CLEANUP ACTION PLAN

OLYMPIC VIEW SANITARY LANDFILL

KITSAP COUNTY, WASHINGTON

ECOLOGY FACILITY SITE IDENTIFICATION NUMBER: 79649975

December 2010

DECLARATIVE STATEMENT

Consistent with the Model Toxics Control Act, Chapter 70.105D RCW, as implemented by the Model Toxics Control Act Cleanup Regulation, Chapter 173-340 WAC, it is determined that the selected cleanup actions are protective of human health and the environment, attain federal and state requirements that are applicable or relevant and appropriate, comply with cleanup standards, provide for compliance monitoring, use permanent solutions to the maximum extent practicable, provide for a reasonable restoration time-frame, and consider public concerns raised during public comment.

Madeline Wall — September 28, 2010

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Date

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ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirements
BKCHD	Bremerton-Kitsap County Health District
CAP	Cleanup Action Plan
CFR	Code of Federal Regulation
DNS	Determination of Non Significance
Ecology	Washington Department of Ecology
EMP	Environmental Monitoring Plan
EMSI	Engineering Management Support, Inc.
ERA	Ecological Risk Assessment
FS	Feasibility Study
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
IRIS	Integrated Risk Information System
KCHD	Kitsap County Health District
KCSL	Kitsap County Sanitary Landfill
MFS	Minimum Functional Standards
mg/L	Milligrams per liter
MTCA	Model Toxics Control Act
NPDES	National Pollutant Discharge Elimination System
OBWL	Old Barney White Landfill
O&M	Operation and maintenance
OVSL	Olympic View Sanitary Landfill
POC	Point of Compliance

RCW	Revised Code of Washington
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SAP	Sampling and Analysis Plan
SEPA	State Environmental Policy Act
U.S. EPA	United States Environmental Protection Agency
µg/L	Microgram per liter
WAC	Washington Administrative Code

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1 INTRODUCTION

This Cleanup Action Plan (CAP) describes the cleanup action to be conducted by the Department of Ecology (Ecology) to address contamination at the Olympic View Sanitary Landfill (OVSL), located in the southern portion of the Kitsap Peninsula, southwest of Bremerton, Washington (Figure 1). This CAP was developed using information presented in the Draft Final Remedial Investigation (RI) Report (Parametrix, 2007) and the Feasibility Study (FS) (EMSI, 2010), submitted by Olympic View Sanitary Landfill, Inc. This document was prepared to satisfy the requirements of the Model Toxics Control Act (MTCA), Chapter 70.105D Revised Code of Washington (RCW), administered by Ecology under the MTCA Cleanup Regulation, Chapter 173-340 Washington Administrative Code (WAC).

A State Environmental Policy Act (SEPA) checklist was completed per the requirements of the MTCA regulations and Chapter 197-11 WAC, the SEPA regulations. The Department of Ecology, the lead agency for the OVSL Cleanup, issued a Determination of Non-Significance (DNS) for the actions selected in this CAP. The completed SEPA checklist and DNS are provided in Appendix A.

2 Site Background

This chapter provides a summary of the physical Site, history of operation, nature and extent of contamination, and the findings of human health and ecological risk assessments.

2.1 Site Description and History

The OVSL Site is located at 10015 SW Barney White Road, Port Orchard, Washington in the Olympic View Industrial Park Complex. The Site, including the landfill, is located in the northeast quarter of Section 10, Township 23 North, Range 1 West. The Site consists of 436 acres of which 65 acres were used as a solid waste landfill. The landfill consists of three adjoining areas (Figure 2):

- The Old Barney White Landfill (OBWL) consists of approximately 20 acres and lies in the southwestern portion of the facility.

- The Phase I Landfill area, located adjacent to the east side of OBWL, consists of:
  - Phase I Stage A has a bottom liner, but was not constructed to meet bottom liner requirements of chapter 173-304 WAC, the Minimum Function Standards for Solid Waste Handling, because the area was already constructed and filled before these requirements were established.
  - Phase I Stage B and Phase I Stage C were designed and constructed with a bottom liner system that met the requirements of WAC 173-304-460.

- The Phase II Landfill area, located adjacent to the north side of Phase I, includes a bottom liner system designed and constructed to meet the requirements of Chapter 173-351 WAC, Criteria for Municipal Solid Waste Landfills.

Concurrent with the closure of the disposal areas at the Landfill in 2002, Waste Management constructed a solid waste transfer station near the Landfill to allow for continued service for south county residents. Table 1 summarizes the history of development and operation of the landfill and describes current land uses at and around the site.

Existing source control and containment systems include:

- Impermeable cap over the Phase I and II landfill cells and OBWL to reduce precipitation infiltration and resulting leachate generation

- Stormwater runoff diversion and control structures to reduce precipitation infiltration and leachate generation

- Impermeable liner beneath Phases I and II to contain leachate

- Leachate collection system from the Phase I and II landfill cells

- OBWL toe drain leachate collection system

- Leachate treatment and disposal systems

- Landfill gas extraction and treatment system for Phase I, II, and OBWL.

2.2 Nature and Extent of Contamination

Groundwater downgradient of the landfill contains volatile organic compounds, trace metals, and general water quality parameters at concentrations above state standards or risk-based levels. The extent of groundwater contamination is primarily coincident with areas located immediately downgradient of the landfill within the property boundary.

As part of the RI, private wells in the area surrounding the landfill property were identified and many were sampled. Results of the sampling provide strong evidence that no domestic wells are impacted by the site (Parametrix, 2007).

Components of landfill gas such as methane and carbon dioxide have historically been detected in monitoring probes located outside of the landfill area, but methane gas has not been detected beyond the facility property boundary. None of the probes currently monitored have levels of landfill gas components in excess of regulatory standards.

Contaminants were not detected in surface water samples obtained from the facility. The chemical concentrations and water quality of the surface waters receiving runoff or groundwater discharge from the landfill area are very similar to those observed in background (non-receiving) waters.

2.3 Risk Assessments

As part of the remedial investigation and feasibility study (RI/FS), assessments were conducted of potential impacts to human health and the environment in the vicinity of the landfill. The Human Health Risk Assessment (HHRA) (AMEC/Geomatrix, 2008) indicates that potential risks to off-site recreational users and off-site residents were either within or below the risk range considered acceptable by U.S. EPA. The primary risk-driving exposure pathway and chemical is ingestion of arsenic in groundwater; however, the levels of arsenic in the deeper groundwater were either at or below the drinking water standard and thus the potential health risks associated with arsenic in the groundwater would be equivalent to a municipal drinking water supply containing an allowable level of arsenic. In addition, the concentrations of arsenic measured in the on-site monitoring wells were generally lower than the concentrations measured in the off-site domestic wells. This suggests that the potential health risks associated with arsenic in groundwater beneath and downgradient of the site are equal to or less than risks from natural occurrences of arsenic in nearby domestic wells.

The Ecological Risk Assessment (ERA) (Arcadis BBL, 2009) identified potential source areas of hazardous substances, indicator hazardous substances, potential exposure pathways, and ecological receptors, and evaluated the potential exposures. The results indicated that the site-related chemicals in the shallow emergent groundwater pose a negligible risk of adverse effects to ecological receptors in the aquatic and terrestrial habitat downgradient of the site. No complete exposure pathways to potentially contaminated subsurface soil were identified. The ERA satisfies the requirements of WAC 173-340-7490 through 7494 for terrestrial ecological evaluations.

3 Cleanup Requirements

The Model Toxics Control Act Cleanup Regulation, Chapter 173-340 WAC, describes the manner in which cleanup actions are to be selected. This section discusses the regulatory considerations that are most pertinent[1] to the OVSL Site and specifies performance standards that the cleanup must meet.

3.1 Ecology Expectations for Cleanup Actions

Ecology has certain expectations for the types of cleanup actions selected for cleanup sites, as laid out in WAC 173-340-370. Those most pertinent to the OVSL Site are discussed below.

Ecology expects that treatment technologies will be emphasized at sites containing liquid wastes, areas contaminated with high concentrations of hazardous substances, highly mobile materials, and/or discrete areas of hazardous substances that lend themselves to treatment. WAC 173-340-370(1). At the OVSL Site, liquid leachate is present in the landfill. Leachate collection, treatment, and offsite disposal are currently used and are expected to be used in the future to address this liquid waste.

Ecology recognizes the need to use engineering controls, such as containment, for sites or portions of sites that contain large volumes of materials with relatively low levels of hazardous substances where treatment is impracticable. WAC 173-340-370(3). At the OVSL Site, large volumes of solid waste are present in engineered disposal cells. The disposal cells are expected to be maintained in the future to contain the solid waste.

Ecology expects that, in order to minimize the potential for migration of hazardous substances, active measures will be taken to prevent precipitation and subsequent runoff from coming into contact with contaminated soils and waste materials. WAC 173-340-370(4). At the OVSL Site, precipitation and runoff are prevented from contacting waste material by the presence of engineered impermeable cover systems. The cover systems are expected to remain in place and be maintained in the future to prevent stormwater contact with waste.

Ecology expects that, for a facility adjacent to a surface water body, active measures will be taken to prevent/minimize releases to surface water via surface runoff and groundwater discharges in excess of cleanup levels. The OVSL Site is adjacent to the Union River, its tributaries, and wetlands. Ecology expects monitoring will be conducted to ensure groundwater discharging to surface water does not exceed cleanup levels and that active measures will be taken if needed.

Ecology expects that natural attenuation of hazardous substances may be appropriate at sites where: (a) Source control (including removal and/or treatment of hazardous substances) has been conducted to the maximum extent practicable; (b) Leaving contaminants on-site during the restoration time frame does not pose an unacceptable threat to human health or the

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[1] Cleanup actions at the OVSL Site must meet all regulatory requirements whether discussed herein or not.

environment; (c) There is evidence that natural biodegradation or chemical degradation is occurring and will continue to occur at a reasonable rate at the site; and (d) Appropriate monitoring requirements are conducted to ensure that the natural attenuation process is taking place and that human health and the environment are protected. WAC 173-340-370(7). At the OVSL Site, Ecology expects that active measures will continue to be taken to prevent leachate and landfill gas from migrating out of the landfill and that groundwater and soil gas will be monitored to ensure levels of contaminants in groundwater remain low and continue to decline and that measurements of soil gas constituents indicate landfill gas is controlled.

3.2 Minimum Requirements for Cleanup Actions

The MTCA Cleanup Regulation specifies minimum requirements for cleanup actions. WAC 173-340-360(2). All cleanup actions must meet these requirements. Those most pertinent to the OVSL Site are discussed below. In considering how best to use agency discretion and best professional judgment in implementing minimum cleanup requirements at specific sites, Ecology gives careful consideration to the regulatory expectations summarized in the preceding section.

The minimum regulatory requirements that every cleanup action must meet are:

- Protect human health and the environment – Cleanup actions that achieve cleanup levels at the applicable point of compliance under Methods A, B, or C (as applicable) and comply with applicable laws are presumed to be protective of human health and the environment. WAC 173-340-702(5). Cleanup action alternatives that provide for the containment of soils must be demonstrated to be protective of human health and the environment through either qualitative or quantitative risk assessments.

- Comply with cleanup standards and applicable state and federal laws[2] – Cleanup standards are those standards adopted under RCW 70.105D.030(2)(e)[3] and Chapter 173-340 WAC. Establishing cleanup standards requires specification of hazardous substance concentrations that protect human health and the environment ("cleanup levels"), the location on the site where those cleanup levels must be attained ("points of compliance"), and additional regulatory requirements that apply to a cleanup action because of the type of action and/or the location of the site. WAC 173-340-200. These requirements are specified in the selection of a specific cleanup action. Cleanup standards for the OVSL Site are discussed in Sections 3.3 through 3.5. They include cleanup levels and their respective points of compliance, and applicable and relevant and appropriate requirements of state and federal laws.

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[2] "Applicable state and federal laws" means all legally applicable requirements and those requirements that Ecology determines, based on the criteria in WAC 173-340-710(4), are relevant and appropriate requirements. WAC 173-340-200.

[3] Note that WAC 173-340-200 incorrectly references RCW 70.105D.030(2)(d) on this point.

- Provide for compliance monitoring – Each cleanup action must include plans for compliance monitoring to ensure human health and the environment are protected during construction, operation, and maintenance activities; to confirm that the actions have attained cleanup standards, remediation levels, and other performance standards; and to confirm the long-term effectiveness of the action once cleanup standards, remediation levels, and other performance standards have been attained. WAC 173-340-410(1).

There are several other requirements that cleanup actions must meet. Those most pertinent to the OVSL Site are:

- Treatment or removal of the source of the release shall be conducted for liquid wastes, areas contaminated with high concentrations of hazardous substances, highly mobile hazardous substances, or hazardous substances that cannot be reliably contained. This includes removal of free product consisting of petroleum and other light nonaqueous phase liquid (LNAPL) from the groundwater using normally accepted engineering practices. WAC 173-340-360(2)(c)(ii)(A).

- Groundwater containment, including barriers or hydraulic control through groundwater pumping, or both, shall be implemented to the maximum extent practicable to avoid lateral and vertical expansion of the groundwater volume affected by the hazardous substance. WAC 173-360(2)(c)(ii)(B).

- Provide for a reasonable restoration time frame. WAC 173-340-360(2)(b)(ii).

- Consider public concerns. WAC 173-340-360(c)(b)(iii).

- Use permanent solutions to the maximum extent practicable. WAC 173-340-360(2)(b)(i).

Ecology carefully considered these minimum requirements when selecting the cleanup action for the OVSL Site from among the alternatives, technologies, and information presented in the Feasibility Study (EMSI, 2010). The manner in which these regulatory requirements were considered is discussed in Chapter 5.

3.3 Groundwater Conditional Point of Compliance

The point of compliance for groundwater is the point or points where the established groundwater cleanup levels must be attained for a site to be in compliance with the cleanup standards. The standard groundwater point of compliance for a site cleanup is throughout the site from the uppermost level of the saturated zone extending vertically to the lowest most depth which could potentially be affected by the site. WAC 173-340-720(8)(b).

Where it can be demonstrated under WAC 173-340-350 through 173-340-390 that it is not practicable to meet the cleanup level throughout the site within a reasonable restoration time frame, Ecology may approve a conditional point of compliance. Where a conditional point of compliance is proposed, the person responsible for undertaking the cleanup action shall demonstrate that all practicable methods of treatment are to be used in the site cleanup. WAC 173-340-720(8)(c).

Ecology is approving use of a conditional point of compliance at the OVSL Site pursuant to WAC 173-340-720(8)(c). Ecology carefully considered the regulatory requirements when approving this conditional point of compliance for the OVSL Site. The following points were considered:

- To monitor groundwater quality throughout the site, monitoring wells would need to be installed beneath the landfill. Installing groundwater monitoring wells through the landfill is not practicable; doing so would compromise the integrity of the cover and liner systems, creating direct pathways for leachate migration to groundwater.

- When landfill waste remains in place, cleanup levels may not be met within a reasonable restoration time frame in groundwater beneath the landfill and immediately adjacent to the landfill.

- The cleanup action selected for the Site uses all practicable methods of treatment, including the collection and treatment of leachate and landfill gas and a contingency plan to implement additional methods of treatment if the selected cleanup action fails to result in cleanup levels being met within a reasonable time period.

The conditional point of compliance is established at 150 meters (492 feet) downgradient of the edge of the landfill. As shown on Figure 3, the conditional point of compliance is monitored by groundwater monitoring wells MW-15R, MW-34A, MW-34C, MW-39, MW-42, and MW-43.

3.4 Groundwater Cleanup Levels

Ecology established groundwater cleanup levels for the ten indicator hazardous substances identified in the OVSL RI and FS reports: arsenic, iron, manganese, 1,4-dichlorobenzene, 1,1-dichloroethane, cis-1,2-dichloroethene, ethyl ether, trichloroethene, vinyl chloride, and ammonia. This section describes the method used to establish cleanup levels for the OVSL Site.

Ecology used standard Method B to establish cleanup levels for the OVSL Site. Method B may be used to establish cleanup levels for potable groundwater at any site. WAC 173-340-720(4)(a). Under Method B, the cleanup level is based on the most stringent of:

- Applicable state and federal laws – The cleanup level must be at least as stringent as the most stringent concentration established under applicable state and federal laws.

- Human health protection – The cleanup level must be at least as stringent as the concentrations that protect human health. For hazardous substances for which sufficiently protective, health-based concentrations have been established under applicable state and federal laws, the most stringent of those concentrations is used. A concentration established under applicable state and federal laws is sufficiently protective if the excess cancer risk does not exceed 1 in 100,000 (1×10^{-5}) and the hazard quotient (HQ) does not exceed one (1). If the concentration is not sufficiently protective, then either the concentration must be adjusted downward in accordance with WAC 173-340-720(7)(b) or a protective concentration must be calculated using the equations provided in the regulation.

For hazardous substances for which health-based concentrations have not been established under applicable state and federal laws, a protective concentration must be calculated using the equations provided in the regulation.

- Protection of surface water beneficial uses – Unless it can be demonstrated that the hazardous substances are not likely to reach surface water, the groundwater cleanup levels must be at least as stringent as the surface water cleanup levels established in accordance with WAC 173-340-730.

3.4.1 Applicable State and Federal Laws

Applicable state and federal laws for potable groundwater are the federal and state maximum contaminant levels (MCLs). As shown in Table 2, MCLs have been established for seven of the ten site indicator hazardous substances.

3.4.2 Human Health Protection

Method B-calculated concentrations for the indicator hazardous substances for non-carcinogenic and carcinogenic effects were obtained from the Cleanup Levels and Risk Calculations (CLARC) database. These concentrations are calculated using the equations provided in WAC 173-340-720(4)(b)(iii) – Equation 720-1 for non-carcinogens and Equation 720-2 for carcinogens. See Table 2.

3.4.3 Protection of Surface Water Beneficial Uses

3.4.3.1 Applicable state and federal laws [WAC 173-340-730(3)(b)(i)]

Ecology reviewed applicable state and federal laws for concentrations of site indicator hazardous substances established to protect surface waters. These included:

- Water quality criteria published in the water quality standards for surface waters of the state of Washington, chapter 173-201A WAC
- Water quality criteria based on the protection of aquatic organisms (acute and chronic criteria) and human health published under section 304 of the Clean Water Act unless it can be demonstrated that such criteria are not relevant and appropriate for a specific surface water body or hazardous substance
- National Toxics Rule, Chapter 40 of the Code of Federal Regulations (CFR) Part 131

Chapter 173-201A WAC lists water quality criteria for two of the indicator hazardous substances – arsenic and ammonia.

EPA's National Recommended Water Quality Criteria, published under section 304 of the Clean Water Act, includes criteria for trichloroethene, vinyl chloride, arsenic, iron, and manganese.

Toxics criteria are established under 40 CFR Part 131 for arsenic, trichloroethene, and vinyl chloride.

3.4.3.2 Environmental effects [WAC 173-340-730(3)(b)(ii)]

Ecology considered the indicator hazardous substances for which environmental effects-based concentrations have not been established under applicable state or federal laws. Environmental effects-based concentrations have not been established for cis-1,2-dichloroethene or ethyl ether.

An Ecological Risk Assessment was conducted for the OVSL Site (Arcadis, 2007). In the assessment, data from thirteen shallow groundwater monitoring wells were used to represent the emergent groundwater in the wetland complex, shallow streams, and Union River adjacent to and downgradient of the site. A muskrat was selected for the purpose of assessing potential impacts to an ecological receptor that may have high potential for exposure to indicator hazardous substances in the shallow groundwater that may discharge to the wetland habitats. The resulting HQs were summed to obtain a hazard index (HI) of 0.009. An HI of less than 1.0 indicates that the exposures evaluated pose a negligible risk of adverse effects to the receptor species.

Ecology did not require whole effluent toxicity testing using the protocols described in chapter 173-205 WAC to make this demonstration for fish and aquatic life because HIs calculated using exposure point concentrations of the drinking water MCL (70 µg/L) for cis-1,2-dichloroethene and the Method B groundwater standard (1,600 µg/L) for ethyl ether were still well below 1.0. For this reason, for cis-1,2-dichloroethene and ethyl ether, cleanup levels based on groundwater standards are considered to be protective of surface water at the OVSL site.

3.4.3.3 Human health protection [WAC 173-340-730(3)(b)(iii)]

Ecology considered the hazardous substances for which sufficiently protective health-based surface water criteria or standards have not been established under applicable state and federal laws. No such criteria or standards have been established for ammonia, cis-1,2-dichloroethene, and ethyl either. When criteria or standards have not been established, they are to be determined using equations provided in WAC 173-340-730(3)(b)(iii) – Equation 730-1 (for noncarcinogens) and Equation 730-2 (for carcinogens). Equation 730-1 requires a reference dose (RfD) for the hazardous substance. Equation 730-2 requires a carcinogenic potency factor for the hazardous substance. Both equations require a bioconcentration factor for the hazardous substance.

Ammonia: According to the U.S. Environmental Protection Agency (EPA) Integrated Risk Information System (IRIS) database, no oral reference dose or carcinogenic potency factor have been established at this time.

Cis-1,2-dichloroethene: According to EPA's IRIS database, no oral reference dose or carcinogenic potency factor have been established at this time. The weight of evidence classification for human carcinogenicity is "D; not classifiable as to human carcinogenicity".

Ethyl ether: According to the EPA's IRIS database, no carcinogenic potency factor has been established at this time. An oral reference dose of 1×10^{-1} mg/kg-day has been established.

No bioconcentration factors were established by EPA for ammonia, cis-1,2-dichloroethene, or ethyl ether. According to the Ecological Risk Assessment for the OVSL Site (Arcadis, 2007), none of the indicator hazardous substances identified in the shallow groundwater are considered to biomagnify through the food web, as indicated by low log octanol-water partitioning coefficients.

Cleanup levels cannot be calculated for ammonia, cis-1,2-dichloroethene, and ethyl ether by using Equations 730-1 and 730-2 because of unavailable reference doses, bioconcentration factors, and carcinogenic potency factors. Therefore, standards will be established based on existing groundwater protection standards or on concentrations detected in background monitoring wells.

3.4.4 Cleanup Levels Established

3.4.4.1 Preliminary Cleanup Levels

Preliminary cleanup levels for the indicator hazardous substances were selected from the criteria and standards listed in Table 2. The most stringent standard or criterion was selected for iron, manganese, 1,2-dichloroethane, cis-1,2-dichloroethene, and ethyl ether. The background concentration level was selected for arsenic and ammonia because background concentrations were higher than the most stringent standard or criterion.

The preliminary cleanup level for 1,4-dichlorobenzene was selected based on adjusting the MCL downward to a concentration representing a 1×10^{-5} excess cancer risk, in accordance with WAC 173-340-720(7)(b).

For trichloroethylene, the preliminary cleanup level selected is the value associated with a HQ of 1 for noncarcinogenic effects. This value is lower than the MCL adjusted downward to 1×10^{-5} excess cancer risk in accordance with WAC 173-340-720(7)(b).

The preliminary cleanup level for vinyl chloride was selected based on adjusting the MCL downward to a concentration representing a 1×10^{-5} excess cancer risk, in accordance with WAC 173-340-720(7)(b). The lower value from the National Recommended Water Quality Criteria for human health ingestion of water and organisms is not applicable because Washington State has established drinking water criteria for vinyl chloride.

3.4.4.2 Adjustments for Total Site Risk

Cleanup levels must be adjusted downward to take into account exposure to multiple hazardous substances if, without these adjustments, the HI would exceed one (1), or the total excess cancer risk would exceed one in one hundred thousand (1×10^{-5}). WAC 173-340-720(7)(a).

For each indicator hazardous substance with non-carcinogenic effects, the hazard quotient (HQ) associated with its preliminary cleanup level was calculated. The HI (the sum of the HQs) for the preliminary cleanup levels was found to exceed 1, as shown in Column F on Table 3.

For each carcinogenic indicator hazardous substance, the excess cancer risk associated with its preliminary cleanup level was calculated. The sum of the individual excess cancer risks for the preliminary cleanup levels was found to exceed 1×10^{-5}, as shown in Column C on Table 3.

The adjustment of the preliminary cleanup levels for total site risk is shown in Table 3. For hazardous substances with non-carcinogenic effects, the type of toxic response was considered before adjusting the preliminary cleanup levels. As shown on Table 4, several of the substances have similar toxic responses; therefore, the hazardous substances were not separated by toxic response when making the adjustments.

The preliminary cleanup levels were individually adjusted such that the total excess cancer risk does not exceed 1×10^{-5} and the HI does not exceed 1. The cleanup levels for each indicator hazardous substance are shown in Column I on Table 3.

If the selected remedy reduces individual hazardous substance concentrations in a manner not anticipated by Ecology when adjusting the preliminary cleanup levels, Ecology may amend the Agreed Order and Cleanup Action Plan to change individual cleanup levels by apportioning the risk differently, as long as the total excess cancer risk does not exceed 1×10^{-5}, the HI does not exceed 1, and the changes conform to the risk limits for individual hazardous substances and applicable state and federal laws.

3.5 Applicable Local, State, and Federal Laws

Cleanup actions must comply with applicable local, state and federal laws. WAC 173-340-360(2)(a)(iii); WAC 173-340-710; RCW 70.105D.090. In certain cases, obtaining a permit is required. In other cases, the cleanup action must comply with the substantive requirements of the law, but are exempt from the procedural requirements of the law. RCW 70.105D.090; WAC 173-340-710(9).

Persons conducting remedial actions have a continuing obligation to determine whether additional permits or approvals are required, or whether substantive requirements for permits or approvals must be met. In the event that either OVSL, Inc. or Ecology becomes aware of additional permits or approvals or substantive requirements that apply to the remedial action, they shall promptly notify the other party of this knowledge. WAC 173-340-710(9)(e).

No new permits or substantive requirements of permits or approvals have been identified for the cleanup actions at the Site.

3.6 Comparison of 2009 Groundwater Quality Monitoring Results to Cleanup Standards

As described in the Remedial Investigation and Feasibility Study Reports, groundwater at the Site has been monitored on a quarterly basis since the 1980s. The current monitoring network consists of 22 wells. Of these, four monitor upgradient groundwater, six are at the edge of the landfill and monitor the performance of the landfill containment systems, six are along the conditional point of compliance, and six are downgradient of the conditional point of compliance within the property boundary. The environmental monitoring program is described in the Environmental Monitoring Plan (EMSI, 2009).

Ecology compared the 2009 groundwater monitoring results for the indicator hazardous substances, as reported in the 2009 Annual Monitoring Report (SCS, 2010), with the cleanup levels listed in Table 3. Cleanup levels for vinyl chloride, ammonia, arsenic, iron, and manganese were exceeded in groundwater samples at or downgradient of the conditional point of compliance during 2009.

3.6.1.1 Vinyl Chloride

Of the volatile organic compounds on the IHS list, only the cleanup level for vinyl chloride was exceeded. The cleanup level for vinyl chloride is 0.2 µg/L. Two wells had detections above this level:

- MW-34C, all quarters of 2009, 0.25 to 0.36 µg/L
- MW-32, all quarters of 2009, 0.24 to 0.41 µg/L

3.6.1.2 Ammonia

The cleanup level for ammonia is 0.19 mg/L. Four wells had detections above this level, ranging from 0.21 to 9.9 mg/L.

3.6.1.3 Arsenic

The cleanup level for arsenic is 0.000462 mg/L. Six wells had detections above the cleanup level, ranging from 0.00078 to 0.0101 mg/L.

3.6.1.4 Iron

The cleanup level for iron is 0.3 mg/L. Eight wells had detections above the cleanup level. In six of the eight well, concentrations exceeding the cleanup level ranged from 0.71 to 4.5 mg/L. In the other two wells, the exceedances ranged from 22 to 44 mg/L.

3.6.1.5 Manganese

The cleanup level for manganese is 0.05 mg/L. Seven wells had detections above the cleanup level, ranging from 0.13 to 5.6 mg/L.

4 Site Remedy

Alternative 2, Landfill Gas Collection System Upgrades, is the selected cleanup action alternative. The alternative is described in the Feasibility Study (EMSI, 2010). The cleanup action includes:

- Continued performance of landfill post-closure care activities
- Increased inspection, repair, and operational improvements to leachate, gas, and stormwater management systems
- Installation of additional landfill gas collection wells
- Monitored natural attenuation
- Continued implementation of the Environmental Monitoring Plan
- Institutional controls

4.1 Closure Care Activities

Post-closure care includes continued operation and maintenance of the existing landfill source control and containment systems and environmental monitoring programs carried out in compliance with requirements of state and local regulations for landfill post-closure (Chapter 173-351 WAC and Kitsap County Health District (KCHD) Ordinance 2004-2). Specific post-closure activities and requirements are detailed in the OVSL Post-Closure Maintenance Plan (GeoSyntec, 2002) and Solid Waste Landfill Post Closure Permit for the Olympic View Sanitary Landfill (KCHD, 2010). The ongoing operations, maintenance, and monitoring activities include:

- Inspection and maintenance of the landfill cover
- Control of weeds and intrusive vegetation to eliminate the potential for root penetration into and resultant damage to the cover
- Inspection and maintenance of stormwater runoff and control structures
- Extraction and collection of leachate from the collection system associated with the Phase I and II landfills and from the OBWL toe drain system
- Storage and treatment of collected leachate in the double-lined leachate collection pond
- Disposal of leachate through a publicly-owned treatment works pursuant to the terms of State Waste Discharge Permit No. 7271
- Inspection, maintenance, and repair of the leachate collection system pumps, piping, transfer and truck load-out pumps and the leachate pond liner and cover
- Inspection, operation and maintenance of the landfill gas vacuum blowers, landfill gas extraction wells, and lateral and header piping to extract and collect landfill gas from the Phase I and II cells and from OBWL
- Destruction of the landfill gas in the landfill gas flare pursuant to the conditions of Order of Approval No. 6954, issued by Puget Sound Clean Air Agency

- Operation of the landfill gas condensate traps to collect condensate and disposal of the condensate in conjunction with leachate disposal
- Inspection and maintenance of the perimeter fencing to limit trespass potential
- Inspection and maintenance of existing berms and, if necessary, construction of additional berms across roads or trails to limit trespass potential
- Inspection, repair and maintenance of the environmental monitoring points and systems.

Under the state and local solid waste regulations, OVSL, Inc. is required to conduct post-closure care for thirty years or until KCHD determines that human health and the environment are protected. WAC 173-351-500(2). OVSL, Inc. is required to maintain financial assurance adequate to cover the cost of post-closure care activities for a period of thirty years after closure. WAC 173-351-600.

4.2 Improvements to Leachate, Gas, and Stormwater Management Systems

The cleanup action includes the following improvements/enhancements and repairs to reduce potential leachate generation, increase leachate capture, optimize gas collection, and further reduce the potential for migration of landfill gas from the landfill. Nearly all of these operational enhancements, repairs and improvements were recently implemented by OVSL. The activities were not required by the Solid Waste Landfill Post Closure Permit issued by KCHD, but rather, were initiated by OVSL to improve waste containment. Ecology and the KCHD concurred with the decision to implement these activities. The locations and descriptions of these elements are provided on Figure 4.

- Repair/modification of the landfill cover system along the landfill toe to reduce potential for stormwater infiltration and resultant leachate generation and to reduce potential for atmospheric air intrusion and resultant increased oxygen levels and loss of vacuum applied by the landfill gas system;
- Inspection and repair of penetrations to cover system to reduce potential for atmospheric air intrusion and resultant increased oxygen levels and loss of vacuum applied by the landfill gas system;
- Repair/replacement of landfill gas extraction wells containing blockages that restrict gas extraction and flow;
- Repair/replacement of landfill gas extraction system conveyance piping as needed to eliminate blockages that restrict gas extraction and flow;
- Repair/replacement of condensate collection equipment as needed to reduce condensate accumulation in the piping that causes blockages, thereby restricting gas extraction and flow;

- Maintenance/repair of landfill gas system vacuum blowers to optimize gas extraction and flow;
- A program of optimization of the landfill gas collection system (well field balancing) to insure that all portions of the landfill are subject to vacuum thereby minimizing the potential for gas migration from the landfill;
- Increased inspection, maintenance and adjustment of the leachate collection system pumps to insure optimum performance of the leachate extraction system;
- Repair and improvement of the perimeter stormwater drainage diversion and control system to minimize the potential for stormwater infiltration into the landfill and resultant leachate generation;
- Installation of a floating cover to eliminate rainwater accumulation in the leachate pond to reduce the amount of leachate requiring treatment or disposal; and
- Permitting of alternate leachate disposal facilities to insure sufficient capacity for leachate collection and disposal.

The focus of these improvements is to reduce potential leachate generation, increase leachate capture, optimize gas collection, and prevent migration of landfill gas from the landfill.

4.3 Additional Landfill Gas Extraction Wells

Additional landfill gas extraction wells will be installed, primarily within OBWL, to reduce the amount of gas that may be contributing to groundwater contamination beneath and subsequently downgradient of OBWL and to reduce the potential for lateral gas migration.

Up to ten additional landfill gas extraction wells will be installed and connected to the landfill gas extraction system. The FS proposed nine wells in the OBWL and one in the Phase II Stage B portion of the lined landfill. As shown on Figure 5, the new wells are proposed for locations within the landfill that are outside the assumed radius of influence of existing extraction wells. The number and locations of additional landfill gas extraction wells shown on Figure 5 are preliminary as adjustments and enhancements to the landfill gas extraction system are ongoing. The design of additional extraction wells will be based on measurements of the performance of the landfill gas extraction system and may be installed in a phased manner over time to allow the effects of the improvements achieved from installation of initial wells to guide the need for, placement, design and operation of subsequent wells.

4.4 Natural Attenuation

The selected cleanup alternative relies upon natural attenuation processes to achieve Site cleanup levels. Over time, natural attenuation reduces the concentrations of chemicals introduced into the environment using natural biological and chemical processes. Natural attenuation has been shown to effectively reduce the concentrations of inorganic and organic contaminants in groundwater at landfills and other contaminant release sites.

Natural attenuation as a cleanup alternative is most appropriate for sites with the following characteristics:

- Source control is concurrently and effectively applied;
- Human health and the environment are protected;
- Site-specific remediation objectives can be achieved in a reasonable timeframe;
- Migration of contaminants in groundwater is limited;
- Transformation of contaminants into more mobile or more toxic substances is unlikely;
- Transformation processes are irreversible;
- Appropriate monitoring is conducted and data are evaluated to ensure the natural attenuation process is taking place; and
- Backup or contingency plans are available.

Table 3 summarizes how these characteristics apply to the OVSL site.

4.5 Environmental Monitoring Program

A critical element of the remedial action is an environmental monitoring program designed to assess the progress toward achievement of cleanup standards. An Environmental Monitoring Plan (EMP) has been developed for the Site (EMSI, 2009). Key components of the EMP include groundwater monitoring locations, water quality parameters to be tested, and monitoring frequency. The EMP includes a Sampling and Analysis Plan (SAP) as an appendix that meets the requirements specified in WAC 173-340-820 and -830 (SCS Engineers, 2009). OVSL, Inc. is currently conducting environmental monitoring in accordance with the EMP.

4.6 Institutional Controls

Institutional controls currently in place due to the site's status as a closed municipal solid waste landfill include:

- Signage to identify the presence of the landfill
- Access restrictions – locked gates, berms
- Restricted use of the landfill surface
- Deed notification regarding the presence of the landfill
- Financial assurance for post-closure operation and maintenance costs
- Existing regulatory prohibitions on installing water supply wells within 1,000 feet of the waste management unit boundaries of a solid waste landfill.

Additional financial assurance for corrective action may be required for compliance with WAC 173-351-600 (4) and WAC 173-340-440 (11).

5 Alternatives Considered and Basis for Remedy Selection

The Feasibility Study (EMSI, 2010) developed five cleanup action alternatives for the Site. The alternatives are summarized in Table 4. All of the alternatives include continuing post-closure care of the landfill as required by state and local regulation and the Solid Waste Landfill Post-Closure Permit issued by KCHD. All of the alternatives also include improvements to the cover, landfill gas, leachate, and stormwater management systems. Alternatives 2, 3, 4, and 5 also include installing additional landfill gas extraction wells in the landfill.

In addition to post-closure care, improvements to cover, landfill gas, leachate, and stormwater management systems, and the installation of landfill gas extraction wells:

- Alternative 3 includes installing and operating a soil vapor extraction (SVE) system to extract soil gas outside of the landfill
- Alternative 4 includes installing and operating an air sparging system to oxygenate shallow groundwater at the edge of the landfill
- Alternative 5 includes excavation of waste from the unlined OBWL with transportation to an offsite permitted facility.

Ecology selected a cleanup action for implementation at the OVSL Site in accordance with the procedures detailed in WAC 173-340-360 as described in the following sections.

5.1 Initial Assessment of Feasibility Study Alternatives

Ecology conducted an assessment of whether each cleanup action alternative proposed by OVSL, Inc. met all minimum requirements for cleanup actions required by the MTCA Cleanup Regulation except for the minimum requirement to use permanent solutions to the maximum extent practicable. WAC 173-340-360(2). Those that passed through this initial screening were included in the determination of which cleanup action uses permanent solutions to the maximum extent practicable as required by WAC 173-340-360(3).

Alternative 3 includes vadose zone gas investigation and extraction. The SVE technology can be effective at removing volatile organic compound (VOC) vapors from soil and thereby reduce concentrations of VOCs in groundwater if the source of the VOCs in groundwater is VOCs in soil gas. As discussed in Section 3.6, however, the concentrations of VOCs in groundwater currently only slightly exceed cleanup levels for one constituent, vinyl chloride, at two monitoring locations. The IHSs with concentrations that consistently exceed cleanup levels are inorganic constituents. SVE is not an effective technology to address inorganic constituents and consequently is not expected to reduce the existing risk or to improve overall environmental quality. Also, as pointed out in the FS, extracting soil gas outside of the landfill could interfere with the landfill gas extraction system that operates to prevent landfill gas from migrating away from the landfill. Ecology did not include Alternative 3 in the determination of which cleanup action uses permanent solutions to the maximum extent practicable.

Ecology determined that Alternatives 1, 2, 4, and 5 meet the minimum requirements for cleanup actions required by the MTCA Cleanup Regulation (as described in Section 3.2), except for the requirement to use permanent solutions to the maximum extent practicable, which is evaluated in the next section.

5.2 Permanence Assessment of Alternatives

The MTCA regulation states that selection of a cleanup action shall give preference to permanent solutions to the maximum extent practicable. WAC 173-340-360(3)(b). A permanent solution is defined in WAC 173-340-200 as:

> A cleanup action in which cleanup standards can be met without further action being required at the site being cleaned up.

To determine whether a cleanup action uses permanent solutions to the maximum extent practicable, a disproportionate cost analysis (DCA) is required.

To conduct a DCA, the alternatives are first evaluated using seven criteria: protectiveness, permanence, cost, effectiveness over the long term, management of short-term risks, technical and administrative implementability, and consideration of public concerns. The criteria are described in WAC 173-340-360(3)(f).

When assessing alternatives, the test used to evaluate which should be chosen is as follows:

> "**Test.** Costs are disproportionate to benefits if the incremental costs of the alternative over that of a lower cost alternative exceed the incremental degree of benefits achieved by the alternative over that of the other lower cost alternative." WAC 173-340-360(3)(e)(i).

The term disproportionate means that the degree of exceedance of incremental costs to incremental benefits must be substantial.

The MTCA Cleanup Regulation states,

> "The comparison of benefits and costs may be quantitative, but will often be qualitative and require the use of best professional judgment. In particular, the department has the discretion to favor or disfavor qualitative benefits and use that information in selecting a cleanup action. Where two or more alternatives are equal in benefits, the department shall select the less costly alternative provided the requirements of subsection (2) of this section are met." WAC 173-340-360(3)(e)(ii)(C).

Quantitative measures of costs and benefits, when made, must be made in units that are common among all alternatives so that the comparison can be meaningful. It is best if the units of costs and the units of benefits can be the same, such as dollars. This is rarely possible at environmental cleanup sites. Costs are estimated in dollars, but quantitative measures of benefits are usually only available in terms of mass or volume of contaminant removed or some other physical, non-monetary measure, if available at all. At OVSL, no quantitative measures of benefits are available.

The OVSL FS includes a DCA that uses a quantitative scoring system to compare the alternatives across the seven evaluation criteria. Ecology does not find the scoring system used adequate to differentiate the benefits of the alternatives considered. Ecology decided to conduct its own DCA and, because the MTCA regulation allows it, to compare benefits and costs qualitatively using best professional judgment. Ecology's evaluation is presented in the following sections.

5.2.1 PROTECTIVENESS, PERMANENCE, AND EFFECTIVENESS OVER THE LONG-TERM

5.2.1.1 Protectiveness

Protectiveness is evaluated by considering the overall protectiveness of human health and the environment, including the degree to which risk is reduced at a facility and the time to achieve that reduction, onsite and offsite risks resulting from implementing the alternative, and improvement of the overall environmental quality.

Risks of future releases of leachate and gas are reduced by all of the alternatives, but to different degrees. Alternative 2 reduces the potential for future releases more than does Alternative 1 because of the addition of landfill gas extraction wells within the landfill to better capture gas that is generated. Alternative 4 may add more protection against releases by adding an air sparging wall that would volatilize organic compounds released from the landfill and increase the groundwater's dissolved oxygen content, thereby possibly preventing metals in the subsurface formation from solubilizing. Alternative 5 adds more protection than Alternative 1, 2, and possibly 4 by removing waste from the unlined part of the landfill.

The FS estimated the time required to attain cleanup standards as three to ten years for Alternatives 1, 2, and 5 and possibly one year less for Alternative 4. Given the inexact nature of estimating cleanup times, Ecology considers the alternatives to be equal in time required to attain cleanup standards.

Onsite and offsite risks from implementing Alternatives 1, 2, and 5 are similarly low. This does not include construction risks which are evaluated under "Short-Term Risks" in Section 5.2.2. Alternative 4 includes an air sparging wall along the downgradient edge of the landfilled waste. The line of air sparge wells would extend about 2,000 feet along the edge of onsite wetlands, in some locations as close to the wetland as 100 feet. This addition of air to groundwater would increase the concentration of dissolved oxygen (DO) which is currently at low levels downgradient of the landfill. Higher DO levels in groundwater discharging to wetlands would impact the wetland environment.

Ecology considers Alternative 5 to offer the most improvement in overall environmental quality because it adds partial waste removal to the components of Alternatives 1 and 2. Removing waste reduces the potential for future releases of leachate and gas to the environment. Because of the air sparging wall's potential to alter the environment of the wetlands, Alternative

4 is considered less of an improvement in overall environmental quality than the other alternatives.

5.2.1.2 Permanence

Permanence refers to the degree to which the alternative permanently reduces the toxicity, mobility or volume of hazardous substances, including the adequacy of the alternative in destroying the hazardous substances, the reduction or elimination of hazardous substance releases and sources of releases, the degree of irreversibility of waste treatment process, and the characteristics and quantity of treatment residuals generated.

Alternatives 1, 2, and 4 are similar in the degree to which they permanently reduce hazardous substances associated with the landfilled waste, by way of collecting and treating or disposing of leachate and landfill gas. Because Alternatives 2 and 4 include additional landfill gas extraction, however, they are considered to do so to a greater degree. Alternative 5 has the highest degree of reducing hazardous substances because it includes removal of a large portion of the waste or source. Similarly, Alternative 5 has the highest degree of irreversibility of hazardous substance or waste removal or treatment and Alternatives 1, 2, and 4 are of similar degrees. For all of the alternatives, the treatment residuals remain the same: leachate disposed of at an offsite wastewater treatment plant and offsite disposal of sediment from periodic cleaning of the leachate lagoon.

5.2.1.3 Effectiveness Over the Long Term

Long-term effectiveness includes the degree of certainty that the alternative will be successful, the reliability of the alternative during the period of time hazardous substances are expected to remain onsite at concentrations that exceed cleanup levels, the magnitude of residual risk with the alternative in place, and the effectiveness of controls required to manage treatment residues or remaining wastes.

Ecology considers Alternatives 2, and 4 to have a higher degree of certainty of success, greater long-term reliability, and better management of remaining untreated wastes than Alternative 1 because of the additional landfill gas extraction with Alternatives 2 and 4. Alternative 4 is not considered to have significantly greater long-term effectiveness than Alternative 2 because the time to reach groundwater cleanup standards is similar for both alternatives, and both alternatives manage the remaining landfilled waste in the same manner. Alternative 5 is considered the most effective over the long-term because it removes a large portion of the waste or source and manages the remaining waste to the same degree as Alternatives 2 and 4.

5.2.1.4 Summary of Protectiveness, Permanence, and Long-term Effectiveness Evaluation

Based on the evaluation of these three criteria, Ecology considers Alternative 5 to provide the greatest degree of protectiveness, permanence, and long-term effectiveness, followed by Alternative 2.

5.2.2 *Consideration of Short-Term Risks and Implementability*

5.2.2.1 Short-Term Risks

Managing short-term risks refers to the risk to human health and the environment during construction and implementation of the alternative and the effectiveness of measures that will be taken to manage such risks. Alternatives 1 and 2 have few if any risks associated with construction activities and alternative implementation. For Alternative 4, the construction of an air sparging wall presents greater short term risks of potential disturbance adjacent wetlands and health and safety risks to workers. The implementation of Alternative 4 involves operation of the air sparging wall for many years, which has the potential to alter the environmental conditions of adjacent wetlands as discussed in Section 5.2.1. Alternative 5 presents risks associated with heavy construction adjacent to wetlands and worker safety. Means are available to manage health and safety risks associated with the construction activities of all alternatives. Risks to adjacent wetlands associated with operating an air sparging wall (Alternative 4) may be more difficult to manage.

5.2.2.2 Technical and Administrative Implementability

This criterion evaluates the ability of the alternatives to be implemented, including consideration of whether alternatives are technically possible, availability of necessary off-site facilities, services and materials, administrative and regulatory requirements, scheduling, size, complexity, monitoring requirements, access for construction operations and monitoring, and integration with existing facility operations and other current or potential remedial actions.

All of the alternatives considered are technically possible to implement. Alternative 4 requires pilot testing to determine the appropriate design. For all alternatives, required off-site facilities, services, and materials are available and administrative and regulatory requirements can be met. Scheduling, size, and complexity are manageable for all alternatives; however, they are more challenging for Alternatives 4 and 5. Monitoring, access, and integration with existing and future operations are manageable for all alternatives.

5.2.2.3 Summary of Short-term Risks and Technical and Administrative Implementability Evaluation

All of the alternatives have manageable short-term risks and are technically feasible. Based on the evaluation of these two criteria, Ecology considers Alternative 1 to be the most easily implemented and have the least short-term risks, followed by Alternative 2.

5.2.3 *Consideration of Public Concerns*

This criterion refers to community concerns about the alternative and the extent to which the alternative addresses the concerns. Concerns previously expressed by the public and those anticipated associated with the alternatives being considered include adequate protection of drinking water, compliance with laws and regulations, control of landfill gas, odors, noise, and traffic. Results of the Remedial Investigation, Human Health Risk Assessment, and ongoing groundwater and landfill gas monitoring indicate that domestic groundwater supplies are not affected by the landfill. This will not change with the implementation of any of the alternatives. All of the alternatives would comply with local, state, and federal laws and regulations. Noise may be noticeable during construction of the air sparging wall in Alternative 4 and during waste excavation and removal in Alternative 5. Odors and increased traffic may also be experienced during the excavation activities of Alternative 5.

While Alternatives 1 and 2 would result in less short-term public concerns of noise, odor, and traffic, Alternative 5 removes waste from the unlined portion of the landfill, reducing the potential for future releases of hazardous substances. Ecology does not recognize a clear favored alternative based on this criterion.

5.2.4 Cost

The cost to implement each alternative, including the cost of construction, the net present value of any long-term costs, and agency oversight costs that are cost-recoverable, was presented in the FS and is summarized in Table 5. The present worth value of the alternatives is estimated as:

Alternative 1 – Increased Inspection, Repair, and Operational Improvements.......$11.1 million

Alternative 2 – Landfill Gas Collection System Upgrades............................. $11.6 million

Alternative 4 – Air Sparge Wall... $15.3 million

Alternative 5 – Excavation and Offsite Re-Disposal of OBWL....................... $178 million

5.2.5 Alternative Ranking and Selection

Ecology considers long-term effectiveness of the cleanup technologies as a significant factor at this site and has carefully considered it qualitatively in selecting the alternative to be implemented. Short-term risks and technical and administrative implementability are less important in selecting an alternative because each alternative can be modified to reduce short-term risk and improve implementability, but modification to achieve greater long-term effectiveness is more challenging. Public concerns are also carefully considered.

In accordance with the DCA procedure described in WAC 173-340-360(3)(2)(ii), Ecology ranked the alternatives from most to least permanent based on the evaluation presented above and the definition of permanent solution as defined in WAC 173-340-200: a cleanup action in which cleanup standards can be met without further action being required at the site being cleaned up.

None of the alternatives considered is a permanent solution because waste is left in place and ongoing management is required to maintain the waste containment system. Ecology ranked the alternatives from most to least permanent as follows:

Alternative 5 – Excavation and Offsite Re-Disposal of OBWL

Alternative 2 – Landfill Gas Collection System Upgrades

Alternative 4 – Air Sparge Wall

Alternative 1 – Increased Inspection, Repair and Operational Improvements

The procedure requires that if no permanent solution is evaluated in the feasibility study, the cleanup action alternative evaluated in the feasibility study that provides the greatest degree of permanence shall be the baseline cleanup action alternative against which other cleanup action alternatives are compared. Alternative 5, therefore, is the baseline cleanup action alternative against which the other alternatives are compared.

As previously stated, under the MTCA rule costs are disproportionate to benefits if the incremental costs of the alternative over that of a lower cost alternative exceed the incremental degree of benefits achieved by the alternative over that of the lower cost alternative. WAC 173-340-360(3)(e)(i).

The estimated cost of Alternative 5, the most permanent cleanup alternative, is $178,000,000. The estimated cost of Alternative 2, the next most permanent alternative, is $11,600,000. The cost of Alternative 5 is approximately 15 times greater than the cost of Alternative 2. As the benefits of the OVSL cleanup action alternatives are not quantifiable, they were evaluated qualitatively. Considering the criteria of protectiveness, permanence, and long-term effectiveness, while removing waste from the unlined portion for the landfill is more protective, permanent, and effective in the long-term, the current level of exceedances of groundwater cleanup levels at the Site is low, the estimated restoration time frames for all alternatives are similar and reasonable, offsite drinking water wells are not affected by the landfill, and health risks associated with the landfill are low. Therefore, Ecology considers the incremental cost to be disproportionate to the incremental benefit of Alternative 5 over Alternative 2. Alternative 2 is favored over Alternative 5.

Alternative 2 is considered to be more permanent than Alternative 4 and the estimated cost of Alternative 2 is less than that of Alternative 4. Alternative 2 is favored over Alternative 4.

The estimated cost of Alternative 2 is 4.5% greater than that of Alternative 1. The added benefit of Alternative 2 over that of Alternative 1 is improved landfill gas recovery. Recovering more of the gas that is generated reduces the potential for gas to migrate away from the landfill where it can contribute to groundwater contamination and exceedances of explosive gas standards. The increased cost of Alternative 2 over that of Alternative 1 is not considered disproportional to the increased benefit. Alternative 2 is favored over Alternative 1.

Based on this DCA, Ecology selects Alternative 2 for implementation at the OVSL Site.

6 Implementation of the Cleanup Action

Implementing the cleanup action will include completion of improvements to leachate, gas, and stormwater management systems, installation and evaluation of gas extraction wells, continuation of groundwater monitoring, and provision of financial assurance. Ecology and OVSL, Inc. will enter into an Agreed Order for the cleanup action implementation.

6.1 Improvements to Existing Systems

As stated in Section 4.2, much of the improvement work to existing systems was completed in 2008, 2009, and 2010. Remaining items to be completed include sealing landfill gas well heads in OBWL and increasing vacuum to OBWL landfill gas wells. These are scheduled for completion in 2010 and 2011.

6.2 Installation of Gas Extraction Wells

OVSL, Inc. will submit a work plan to Ecology for the installation of initial extraction well(s), the method to be used to evaluate well performance, and criteria for making decisions about the need for and location of additional wells. This work will begin in 2011.

6.3 Monitoring Program

Groundwater downgradient of the landfill and landfill gas probes will be monitored to assess the effectiveness of the selected cleanup actions and the compliance with cleanup standards. Monitoring of the selected cleanup action will be conducted in accordance with the EMP described in Section 4.5. Groundwater and landfill gas are currently, and will continue to be, monitored quarterly.

6.4 Financial Assurance

Financial assurance will be provided in accordance with WAC 173-340-440 (11) Financial assurances.

7 REFERENCES

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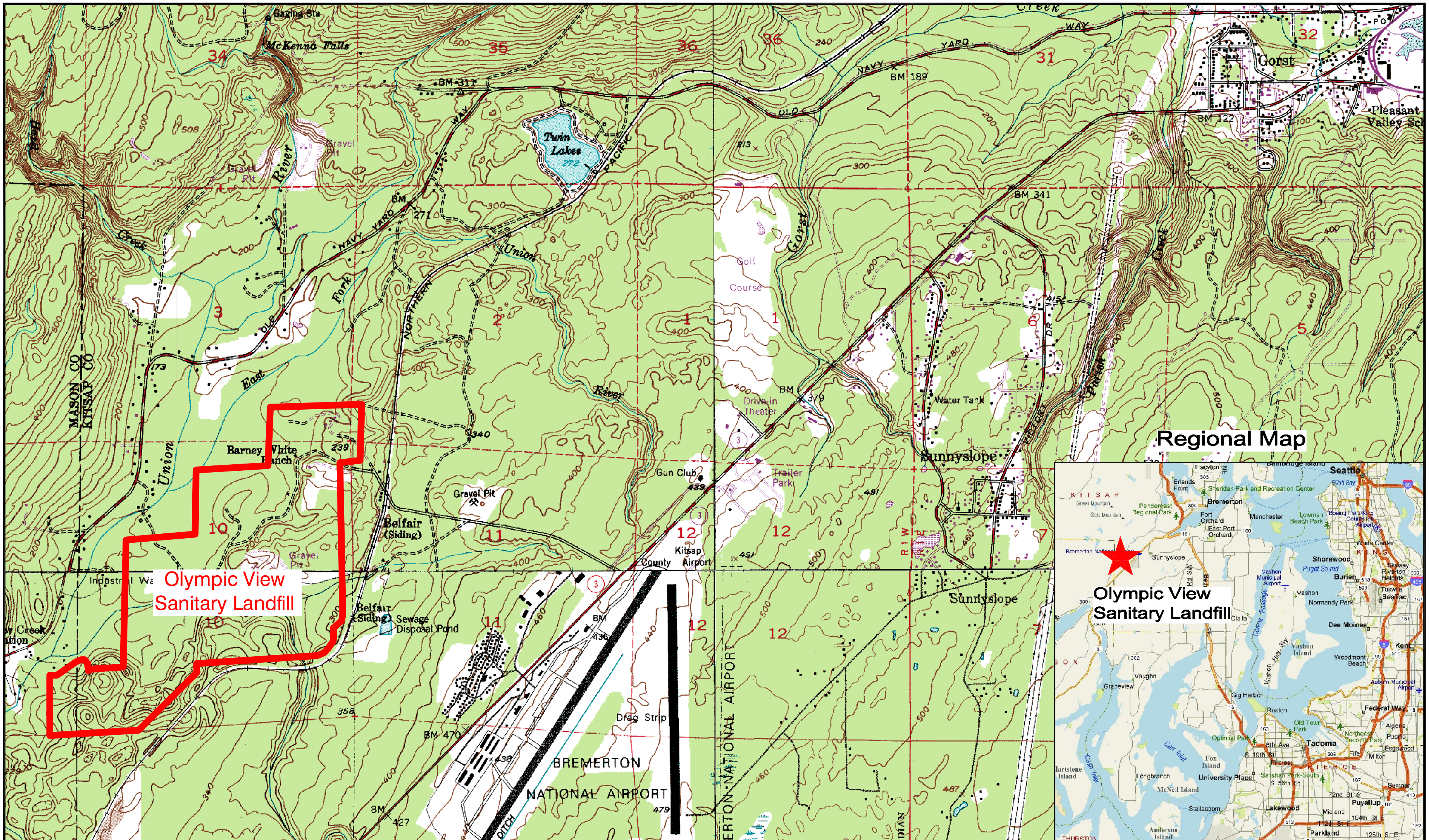


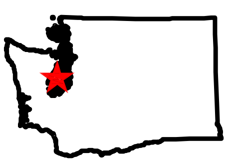
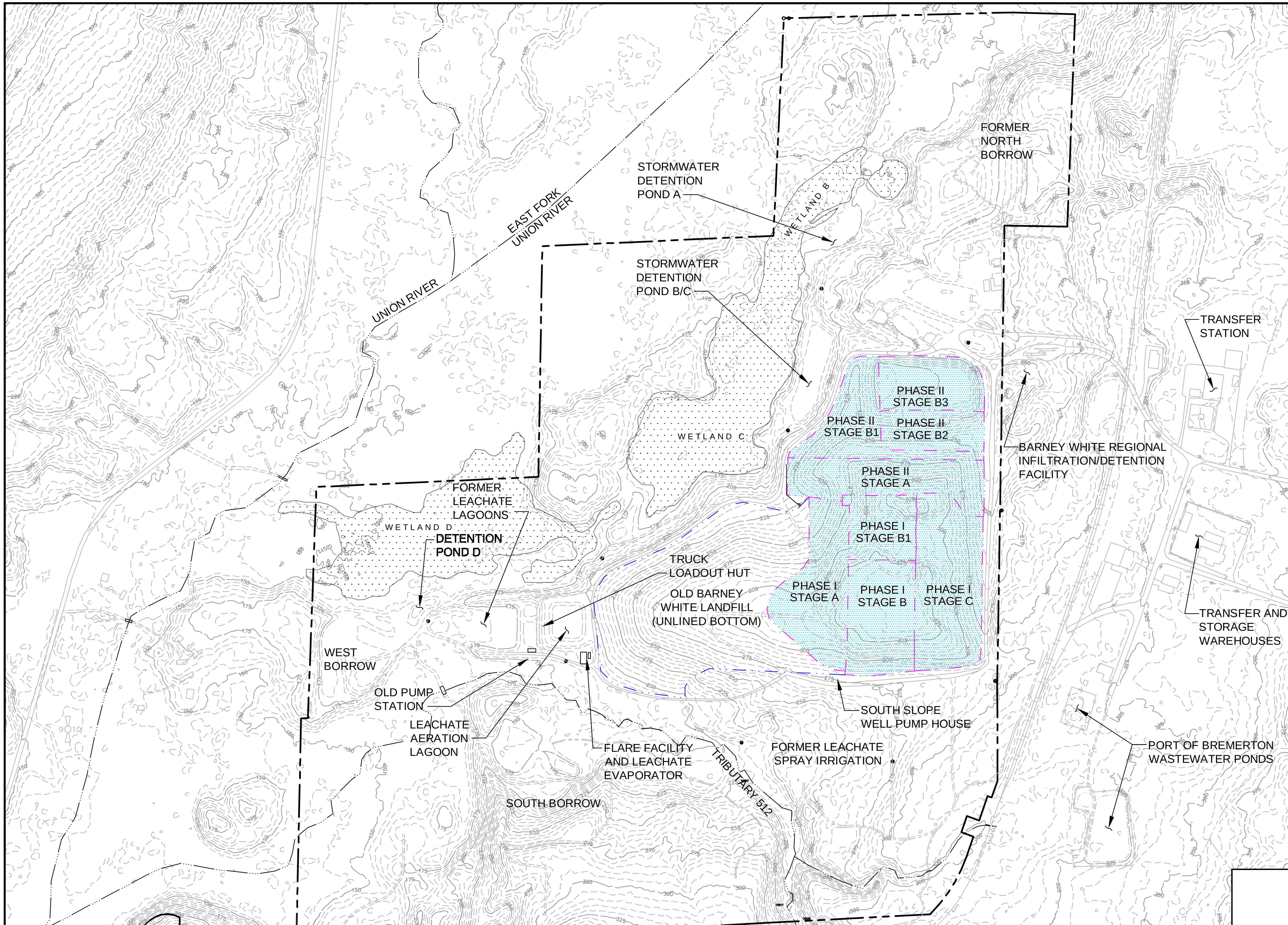


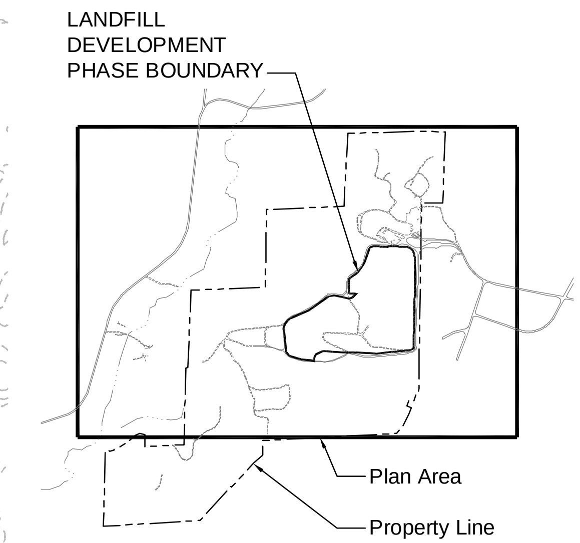
Figure 1

Site Location Map
Kitsap County, Washington

Olympic View Sanitary Landfill

EMSI Engineering Management Support, Inc.





KEY MAP

NO SCALE

NOTES:

1. Contour data based on topographic survey data supplied by Space Imaging LLC & Kitsap County GIS Aerial Imagery, June 2001.
2. Additional property to south (see Key Map).

600 0 600

SCALE IN FEET

Figure 2

Overall Site Plan

Olympic View Sanitary Landfill

EMSI Engineering Management Support, Inc.

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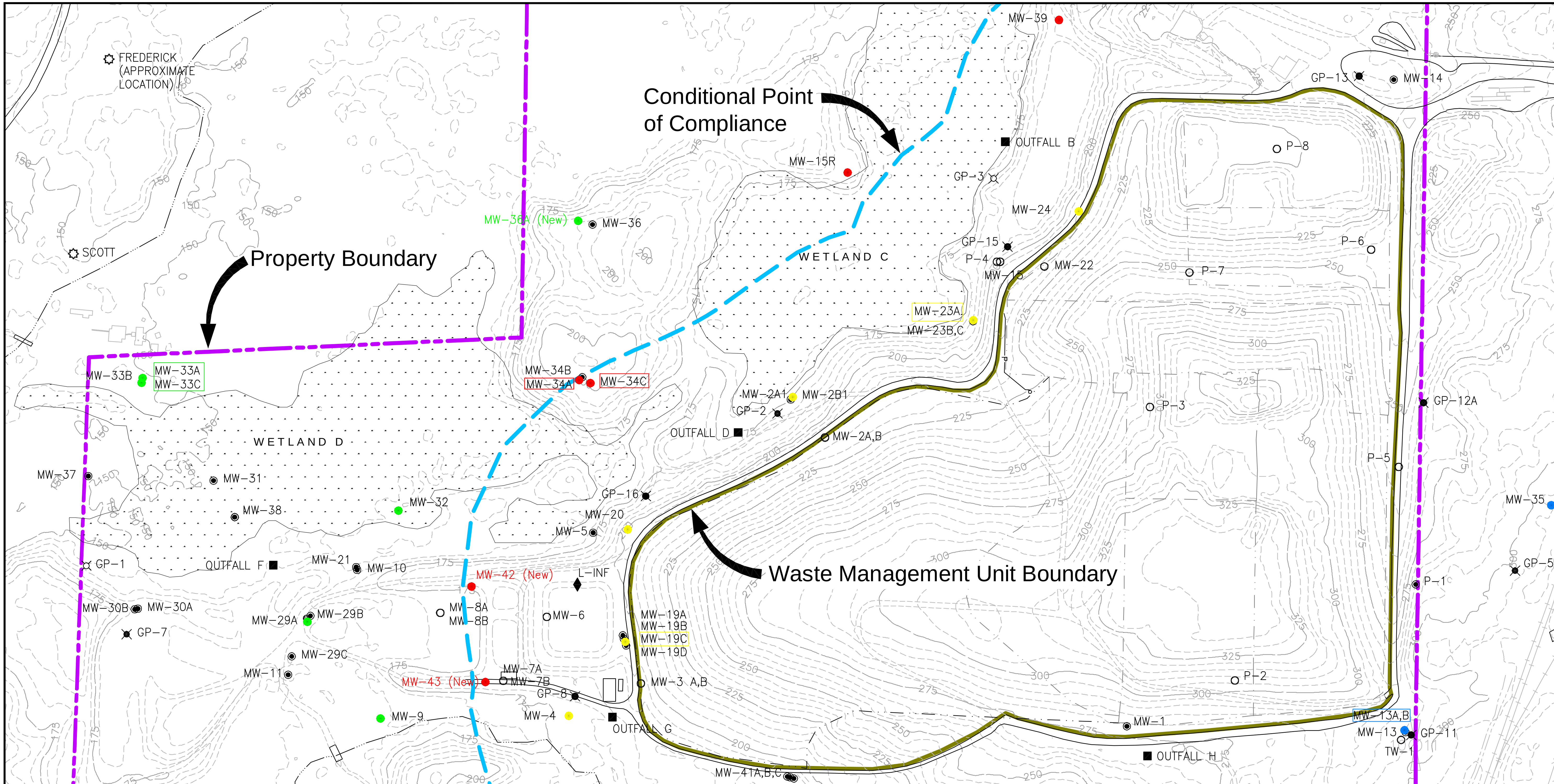

LEGEND:

MW-32	Monitoring Well or Piezometer
SCOTT	Offsite Private Well
MW-15	Decommissioned Monitoring Well or Piezometer
L-INF	Leachate Influent Monitoring Station
GP-15	Gas Probe
GP-6	Decommissioned Gas Probe
GP-7B	Decommissioned Gas Probe Boring
OUTFALL B	Stormwater Monitoring Outfall

Property Boundary
Waste Management Unit Boundary
Conditional Point of Compliance
Landfill Development Phase Boundary
Stream
Access Road
Railroad

MONITORING WELL KEY

- Compliance Monitoring Well
- Performance Monitoring Well
- Downgradient Monitoring Well
- Upgradient (background) Monitoring Well

Figure 3

Conditional Point of Compliance

Olympic View Sanitary Landfill

EMSI Engineering Management Support, Inc.

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M:\CLIENTS\EMSI\WASTE-MAN-OVSL\PARAMETRIX\BL2982003P06T04F2-1 11-9-07\DRAFT-CAP\OVSL-DRAFT_CAP-FIG-4.DWG-LAYOUT 09/28/2010 10:56AM

Note: Alternative 1 would also include activities associated with continued operation and maintenance of the existing landfill source control and containment systems, institutional controls, and environmental monitoring programs described as part of continued Post-Closure care.

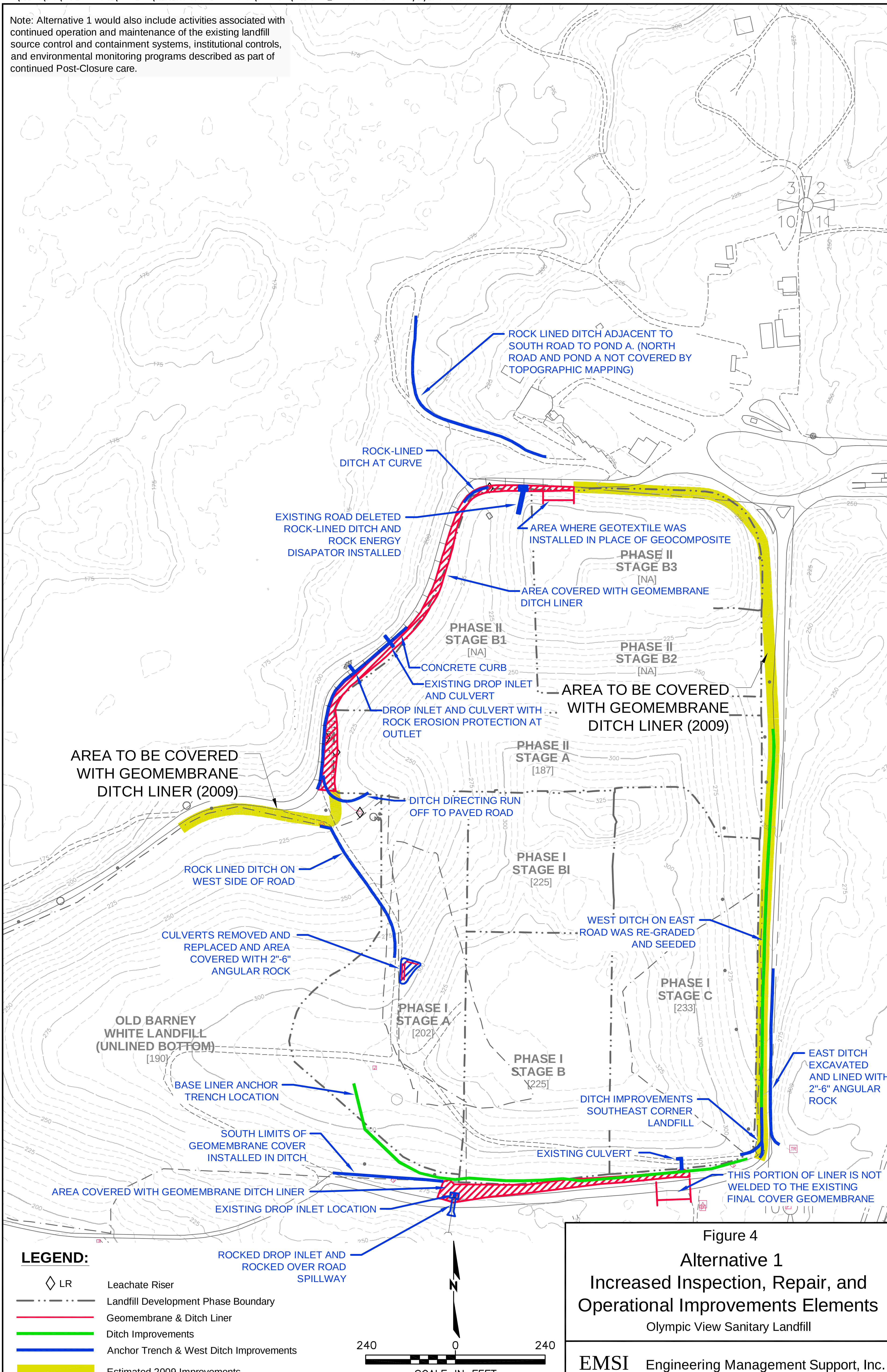
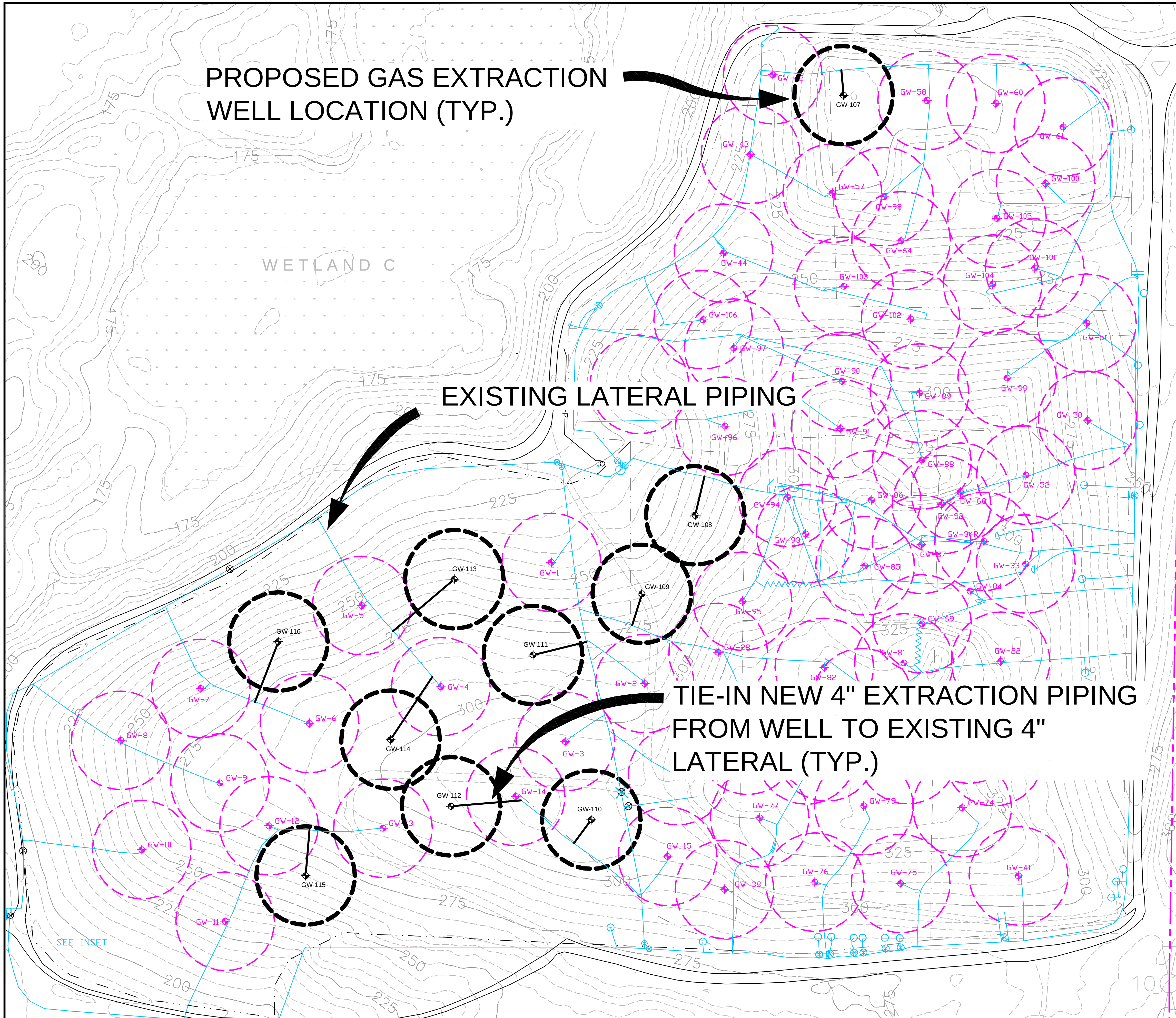


Figure 4

Alternative 1
Increased Inspection, Repair, and Operational Improvements Elements

Olympic View Sanitary Landfill

EMSI Engineering Management Support, Inc.



Note: Alternative 2 would also include the increased inspection, repair and operational enhancements of Alternative 1 and the activities associated with continued operation and maintenance of the existing landfill source control and containment systems, institutional controls, and environmental monitoring programs described as part of continued Post-Closure care.

LEGEND

GW-33 — Existing Gas Extraction Well With 100' Radius of Influence

GW-113 — Proposed Gas Extraction Well With 100' Radius of Influence

Proposed Tie In to Existing Gas Collection Piping System

200 0 200
SCALE IN FEET

Figure 5
Alternative 2
Landfill Gas Collection System Upgrades
Olympic View Sanitary Landfill

EMSI Engineering Management Support, Inc.

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Table 1 Summary of Site Background

	Olympic View Sanitary Landfill	Surrounding Area
Size	65 acres of contiguous solid waste disposal areas, associated facilities including access roads, landfill gas treatment and leachate collection and treatment systems, soil borrow areas, stormwater detention basins and wooded land, all located within an overall 436 acre property.	Sparsely populated, primarily forested land and industrial facilities.
Ownership	Olympic View Sanitary Landfill, Inc.	The landfill is located in and bordered by the Olympic View Industrial Park on the north and east. Property to the south is owned by KB Archers. Private individuals own the properties to the west.
Past Use	**1963** – Landfill began operation as a burning municipal garbage dump known as the Barney White Landfill. **1970** – Site acquired by Brem Air Disposal, Inc. and renamed the Brem Air Disposal Northwest. **1975** – Brem Air ceased burning and developed the Old Barney White Landfill (OBWL) to meet new state regulations, the Minimum Function Standards for Solid Waste Handling (MFS) and Bremerton-Kitsap County Health District permit requirements. Brem Air Disposal shareholders formed a new corporation, the Kitsap County Sanitary Landfill, Inc. (KCSL). **1984/1985** - OBWL was closed and covered with 12-inches of low permeability silt covered with 2-feet of native soil and top soil. **1985** – The Landfill expanded in accordance with the Development and Closure Plan to include two new cells, Phase I (25 acres) and Phase II (20 acres). **1991/1992** – OBWL was recapped with a flexible membrane cover, geocomposite drainage layer, soil and hydro seeding that met the MFS. **1993** - Envirofil purchased KCSL and its assets but KCSL continued to operate the Landfill. **1994** – Envirofil merged with USA Waste, KCSL continued to operate the landfill but the facility name was changed to Olympic View Sanitary Landfill (OVSL). **1998** – USA Waste merged with Waste Management, Inc. and OVSL became a subsidiary of Waste Management, Inc. **2001** – Ecology issued Agreed Order under MTCA. **2002** - OVSL ceased accepting waste and was capped. A new waste transfer station was constructed adjacent to the landfill. **2004** –Kitsap County Health District certified the landfill closure and issued a Post-Closure Permit.	Forested land, sparse rural residences, and industrial use.
Current Use	Since 2002, the Landfill has been closed to receipt of refuse. All disposal areas have been capped. Active gas extraction and leachate collection systems are operated to remove and treat landfill gas and leachate generated from the refuse. Quarterly monitoring of groundwater and surface water continues to be conducted. Landfill gas and soil gas continue to be monitored.	Industrial activities to the north and east including the waste transfer station, recreational uses to the south, and residential uses to the west.

Table 2 Preliminary Groundwater Cleanup Levels

Indicator Hazardous Substance	Units	Groundwater Standards & Criteria			Protection of Surface Water										Background (e)	Preliminary Cleanup Level	Basis
			MTCA Method B CLARC Database Levels		WA Surface Water Quality Standards (b)		National Toxics Rule (c)				National Recommended Water Quality Criteria (d)						
		Federal/State MCL (a)	Carcinogen $1x10^{-6}$ risk	Noncarcinogen	Freshwater Max Conc.	Freshwater Continuous Conc.	Freshwater Max Conc.	Freshwater Continuous Conc.	HH water + organism	HH organism only	Freshwater Max Conc.	Freshwater Continuous Conc.	HH water + organism	HH organism only			
Arsenic	mg/l	0.01	0.000058	0.0048	0.36	0.19	0.36	0.19	0.000018	0.00014	0.34	0.15	0.000018	0.00014	0.000462	**0.000462 mg/l**	background
Iron	mg/l	0.3	NE	NE	NE	NE	NE	NE	NE	NE	NE	1000	300	NE	0.23	**0.3 mg/l**	lowest value
Manganese	mg/l	0.05	NE	2.2	NE	NE	NE	NE	NE	NE	NE	NE	50	100	0.031	**0.05 mg/l**	lowest value
1,4-Dichlorobenzene	µg/l	75	1.8	NE	NE	NE	NE	NE	400	2600	NE	NE	63	190	NA	**18 µg/l**	other (g)
1,1-Dichloroethane	µg/l	NE	NE	1,600	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	**1600 µg/l**	lowest value
cis-1,2-Dichloroethene	µg/l	70	NE	80	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	**70 µg/l**	lowest value
Ethyl ether	µg/l	NE	NE	1,600	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	**1600 µg/l**	lowest value
Trichloroethene	µg/l	5	0.49	2.4	NE	NE	NE	NE	2.7	81	NE	NE	2.5	30	NA	**2.4 µg/l**	other (h)
Vinyl Chloride	µg/l	2	0.029	24	NE	NE	NE	NE	2	525	NE	NE	0.025	2.4	NA	**0.29 µg/l**	other (i)
Ammonia	mg/l	NE	NE	NE	36.7 (f)	0.00057 (f)	NE	NE	NE	NE	NE	NE	NE	NE	0.19	**0.19 mg/l**	background

(a) MCL = maximum contaminant level as either a federal or state primary or secondary drinking water standard
(b) From WAC 173-201A-240
(c) 40 CFR Part 131
(d) Section 304 of the Clean Water Act
(e) Background is based on the 99% upper prediction limit for the site
(f) Assumes pH of 6 and temperature of 12 degrees C
(g) MCL adjusted downward to $1x10^{-5}$ cancer risk in accordance with WAC 173-340-720(7)(b)
(h) Noncarcinogen value associated with a Hazard Index of 1, because it is lower than the MCL ajusted downward to $1x10^{-5}$ cancer risk in accordance with WAC 173-340-720(7)(b)
(i) MCL adjusted downward to $1x10^{-5}$ cancer risk in accordance with WAC 173-340-720(7)(b). Lower value from National Recommended Water Quality Criteria for human health ingestion of water and organisms not applicable because WA has established drinking water standards for vinyl chloride.

Table 3 Groundwater Cleanup Levels

A	B	C	D	E	F	G	H	I
		Adjustment for Excess Cancer Risk			Adjustment for Non-Carcinogenic Effects			
Indicator Hazardous Substance	Preliminary Cleanup Level (See Table 2)	Excess Cancer Risk for Preliminary Cleanup Level	Cleanup Level Adjusted for Cancer Risk	Excess Cancer Risk for Adjusted Cleanup Level	Hazard Quotient and Hazard Index of Preliminary Cleanup Levels	Cleanup Level Adjusted for Non-Carcinogenic Effects	Hazard Quotient and Hazard Index of Adjusted Cleanup Levels	**Cleanup Level**
Arsenic	0.000462 mg/l							**0.000462 mg/l**
Iron	0.3 mg/l							**0.3 mg/l**
Manganese	0.05 mg/l				0.02	0.05	0.02	**0.05 mg/l**
1,4-Dichlorobenzene *	18 µg/l	1.00E-05	2	1.10E-06				**2 µg/l**
1,1-Dichloroethane	1,600 µg/l				1	50	0.03	**50 µg/l**
cis-1,2-Dichloroethene	70 µg/l				0.88	35	0.5	**35 µg/l**
Ethyl ether	1,600 µg/l				1	50	0.03	**50 µg/l**
Trichloroethene *	2.4 µg/l	4.90E-06	1	2.04E-06	1	1	0.41	**1 µg/l**
Vinyl Chloride *	0.29 µg/l	1.00E-05	0.2	6.90E-06	0.01	0.2	0.007	**0.2 µg/l**
Ammonia	0.19 mg/l							**0.19 mg/l**
Sum		2.49E-05		1.00E-05	3.91		0.997	

* Carcinogen

Table 4 Non-Carcinogenic Effects of Indicator Hazardous Substances

Indicator Hazardous Substance	Preliminary Cleanup Level	Hazard Quotient of Preliminary Cleanup Level	Target Organ or Toxic Effect			Hazard Quotient by Toxic Effect								
			CLARC August 2001[1]	NIOSH Pocket Guide 2007[2]	IRIS Online Database[3]	cardiovascular toxicity	dermal toxicity	hemotoxicity	hepatotoxicity	nephrotoxicity	neurotoxicity	oculartoxicity	pulmonary toxicity	weight
Arsenic	0.000462 mg/l													
Iron	0.3 mg/l													
Manganese	0.05 mg/l	0.02	neurotoxicity	resp. system, CNS, blood, kidneys	CNS effects			0.02		0.02	0.02		0.02	
1,4-Dichlorobenzene	18 µg/l													
1,1-Dichloroethane	1600 µg/l	1	not available	skin, liver, kidneys, lungs, CNS	not available		1		1	1	1		1	
cis-1,2-Dichloroethene	70 µg/l	0.88	hemotoxicity	eyes, resp. system, CNS	not available						0.88	0.88	0.88	
Ethyl ether	1600 µg/l	1	weight	eyes, skin, resp. system, CNS	body weight		1				1	1	1	1
Trichloroethene	2.4 µg/l	1	not available	eyes, skin, resp. system, heart, liver, kidneys	not available	1	1		1	1		1	1	
Vinyl Chloride	0.29 µg/l	0.01	liver cell polymophism	liver, CNS, blood, resp. system	liver cell polymophism			0.01	0.01		0.01		0.01	
Ammonia	0.19 mg/l													
	Hazard Index =	3.91			Hazard Index =	1	3	0.03	2.01	2.02	2.91	2.88	3.91	1

Notes:
1 Cleanup Levels and Risk Calculatoins under the Model Toxics Control Act Cleanup Regulatoin, Version 3.1, updated November 2001
2 NIOSH Pocket Guide to Chemical Hazards, NIOSH Publication Number 2005-149, http://www.cdc.gov/niosh/npg/
3 Integrated Risk Information System, US EPA, http://www.epa.gov/iris/

Table 5 Natural Attenuation Criteria Applied to OVSL Site

Natural Attenuation Site Criteria	OVSL Site
Source control is concurrently and effectively applied.	The existing landfill cap, landfill gas control system and leachate collection and treatment and disposal systems provide source control resulting in declining concentrations of indicator hazardous substances in groundwater over time.
Human health and the environment are protected.	Currently, exposures to site-related chemicals do not exist and are not expected to occur in the future and therefore risks to human health and the environment are low. Existing and additional institutional controls will limit use and exposure to contaminated groundwater beneath the landfill and adjacent OVSL-owned property.
Cleanup standards can be achieved in a reasonable time.	The time required to meet cleanup standards is expected to be between 5 and 15 years depending upon aquifer properties and the distance of the monitoring point from the landfill. Releases of indicator chemicals may initially continue but are expected to decline over time such that cleanup standards are met within approximately 15 years.
Migration to groundwater is limited.	Chemical migration to groundwater appears to primarily result from impacts associated with landfill gas (gas-to-water migration of VOCs and landfill-gas caused reducing conditions resulting in increased metals solubility). Improvements to landfill gas controls should reduce the impacts caused by landfill gas occurrences. In the event that landfill gas is not the primary source of groundwater contamination, additional, contingent source control actions may be required to reduce the levels of chemical migration from the landfill.
Transformation of contaminants into more mobile or more toxic substances is unlikely.	Vinyl chloride degrades to ethene which is not considered hazardous. Mobility of vinyl chloride and ethene are not expected to change over time. Oxidation and precipitation processes for arsenic, iron and manganese result in less mobile and less toxic substances, and hence lower concentrations.
Transformation processes are irreversible.	Attenuation processes for vinyl chloride are irreversible. Attenuation processes for arsenic, iron and manganese are potentially reversible; however, oxidizing conditions in the aquifer downgradient and offsite of the landfill favor irreversibility.
Appropriate monitoring is conducted to ensure the natural attenuation process is taking place.	An Environmental Monitoring Program for monitoring landfill gas, leachate, and groundwater has been established.
Backup or contingency plans are available.	Possible backup plans and contingent actions include using active systems such as soil vapor extraction or air sparging to further improve groundwater quality along the downgradient boundary of the waste management unit if necessary.

Table 6 Summary of Cleanup Action Alternatives

Alternative	1	2	3	4	5
Technology	Continued post-closure care	Continued post-closure care	Continued post-closure care	Continued post-closure care	Continued post-closure care
	Improvements to cover, landfill gas, leachate, and stormwater management systems	Improvements to cover, landfill gas, leachate, and stormwater management systems	Improvements to cover, landfill gas, leachate, and stormwater management systems	Improvements to cover, landfill gas, leachate, and stormwater management systems	Improvements to cover, landfill gas, leachate, and stormwater management systems
	Natural Attenuation	Natural Attenuation	Natural Attenuation	Natural Attenuation	Natural Attenuation
		Install additional landfill gas extraction wells	Install additional landfill gas extraction wells	Install additional landfill gas extraction wells	Install additional landfill gas extraction wells[1]
			Investigate soil gas outside of landfill and install and operate soil vapor extraction system along down-gradient edge of landfill	Install and operate air sparge system along down-gradient edge of landfill	Excavate the unlined Old Barney White Landfill waste and transport offsite for disposal
Capital Cost	$0.78 M	$1.21 M	$1.94 M	$2.64 M	$168 M
Annual O&M Cost	$0.42 - 1.2 M	$0.42 - 1.2 M	$0.42 - 1.3 M	$0.53 - 1.31 M	$0.42 - 1.20 M
Present Value Cost	$11.2 M	$11.6 M	$12.8 M	$15.3 M	$178 M

Notes
1 - includes only 1 well because wells in OBWL are not necessary if waste is removed

Table 7 Estimated Cost of Cleanup Alternatives

Alternative	Estimated Costs ($M)		
	Capital Costs	Annual Operation, Maintenance, and Monitoring Cost	Present Worth Cost
1 Increased Inspection, Repair, and Operational Improvements	0.78	0.42 to 1.2	11.1
2 Landfill Gas Collection System Upgrades	1.21	0.42 to 1.2	11.6
4 Air Sparge Wall	2.64	0.53 to 1.31	15.3
5 Excavation and Offsite Re-Disposal of OBWL	168	0.42 to 1.2	178

Source: Feasiblity Study, Olympic View Sanitary Landfill, EMSI, June 2010, Appendix A