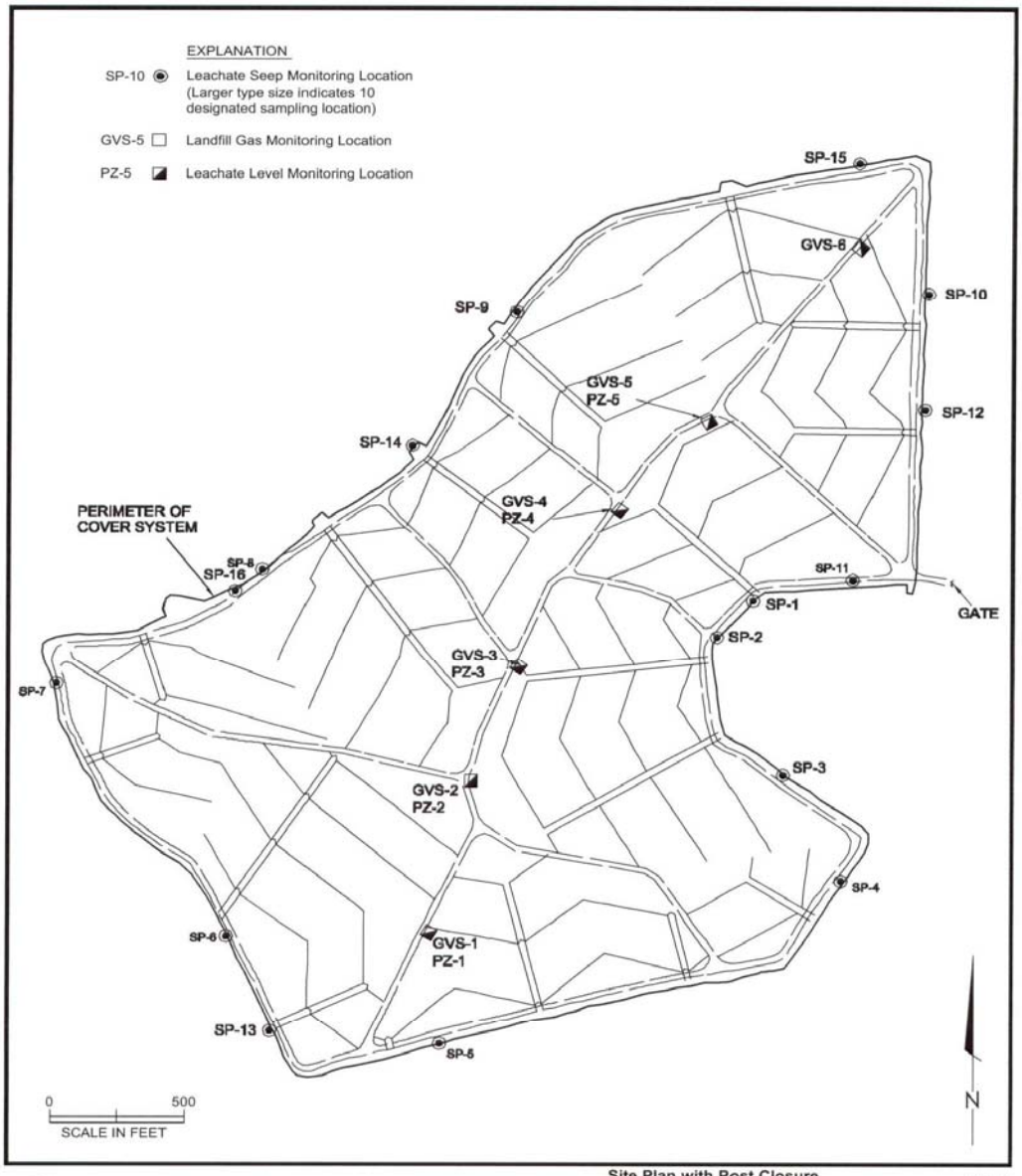
Site Location Map
Tulalip Landfill - Environmental Monitoring Plan
Post Closure Care
Marysville, Washington

FIGURE 1

JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE
826.005.01.002	82600501002_F-01		10/04

Figure #2: Aerial Photograph of the Site (Nov 2000)

Figure #3: Site Plan with Post Closure Monitoring Locations



PES Environmental, Inc.
Engineering & Environmental Services

Site Plan with Post Closure Monitoring Locations
Tulalip Landfill - Environmental Monitoring Plan
Post Closure Care
Marysville, Washington

FIGURE 2

JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE
826.005.01.002	82600501002_F-01		10/04

Figure #4: Historical Leachate Elevations

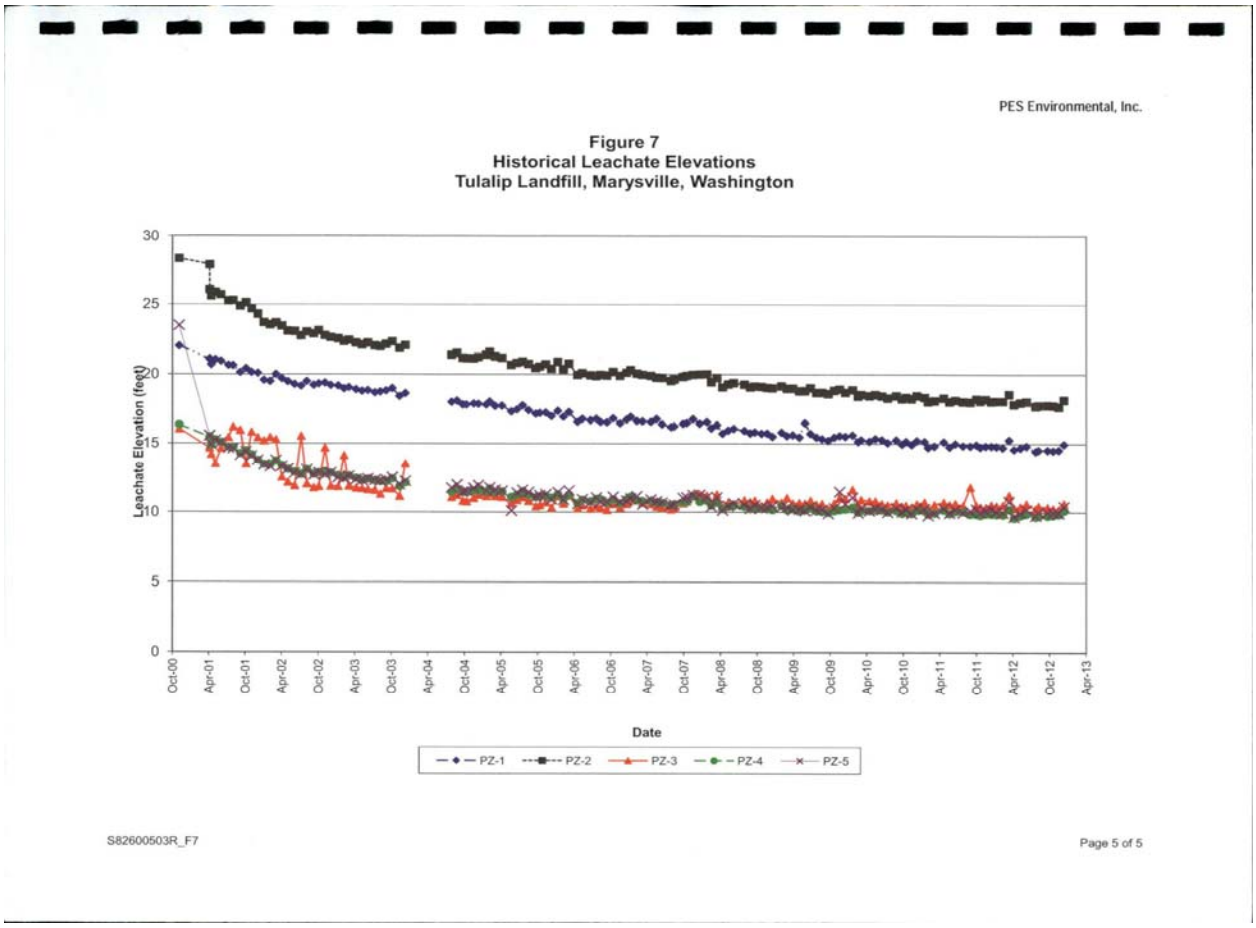
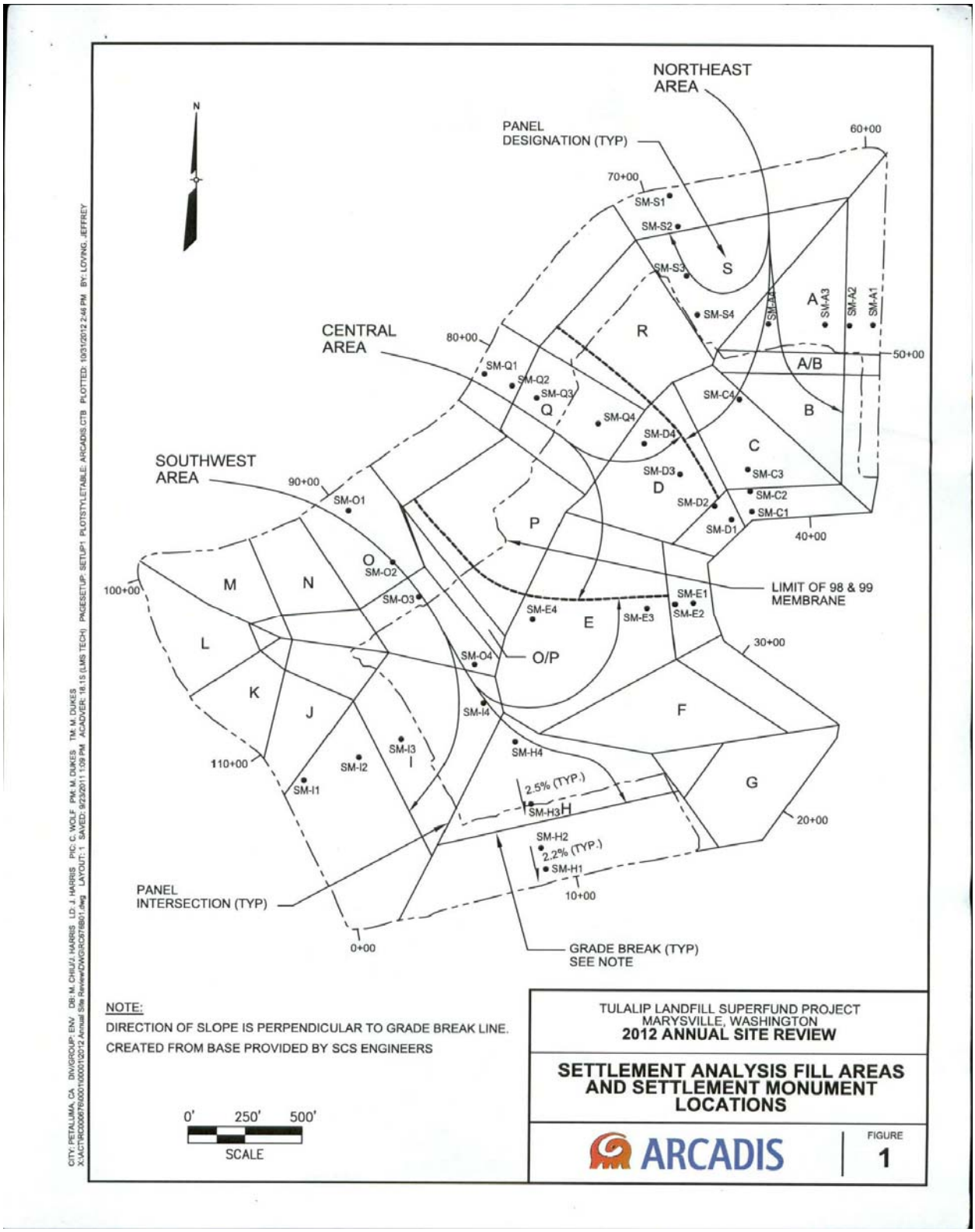



Figure #5: Settlement Analysis Fill Areas and Settlement Monument Locations