STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

In the Matter of Remedial Action by: City of Seattle; and South Park Property Development, LLC	AGREED ORDER No. DE 6706

TO: Ray Hoffman, Director
City of Seattle
Seattle Public Utilities
Seattle Municipal Tower
700 5th Avenue, Suite 4900
PO Box 34018
Seattle, WA 98124-4018

Robert A. Howie, Jr.
South Park Property Development, LLC
165 NE Juniper Street, Suite 100
Issaquah, WA 98027

I. INTRODUCTION

Agreed Order No. DE 6706 (Order) entered into by the State of Washington, Department of Ecology (Ecology), the City of Seattle and South Park Property Development, LLC (SPPD) on May 4, 2009, requires that the Potentially Liable Parties (PLPs) perform a remedial investigation/feasibility study and prepare a draft Cleanup Action Plan. By this Amendment to Agreed Order No. DE 6706 (Amendment), Ecology requires an interim action be conducted at the Site. Ecology believes the actions required by this Amendment are in the public interest.

This Amendment does not attempt to recite all of the provisions of the Order. Provisions of the Order not specifically changed in this Amendment remain in full force and effect.

II. JURISDICTION

This Amendment is issued pursuant to the authority of RCW 70.105D.050(1).

III. AMENDMENTS

Ecology Determinations, Section VI. of the Order is Amended:

The Order, Section VI. (Ecology Determinations) is hereby amended to add the following:

I. Based on all information known to Ecology, Ecology has determined that the interim action required herein is necessary to reduce a threat to human health or the environment by substantially reducing one or more pathways for exposure, to correct a problem that may become substantially worse or cost substantially more to address if remedial action is delayed, and to help provide for completion of an RI/FS or design of a cleanup action. WAC 173-340-430(1). Performing the interim action will result in a partial cleanup of the Site, and is consistent with WAC 173-340-430.

Work to be Performed, Section VII. of the Order is Amended:

The Order, Section VII. (Work to be Performed), is hereby amended to add the following requirement:

F. Interim Action

1. MTCA establishes that the PLPs are strictly, jointly, and severally liable for the remediation of the Site, as the Site is defined in the Order. To effectuate the work to be performed under this Amendment in the most efficient manner, SPPD has elected to take responsibility for performing the interim action, and Ecology concurs that SPPD shall be responsible for implementing the Interim Action. Language in this Amendment and the exhibits attached hereto may reflect this arrangement. However, in the event that SPPD should become unable to complete performance of the work required by this Amendment, Ecology shall provide written notice to the City of Seattle that SPPD is unable to complete the work. Upon receipt of such notice, the City of Seattle shall then take on the responsibility to perform the remaining work, if any. The City of Seattle and Ecology shall meet to determine a schedule for completion of work required by this Amendment. This schedule may include, at Ecology's discretion, delay of the work until it can be incorporated into a final remedial action for the Site.

2. Location of interim action. The location of the interim action work is illustrated in Exhibit D. This attachment is an integral and enforceable part of this Amendment.

3. Interim Action. The interim remedial action will include constructing an impervious landfill cap; instituting landfill gas and surface water controls; implementing institutional controls; and conducting compliance monitoring. The work plan for the interim action authorized herein is set forth in Exhibit E. This attachment is an integral and enforceable part of this Amendment.

4. Schedule. The timeline of deliverables required for the interim action is included in the interim action work plan (Exhibit E).

Effective date: 6/6/13

CITY OF SEATTLE

Ray Hoffman
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Seattle Public Utilities
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STATE OF WASHINGTON, DEPARTMENT OF ECOLOGY

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SOUTH PARK PROPERTY DEVELOPMENT, LLC

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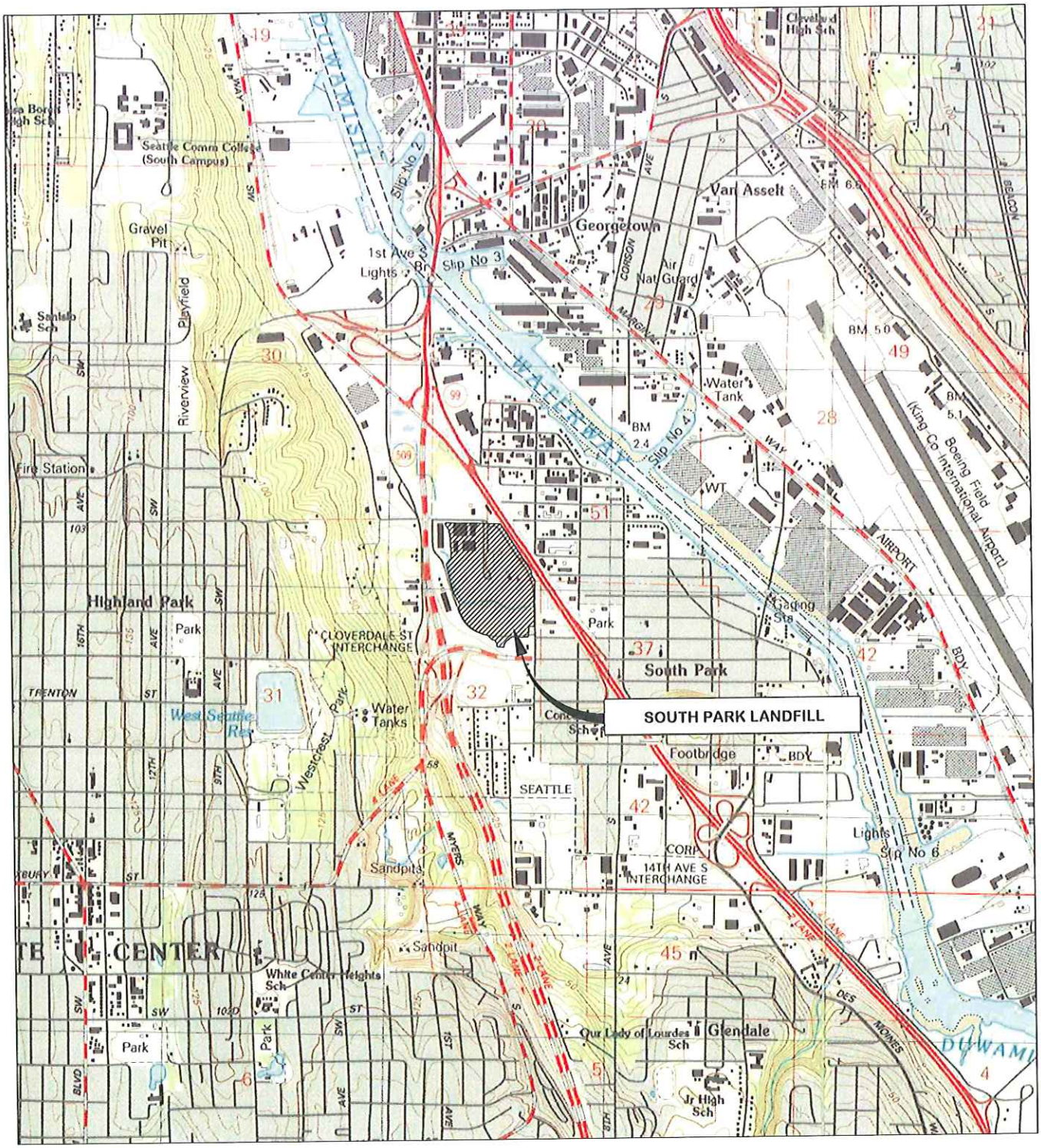
EXHIBIT D

LOCATION OF INTERIM ACTION



REFERENCE: 7.5 MINUTE USGS QUADRANGLE SEATTLE SOUTH, WASHINGTON. DATED 1953 AND PHOTOREVISED 1981

WASHINGTON

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027

FIGURE 1

SITE VICINITY MAP
SOUTH PARK LANDFILL SITE
SEATTLE, WASHINGTON

FARALLON PN: 408-002

Drawn By: DEW	Checked By: TC	Date: 5/1/12	Disk Reference: BASEMAPb

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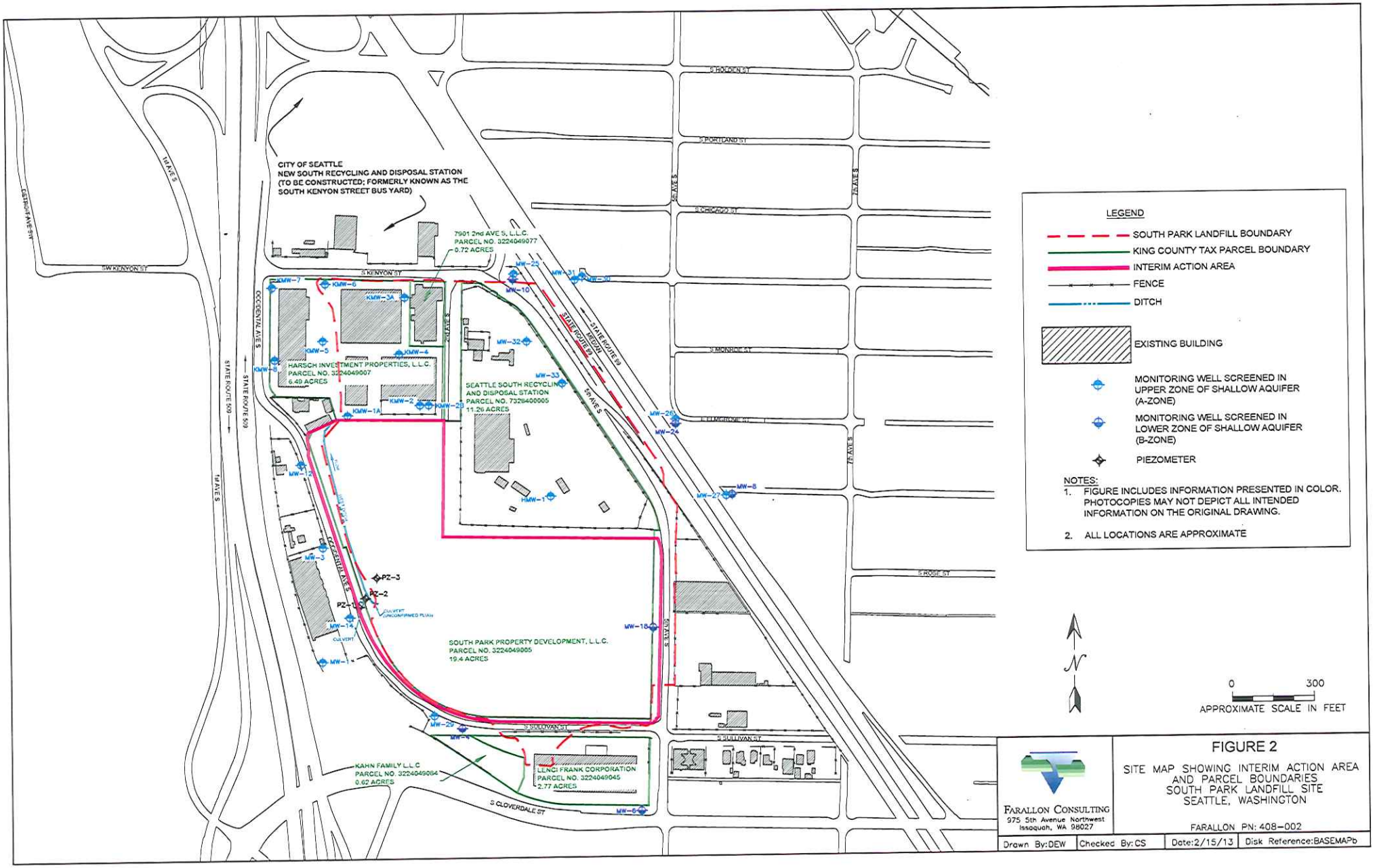

FARALLON CONSULTING
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FIGURE 2

SITE MAP SHOWING INTERIM ACTION AREA AND PARCEL BOUNDARIES
SOUTH PARK LANDFILL SITE
SEATTLE, WASHINGTON

FARALLON PN: 408-002

Drawn By: DEW	Checked By: CS	Date: 2/15/13	Disk Reference: BASEMAPb

EXHIBIT E

INTERIM ACTION WORK PLAN

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INTERIM ACTION WORK PLAN

SOUTH PARK LANDFILL SITE
SEATTLE, WASHINGTON

Submitted by:
Farallon Consulting, L.L.C.
975 5th Avenue Northwest
Issaquah, Washington 98027

Farallon PN: 408-002

For:
South Park Property Development, L.L.C.
165 Northeast Juniper Street
Issaquah, Washington 98027

February 22, 2013

Prepared by:

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Principal

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APPENDIX

ACRONYMS AND ABBREVIATIONS

AESI	Associated Earth Sciences, Inc.
Agreed Order	Agreed Order No. 6706 between the Washington State Department of Ecology, the City of Seattle, and South Park Property Development, L.L.C.
ARARs	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
CAP	Cleanup Action Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPCs	constituents of potential concern
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
Farallon	Farallon Consulting, L.L.C.
HDPE	high-density polyethylene
Herrera	Herrera Environmental Consultants, Inc.
HVOCs	halogenated volatile organic compounds
MFS	WAC 173-304 Minimum Functional Standards for Solid Waste Handling
MTCA	Washington State Model Toxics Control Act Cleanup Regulation
NPDES	National Pollutant Discharge Elimination System
PLPs	potentially liable persons
RI/FS	remedial investigation/feasibility study
RI/FS Report	Remedial Investigation/Feasibility Study Report produced by the common consultants on behalf of potentially liable persons for the South Park Landfill Site in 2012, submitted to the Washington

	State Department of Ecology on April 16, 2012 (Floyd|Snider, 2012)
RI/FS Work Plan	*Final Remedial Investigation/Feasibility Study Work Plan, South Park Landfill Site, Seattle, Washington* dated November 3, 2010, prepared by Farallon Consulting, L.L.C.
South Park Landfill Site	The locations where contamination caused by the release of hazardous substances from the South Park Landfill has come to be located.
SPPD	South Park Property Development, L.L.C.
VOCs	volatile organic compounds
WAC	Washington Administrative Code

1.0 INTRODUCTION

This Interim Action Work Plan has been prepared by Farallon Consulting, L.L.C. (Farallon) to describe an interim action to be conducted on a portion of the South Park Landfill located in the South Park neighborhood less than 5 miles south of downtown Seattle, Washington (Figure 1). The South Park Landfill is roughly bounded by South Kenyon Street to the north, State Route 99 and 5th Avenue South to the east, South Sullivan Street to the south, and Occidental Avenue South to the west. The South Park Landfill covers an area of approximately 39 acres, of which nearly half is presently developed. Figure 2 shows the approximate boundaries of the South Park Landfill based on review of aerial photographs, information obtained from numerous subsurface investigations conducted in the area, and on data collected during completion of the remedial investigation (RI) in 2011 (Floyd|Snider 2012).

In accordance with the provisions of the Washington State Model Toxics Control Act Cleanup Regulation (MTCA), as established in Chapter 173-340 of the Washington Administrative Code (WAC 173-340), the South Park Landfill Site is defined by the locations where contamination caused by the release of hazardous substances from the South Park Landfill has come to be located and includes the West Ditch located along the western edge of the South Park Landfill. South Park Property Development, L.L.C. (SPPD) and the City of Seattle were identified by the Washington State Department of Ecology (Ecology) as potentially liable persons (PLPs) for the South Park Landfill Site. Agreed Order No. 6706 executed by the PLPs and Ecology (Agreed Order) requires that the PLPs conduct a remedial investigation/feasibility study (RI/FS) and prepare a draft Cleanup Action Plan (CAP) for the South Park Landfill Site. Although King County also has been identified as a PLP for the South Park Landfill Site, King County is not a signatory to the Agreed Order at this time.

The Agreed Order states that the PLPs and King County "intend to mutually amend the [Agreed Order] … to expand the scope of work to include implementation of an interim action that meets the requirements of WAC 173-340-430." This Interim Action Work Plan will be issued as an attachment to an amendment to the Agreed Order.

The objective of the RI/FS is to collect and evaluate sufficient information to enable selection of a cleanup action for the South Park Landfill Site. The work involves characterizing the nature and extent of constituents of potential concern (COPCs) in each medium of concern, defining the appropriate cleanup standards for a cleanup action, developing and evaluating cleanup action alternatives, and complying with other requirements for conducting an RI/FS as defined in WAC 173-340-350 and the Agreed Order. The *Draft South Park Landfill Remedial Investigation/Feasibility Study* dated April 16, 2012, prepared by Floyd|Snider (2012) (RI/FS Report) was submitted for Ecology review on April 16, 2012.

1.1 RATIONALE FOR INTERIM ACTION

In accordance with WAC 173-340-430, an interim action is a remedial action that is technically necessary to reduce a threat to human health or the environment by eliminating or substantially reducing one or more pathways for exposure to a hazardous substance at a facility.

Investigations of soil, landfill cover material, groundwater, landfill gas, and surface water were conducted by King County and/or the City of Seattle over a period of 25 years. From 2007 through 2009, the PLPs performed semiannual groundwater monitoring events and attempted to identify the source of halogenated volatile organic compounds (HVOCs) present in shallow groundwater up-gradient of the South Park Landfill. The results from these prior investigations were compiled and summarized in the *Final Remedial Investigation/Feasibility Study Work Plan, South Park Landfill Site, Seattle, Washington* dated November 3, 2010, prepared by Farallon (2010) (RI/FS Work Plan) and were used to identify pathways for potential exposure to hazardous substances at the South Park Landfill Site. The RI/FS Work Plan was implemented in 2011, and the RI/FS Report was submitted on April 16, 2012 for Ecology review.

The portion of the South Park Landfill owned by King County in the 1990s was offered for sale to facilitate redevelopment of the property. SPPD acquired the property in 2006 and has been working to attract tenants that meet the criteria described in the Purchase and Sale Agreement and to obtain permits for the SPPD property redevelopment. Redevelopment will be preceded by this interim action, which will include capping the landfill surface, controlling landfill gas, and constructing a stormwater collection and conveyance system. The interim action will be designed and implemented, with oversight by Ecology, to protect human health and the environment, and to mitigate potential exposure pathways that could occur from redevelopment and subsequent use of the SPPD property.

1.2 DESCRIPTION OF INTERIM ACTION AREA

The Interim Action Area is within the South Park Landfill Site but does not encompass the entire South Park Landfill footprint (Figure 2). The boundaries of the South Park Landfill Site will be defined after the cleanup levels for COPCs have been determined and the extent of contamination has been defined. References in this Interim Action Work Plan to the South Park Landfill are specific to the area where solid waste was placed during operation of the landfill (Figure 2). The South Park Landfill Site will not necessarily be co-extensive with the extent of solid waste within the landfill boundaries.

The Interim Action Area includes the SPPD property and those areas contiguous with the SPPD property where solid waste from the South Park Landfill operation extends beneath City of Seattle street rights-of-way beneath 5th Avenue South, 2nd Avenue South, and South Sullivan Street as shown on Figure 2. The City of Seattle property occupied by the Seattle South Recycling and Disposal Station and adjacent unused land to the south and west, including King County Tax Parcel Nos. 7328400005; the Kenyon Industrial Park owned by Harsch Investment Properties, LLC, including King County Tax Parcel No. 3224049007; and the property at 7901 2nd Avenue South, including King County Tax Parcel No. 3224049077, are not part of the Interim Action Area. The City of Seattle property, the Kenyon Industrial Park property, and the 7901 2nd Avenue South property will be addressed by the draft CAP to be prepared for the South Park Landfill Site following Ecology approval of the RI/FS Report.

1.3 OVERVIEW OF THE INTERIM ACTION

An interim action is distinguished from a cleanup action in that an interim action only partially addresses the cleanup of a site. The Interim Action at the SPPD property and adjacent City of Seattle rights-of-way is technically necessary to reduce a threat to human health or the environment by eliminating or substantially reducing one or more pathways for exposure to a hazardous substance, and is designed to be consistent with the likely final cleanup action for the South Park Landfill Site. In conformance with requirements in MTCA delineated in WAC 173-340-430(3)(b), the Interim Action will not preclude implementation of reasonable alternatives for the final cleanup action.

Potential alternatives for the Interim Action were evaluated in accordance with WAC 173-340-430(7)(b)(ii) and are described in Section 4, Evaluation of Alternatives for Interim Action. MTCA, WAC 173-340-710(7)(c), allows for containment to be the selected remedy for closed solid waste landfills, with WAC 173-304, Minimum Functional Standards for Solid Waste Handling (MFS) as an Applicable or Relevant and Appropriate Requirement (ARAR). The selected alternative involves construction of an impervious landfill cap and includes provisions for landfill gas and surface water controls and compliance monitoring. The landfill cap consists of an asphaltic concrete cap and a low-permeability membrane cap in some peripheral areas that are too steep for pavement. The landfill gas collection system will consist of vertical and horizontal landfill gas collectors, conveyance piping, and an equipment compound. Surface water controls will consist of stormwater conveyance and treatment measures. To facilitate stormwater conveyance and treatment, unconsolidated recently deposited material in the West Ditch will be solidified to improve geotechnical conditions as well as to reduce the potential for its off-site migration. Details regarding the Interim Action are presented in Section 5, Interim Action Components.

1.4 PURPOSE OF THE INTERIM ACTION WORK PLAN

The purpose of the Interim Action Work Plan is to provide:

- A description of the Interim Action and how it will meet the criteria identified in WAC 173-340-430(1), (2), and (3);
- A description of existing Interim Action area conditions and a summary of available data related to the Interim Action;
- A description of the alternative Interim Action approaches that were considered and the rationale for selection of the proposed alternative; and
- Information to support the applicable subsections of the design and construction requirements of WAC 173-340-400(4), (6), and (8).

Additional plans describing the design, implementation, and monitoring of the Interim Action will be prepared and submitted to Ecology for review and comment, including:

- Engineering Design Report for landfill cap, landfill gas control and surface water control elements of the interim action (WAC 173-340-400[4][a]);

- Construction plans and specifications for landfill cap, landfill gas control and surface water control elements of the interim action (WAC 173-340-400[4][b]);
- Operation and Maintenance Plan for landfill cap and landfill gas collection elements of the interim action (WAC 173-340-400[4][c]);
- Construction documentation such as as-built documents (WAC 173-340-400[6]);
- Compliance Monitoring Plan (WAC 173-340-410);
- Sampling and Analysis Plan (WAC 173-340-820);
- Quality Assurance Project Plan (WAC 173-340 and current Ecology guidelines); and
- Health and Safety Plan (WAC 173-340-810[2]).

1.5 ORGANIZATION OF THE INTERIM ACTION WORK PLAN

The Interim Action Work Plan has been developed in accordance with the provisions of WAC 173-340-430 and consists of the following nine sections:

- **Section 1, Introduction** describes the regulatory framework for conducting the Interim Action, provides an overview of the Interim Action, and describes the purpose of the Interim Action Work Plan.
- **Section 2, Interim Action Area Features and Background** describes features in the Interim Action Area and other details such as hydrogeology and surface water bodies in the vicinity, and presents an overview of previous investigations at the South Park Landfill Site and a summary of environmental conditions relevant to the Interim Action.
- **Section 3, Regulatory Considerations** includes a description of Applicable or Relevant and Appropriate Requirements (ARARs), which are federal, state, and local requirements that will apply to the Interim Action; regulatory agency guidance documents that may also be considered; and the relationship of the Interim Action to the planned private development of the SPPD property.
- **Section 4, Evaluation of Interim Action Alternatives** identifies the cleanup action alternatives that were considered for the Interim Action and provides the basis for selecting the preferred Interim Action alternative.
- **Section 5, Interim Action Components** presents a summary of the work elements that comprise the Interim Action, including describing the impervious landfill cap, landfill gas control, and surface water control elements of the Interim Action.
- **Section 6, Compliance Monitoring and Reporting** provides a summary of the compliance monitoring and reporting protocols for the Interim Action.
- **Section 7, Schedule** refers to the schedule for implementation of the Interim Action, which will be presented in an amendment to the Agreed Order.
- **Section 8, References** lists documents cited in the Interim Action Work Plan.
- **Section 9, Limitations** presents Farallon's standard limitations.

2.0 INTERIM ACTION AREA FEATURES AND BACKGROUND

This section provides a description of the setting and features in the Interim Action Area and the local geology and hydrogeology relevant to the Interim Action. A summary of prior investigations for the South Park Landfill Site is presented in the RI/FS Work Plan and in the RI/FS Report. Information summarized below for the Interim Action Area is based on the results of previous investigations conducted on behalf of King County, the City of Seattle, Kenyon Industrial Park, and SPPD beginning in the 1980s and continuing through March 2009, and on available information from subsequent RI/FS work conducted in 2011 presented in the RI/FS Report. Aerial photographs and information from the City of Seattle Department of Planning and Development, Seattle Public Utilities, Sanborn Fire Insurance Maps, Kroll Atlases, and Polk and Cole City Directories have been used to supplement information provided in prior technical reports.

2.1 INTERIM ACTION AREA FEATURES AND CURRENT USE

The SPPD property (King County Tax Parcel No. 3224049005) is approximately 19.4 acres of undeveloped land. The SPPD property is zoned IG-2(U65), which is an Industrial General 2 designation. Prior to purchase by SPPD from King County in 2006, the property was vacant and mostly covered with vegetation. The SPPD property was largely cleared of vegetation in late 2006, and portions of the eastern half of the property currently are used for truck parking and storage of empty box storage containers. SPPD has placed some imported fill (e.g., crushed concrete), to grade the ground surface and to enable truck access. Accessible portions of the perimeter of the SPPD property are fenced. Access to the SPPD property is through two gates along 5th Avenue South. The SPPD property is not served by municipal water, sewer, electricity, or other utilities. The SPPD property will be developed with industrial or commercial improvements according to the needs of future tenants. Planned improvements currently going through permitting with the City of Seattle include grading, construction of parking areas, surface water controls, and associated amenities. Tentative buildings for prospective tenants also are indicated in the permit submittals. Status of permitting is summarized in Section 3.3, Relationship to Planned Private Development.

Those areas of Occidental Avenue South, South Sullivan Street, and 5th Avenue South that are within the Interim Action Area are paved and have adjacent gravel parking strips or unlined ditches, but no curbs, gutters, or sidewalks. Several subsurface utilities are located within the City of Seattle rights-of-way for these streets.

A primary topographic feature at the SPPD property is an east-west-oriented channel (herein referred to as the East-West Channel) that is 10 to nearly 20 feet lower than the surrounding topography. The culvert between the western end of the East-West Channel and the West Ditch appears to be at least partially blocked. Differential settlement around the culvert has further reduced connectivity with the West Ditch. Filling of the East-West Channel with soil began in April 2012 to pre-load and consolidate underlying soils in advance of construction.

The West Ditch, another prominent topographic feature along the west property line of the SPPD property, is unlined and borders the northern half of the western side of the SPPD property (Figure 2). Some portions of the West Ditch are on the City of Seattle right-of-way for Occidental Avenue South, and some portions are on the SPPD property. The base of the West Ditch is 8 to 10 feet lower than the typical grade of the SPPD property to the east and approximately 6 feet lower than Occidental Avenue South to the west. Moderate to dense vegetation covers the slopes and base except in areas where standing water is prevalent during the year. Intermittent northerly flow in the West Ditch discharges to a 30-inch-diameter culvert that passes about 10 feet beneath the Kenyon Industrial Park property.

No wetlands are located within the Interim Action Area. The Department of the Army, Seattle District, Corps of Engineers (2007) determined that the East-West Channel and the West Ditch are not waters of the United States. Review by Ecology (2009) and the City of Seattle (Seattle Department of Planning and Development 2008) determined that the East-West Channel and the West Ditch are not regulated as wetlands under state or Seattle Municipal Code regulations, respectively.

2.2 HYDROGEOLOGY

The South Park Landfill Site geologic and hydrogeologic conditions are summarized from information in the RI/FS Work Plan and the RI/FS Report.

2.2.1 Geology

The Site is located in the Duwamish Valley, which is a glacially-carved trough that is in-filled with more recent sediments and soil. In many areas of the Duwamish Valley, the ground surface was modified by dredging and fill placement, which overlies the alluvial soil. Associated Earth Sciences, Inc. (AESI) et al. (2000) divided its discussion of local geology according to four defined units: imported fill, alluvial sediments, estuarine deposits, and glacial soil. A description of each unit, supplemented with more-recent geologic information from the South Park Landfill Site area, including information collected during the RI subsurface explorations completed by PLPs in 2011, is provided below. Logs for borings, test pits, gas probes, and monitoring wells located at the South Park Landfill Site are provided in Appendix A of the RI/FS Work Plan and Appendix B of the RI/FS Report.

Imported Fill/Solid Waste—Imported fill at the South Park Landfill is composed of solid waste disposed during operation of the landfill, structural fill placed for development of the Kenyon Industrial Park and Seattle South Recycling and Disposal Station facilities, and landfill cover soil placed on the SPPD property by the City of Seattle and King County in the 1960s and 1970s. SPPD placed a layer of surficial fill to support use of the property for equipment storage across portions of the eastern and southern areas of the SPPD property prior to 2010. The surficial fill consisted primarily of gravel and variably sized chunks of crushed concrete.

The solid waste disposed at the South Park Landfill is composed of domestic waste and waste from local businesses. From the 1940s until 1961, solid waste occasionally was burned to reduce volume and promote more-rapid settling and compaction (AESI et al. 1998). In general, the

thickness of the solid waste ranges from 10 feet or less on the fringe to over 20 feet in the central and south-central area of the South Park Landfill. The composition and texture of the solid waste encountered during subsurface investigations conducted at the South Park Landfill Site have varied widely among locations. Typical solid waste materials that have been observed include ash, plastic, glass, tires, organic material, and other anthropogenic materials. Other materials such as cement kiln dust, wood, metal, brick, concrete and other types of construction-related debris also were noted in some locations, but are not necessarily related to disposal activities at the South Park Landfill. Therefore, this Interim Action Work Plan and the RI/FS Report consider these materials to be unclassified fill, not solid waste, brought in to enable development of the Kenyon Industrial Park, the Seattle South Recycling and Disposal Station, and other industrial facilities in the area.

The cover layer placed across most of the SPPD property portion of the South Park Landfill reaches up to 4 feet in thickness but was absent in some areas of the SPPD property, according to an assessment conducted by AESI et al. (1999a). In general, the cover material was composed of sand, silty sand, gravel, and silty gravel. The cover material observed in the eastern portion of the SPPD property contained angular pieces of concrete and slag (AESI et al. 1999b). Lithologic logs for borings at Kenyon Industrial Park and the Seattle South Recycling and Disposal Station indicate that a laterally continuous soil cover layer is not present at these properties. Soil boring logs are provided in Appendix A in the RI/FS Work Plan and Appendix B of the RI/FS Report.

Hydraulically placed fill composed of sand and silty sand dredged from the Duwamish Waterway is common in the South Park neighborhood. Available information does not indicate that hydraulically placed fill is located within the boundaries of the South Park Landfill.

Alluvial Sediments—AESI et al. (2000) reported that the South Park Landfill was developed on alluvial sediments. The alluvial sediments were divided into an upper section of overbank flood deposits and a lower underlying section of silty sands and sands generally described as follows:

- The overbank flood deposits consist of interbedded fine sand and silt containing abundant organic debris associated with marshland vegetation, with a density ranging from loose to firm.
- The underlying sequence of dark gray or black silty sands and sands constitutes the thickest section of the alluvial soil. The upper portion of this silty sand and sand sequence has been described as reddish brown or brown at some boring locations.

Saturated material in the alluvial sediment strata is regionally referred to as the Alluvial Aquifer. For the South Park Landfill Site, the RI/FS Report refers to the Alluvial Aquifer as the Shallow Aquifer. The thickness of the alluvial sediments increases from west to east, with thicknesses ranging from 15 feet or less at monitoring wells MW-12 and MW-14 in the west to 75 feet at boring SB-26 in the south-central portion of the South Park Landfill. The base of the alluvium was not encountered to the total depth drilled of approximately 50 feet below ground surface (bgs) at deeper monitoring wells MW-8, MW-10, or MW-24 installed along the eastern perimeter of the South Park Landfill (RI/FS Work Plan Figures 3 and 5).

Estuarine Deposits—Logs for deep borings in the Duwamish Valley indicate a sequence of estuarine deposits progressing upward vertically into an alluvial sequence. The estuarine deposits typically are composed of fine sands and silts with shell fragments, which distinguish sediments that were deposited on the border of a marine environment. A thin layer of estuarine deposits was encountered at monitoring wells MW-12, MW-14, and KMW-7 at approximately 20 feet bgs (RI/FS Work Plan Figures 3 and 5). To the southeast, estuarine deposits were considerably deeper and were encountered at a depth of 47 feet bgs at monitoring well MW-4.

Glacial Soil—Glacial soil is present at the margins of the Duwamish Valley and was encountered at a relatively shallow depth west of the South Park Landfill Site. At monitoring well borings MW-12 and MW-14, glacial soil was encountered at depths of 22 and 28 feet bgs, respectively (RI/FS Work Plan Figures 3 and 5). The glacial soil is composed of dense silt, sand, and gravel. At both locations, glacial soil was in direct contact with the overlying estuarine deposits. It is likely that glacial soil is present beneath the SPPD property portion of the South Park Landfill at depths greater than those explored to date. Glacial soil was not encountered in deep geotechnical borings SB-26 or SB-27 at the South Park Landfill at completed depths of 95 and 105 feet bgs, respectively (AESI et al. 2000).

2.2.2 Surface Water

Surface water at the South Park Landfill is generally present within the East-West Channel that bisects the SPPD property and is present perennially in the West Ditch (Figure 2). The unlined East-West Channel was constructed through solid waste in the central portion of the South Park Landfill in approximately 1967. The East-West Channel was excavated to provide surface water drainage from properties east of the South Park Landfill. The original surface water flow direction was westward through a culvert to the West Ditch. In 1995, the storm drain system along 5th Avenue South was installed, and stormwater runoff is no longer discharged to the East-West Channel from properties east of 5th Avenue South. In addition, the culvert between the western end of the East-West Channel and the West Ditch appears to be at least partially blocked. Differential settlement around the culvert has further reduced connectivity. Prior to the infilling of the East-West Channel that began in April 2012 for consolidation pre-loading, ponded water was present in the East-West Channel, and may have been a surface expression of groundwater during some periods. The elevation of ponded water in the East-West Channel varied seasonally. Portions of the East-West Channel base were dry during the dry season when groundwater elevations are lowest.

The West Ditch is unlined and borders the northern half of the western side of the SPPD property (Figure 2). The West Ditch receives overland flow from adjacent areas on the SPPD property and the right-of-way for Occidental Avenue South, and receives stormwater from a number of pipes exposed along the West Ditch. Surface water inflows to the West Ditch were investigated in more detail during the RI work in 2011, and are further documented in the RI/FS Report. According to mapping conducted by the City of Seattle in 2010 (Farallon 2010) and the RI/FS Report, inflows to the West Ditch include the following.

In the north part of the West Ditch:

- A 12-inch corrugated plastic pipe that drains an unknown area;

- A 12-inch culvert, likely a remnant non-active culvert, that drains Occidental Avenue South;
- A possible surface water pipe that drains International Construction Equipment, Inc. at 8101 Occidental Avenue South; and
- A culvert from the stormwater collection and detention system at International Construction Equipment, Inc. at 8101 Occidental Avenue South.

In the central part of the West Ditch:

- A 12-inch culvert that conveys drainage from the north part of the parking lot of the North Star Ice Equipment Corporation property at 8151 Occidental Avenue South.

In the south part of the West Ditch:

- A buried 6- to 8-inch-diameter culvert confirmed at a depth of about 4.5 feet bgs during the RI that likely drains from the south part of the North Star Ice Equipment Corporation property at 8151 Occidental Avenue South; and
- A culvert, possibly plugged, that connects to the western end of the East-West Channel.

Stormwater drainage from Occidental Avenue South appears to flow across an unimproved shoulder into the West Ditch. The West Ditch also receives some discharge from groundwater (Section 2.2.3, Groundwater). During the dry season, the West Ditch generally does not flow, although some localized standing water may result from groundwater seepage where the north part of the West Ditch intersects a regional shallow groundwater table. Water level elevations in the south part of the West Ditch, however, were higher and were inferred in the RI/FS Report to be indicative of shallow groundwater perched on the silt overbank deposits (See Section 2.2.3, Groundwater).

Northerly flow in the West Ditch discharges to a 30-inch-diameter culvert that passes about 10 feet beneath the Kenyon Industrial Park property. This culvert is a private storm drain that extends to a City of Seattle maintenance manhole in South Kenyon Street. This maintenance manhole also is fed by a City of Seattle stormwater line flowing west beneath South Kenyon Street, transitioning to larger piping and eventually to a 48-inch-diameter pipe as it crosses beneath State Route 509 and discharges to a man-made wetland west of the highway. Surface water from the West Ditch and stormwater from multiple properties in the area, including State Route 509, ultimately discharge to this wetland system west of State Route 509, which is tidally influenced by the Lower Duwamish Waterway.

The Duwamish Waterway is located approximately 1,700 feet northeast of the South Park Landfill. The Duwamish River forms at the confluence of the Green and Black Rivers and historically meandered along the valley floor, discharging into Elliott Bay. Figure 1 shows the location of the South Park Landfill in relation to the Duwamish Waterway. Figure 4 of the RI/FS Work Plan shows surface water and drainage features in the area.

2.2.3 Groundwater

Groundwater in the vicinity of the South Park Landfill generally occurs within the saturated portion of the alluvial sediments, the Alluvial Aquifer is synonymously referred to as the Shallow Aquifer at the South Park Landfill Site in the RI/FS Report. For the purposes of the RI/FS Work Plan, the Shallow Aquifer was subdivided into the Upper Zone and the Lower Zone. The RI/FS Report describes the Shallow Aquifer as consisting of a groundwater system perched on a silt overbank deposit aquitard (Perched Zone in the RI/FS Report) and aquifer material immediately below this aquitard as the A-Zone of the Shallow Aquifer. What was referred to in the RI/FS Work Plan as the Lower Zone of the Shallow Aquifer is referred to in the RI/FS Report as the B-Zone of the Shallow Aquifer. Groundwater movement through the Shallow Aquifer is primarily through the A- and B-Zones. The three groundwater-bearing zones are summarized as follows:

- The Perched Zone: a discontinuous shallow zone of groundwater and infiltrating precipitation stormwater, typically less than 3 feet in thickness where present in the Interim Action Area, and occurring at elevations generally from 0 to +10 feet North American Vertical Datum of 1988 (NAVD 88).
- The A-Zone of the Shallow Aquifer: the groundwater-bearing material in the Shallow Aquifer beneath the silt overbank deposit, occurring at elevations generally from 0 to -15 feet NAVD 88.
- The B-Zone of the Shallow Aquifer: the water-bearing material in the Shallow Aquifer beneath the A-Zone occurring at elevations generally from -15 to -40 feet NAVD 88, but above the estuarine/marine deposits. The approximate elevation of -15 feet is an arbitrary boundary between the A- and B-Zones, and is not based on a hydrogeologic change in the Shallow Aquifer. The B-Zone does not exist along the up-gradient edge of the South Park Landfill near the western valley wall because the Shallow Aquifer thins, and only the A-Zone is present.

The Shallow Aquifer ranges in thickness from about 20 feet thick near the western edge of the South Park Landfill, thickening toward the east, where it has been measured as thick as 50 feet. The alluvial deposits of the Shallow Aquifer overlie fine sand and silt estuarine deposits ranging in elevation from about sea level beneath the western side of the South Park Landfill to deeper than -35 feet NAVD 88 in the center of the Duwamish River valley toward the northeast. Dense silty glacial soils have been encountered beneath the estuarine deposits as shallow as about -9 feet NAVD 88 beneath the southwestern edge of the South Park Landfill. Refer to Section 2.2.1, Geology, and to the RI/FS Report for additional discussion of geologic units encountered in the vicinity of the South Park Landfill.

The silt overbank deposits cause perched groundwater conditions in some areas (e.g., the south end of the West Ditch). The overbank deposits appear to pinch out beyond the extents of solid waste beneath the western side of the Kenyon Industrial Park property and beneath State Highway 99 east of the SPPD property. In some areas, it appears as though solid waste was placed where either the overbank deposits were absent or where they were removed prior to placement of the solid waste. According to the RI/FS Report, these areas are where solid waste

thickness is greatest (more than 20 feet thick in some areas) such as in the interior of the Kenyon Industrial Park property. According to AESI et al. (1998), the water table is up to 10 feet above the base of the solid waste during periods of high groundwater conditions (winter and spring), and the average thickness of saturated solid waste is about 3 feet.

The A-Zone of the Shallow Aquifer extends to a depth of approximately 20 feet below the water table, where it is hydraulically connected to the B-Zone of the Shallow Aquifer (i.e., there is not an aquitard between the zones). However, as noted in the RI/FS Work Plan, at some of the monitoring wells installed to a slightly greater depth at the South Kenyon Street Bus Yard Site on the north side of South Kenyon Street during a remedial investigation conducted by the City of Seattle, a thin layer comprising an apparent aquitard was encountered at 30 to 45 feet bgs (AMEC Earth and Environmental, Inc. 2009). Groundwater levels in adjacent monitoring wells screened in the A- and B-Zones of the Shallow Aquifer where the silt layer was present had more than a 3-foot difference in potentiometric head. These groundwater levels suggest a vertical downward head difference at the South Kenyon Street Bus Yard Site, indicating a potential for downward flow. The RI/FS Report also indicates a vertical downward head difference between perched groundwater and the A-Zone of the Shallow Aquifer, with a downward vertical gradient between 0.06 and 0.08 foot per foot. A slight upward vertical gradient in the range of 0.0005 to 0.006 foot per foot was measured between wells completed in the A- and B-Zones of the Shallow Aquifer.

According to information presented in the RI/FS Work Plan, the depth to groundwater at the South Park Landfill Site varies from approximately 2 feet bgs at monitoring well MW-1 to over 15 feet bgs at monitoring well MW-18 (Table 1). As discussed in Section 2.2.2, Surface Water, ponded water in the south part of the West Ditch has been interpreted to be an expression of Perched-Zone groundwater during periods of high groundwater levels (i.e., the groundwater table is above the base of the West Ditch). The groundwater flow direction beneath the South Park Landfill Site has consistently been east/northeast. Figure 3 depicts groundwater level contours and the approximate inferred direction of flow for the March 30, 2009 monitoring event at the South Park Landfill Site. The RI/FS Report indicates a more northerly groundwater flow direction in the interior of the South Park Landfill Site and the north part of the Interim Action Area. More easterly groundwater flow was inferred in the south part of the Interim Action Area. AESI et al. (2000) estimated the groundwater flow velocity at the South Park Landfill Site to be between 22 and 1,900 feet per year, depending on location and seasonal variations. According to the RI/FS Report, the average groundwater flow velocity in the A-Zone of the Shallow Aquifer was calculated to be about 700 feet per year in northern areas of the South Park Landfill Site and about 200 feet per year in southern areas. There is no evidence that groundwater elevations are tidally influenced at wells in the South Park Landfill Site monitoring well network.

According to the RI/FS Work Plan, groundwater levels in the vicinity of the West Ditch indicate a transition from a relatively steep gradient of 0.025 to 0.05 foot per foot west (up-gradient) of the West Ditch to relatively flat, ranging from less than 0.001 to 0.005 foot per foot beneath the South Park Landfill (Figure 3). This transition likely is related to both discharge of groundwater to the surface at the West Ditch and to the increasing thickness of the Shallow Aquifer east of Occidental Avenue South. The RI/FS Report corroborated the interpretation that groundwater from the Shallow Aquifer discharges into the West Ditch. However, water level elevations in the

south part of the West Ditch were inferred to be more indicative of inflow of Perched-Zone groundwater, whereas further downstream West Ditch inflow derives from the A-Zone of the Shallow Aquifer.

Recharge of the groundwater system occurs primarily in up-gradient upland areas south and west of the South Park Landfill Site. However, some precipitation falling on pervious areas of the South Park Landfill Site infiltrates to the Shallow Aquifer. During periods of high groundwater (winter and spring), groundwater is discharged to the West Ditch, where it flows to the north. Section 2.2.2, Surface Water, provides additional details pertaining to drainage and the occurrence of surface water at the South Park Landfill Site.

2.3 SUMMARY OF ENVIRONMENTAL CONDITIONS

This section provides a general summary of the environmental conditions in the vicinity of the Interim Action Area based on studies for the South Park Landfill Site through 2009, and on information in the RI/FS Report. These studies are discussed in detail in the RI/FS Work Plan (see Table 2). The RI/FS Report also provides detailed presentation of results of the 2011 investigations to complete the RI, as well as summaries of prior environmental investigations. This section is not intended to be a complete discussion of the nature and extent of contamination, but rather a summary of available data used to support the design of the Interim Action.

The RI/FS Report identifies potential exposure pathways at the South Park Landfill Site as: 1) direct contact with contaminated soil or solid waste that is not under a controlled landfill cap; 2) direct contact with contaminated groundwater (because there are no drinking water wells, such contact would be limited to construction activities below the water table); and 3) direct contact/inhalation with indoor air that may contain concentrations of volatile organic compounds from landfill gas diffusion into structures. Refer to the RI/FS Report for chemicals of concern and cleanup standards at the South Park Landfill Site.

2.3.1 Soil

Approximately 80 test pits have been excavated to estimate the thickness of the landfill cover and/or to assess conditions in shallow soil at the South Park Landfill. Prior to work in 2011 to complete the RI, over 60 borings had been drilled at the South Park Landfill Site and vicinity to assess deeper soil conditions, and numerous borings have been drilled to evaluate geotechnical conditions for improvements to streets, buildings, and subsurface utilities. The most extensive assessment to identify potential contamination of landfill cover soil and the thickness of landfill cover soil was conducted on the SPPD property (AESI et al. 1999a). Samples were collected in 1997 and 1998 for this assessment and tested for petroleum hydrocarbons and other COPCs. This assessment concluded that:

- The soil cover contained concentrations of total petroleum hydrocarbons as diesel-range organics and as oil-range organics and lead exceeding MTCA industrial cleanup standards at some locations sampled; and

- The soil cover thickness is highly variable, ranging from 0 to 4 feet, and did not completely cover the Interim Action Area.

Soil samples collected during prior investigations along 5th Avenue South identified the presence of COPCs, including metals (arsenic, cadmium, lead, copper, and mercury), petroleum hydrocarbons, semi-volatile organic compounds (benzo[a]pyrene), volatile organic compounds (methylene chloride), and polychlorinated biphenyls (Aroclor 1254). RI work conducted in 2011 included sampling of exposed surface soils using a multi-increment sampling technique for 17 dioxin and furan congeners in three study areas: the West Ditch, the Seattle South Recycling and Disposal Station, and the SPPD parcel. Calculated toxicity equivalent quotient concentrations of 2,3,7,8-tetrachloro-dibenzo-p-dioxin for three areas of the South Park Landfill were below the regulatory screening level for industrial land use for all three areas. The RI/FS Report identifies arsenic and lead as the chemicals of concern for the South Park Landfill Site.

Incorporating the construction of an impervious landfill cap plus implementing institutional controls at the Interim Action Area will mitigate the potential for contaminant exposure from landfill cover soil or solid waste via the direct human contact pathway, and reduce the potential for contaminant migration to surface water and groundwater.

2.3.2 Groundwater

Monitoring of groundwater conditions in the vicinity of the South Park Landfill commenced in 1989 at the Kenyon Industrial Park property. A total of 10 monitoring wells were installed at the Kenyon Industrial Park property. City of Seattle installed 8 monitoring wells along 5th Avenue South in 1991 to assess geotechnical conditions for a storm drain upgrade project. These wells along 5th Avenue South were apparently later decommissioned. King County installed the existing network of 11 monitoring wells at the perimeter of the landfill starting in 1999. This network also incorporated three existing monitoring wells at the North Star Ice Equipment Corporation property at 8151 Occidental Avenue South. Groundwater levels and groundwater quality samples have been collected at 13 to 21 monitoring well locations quarterly or semiannually for up to 10 years. As documented in the RI/FS Report, work conducted during completion of the RI in 2011 included reconnaissance groundwater sampling at eight locations (five up-gradient and three down-gradient of the South Park Landfill), and installation and sampling of five new monitoring wells (one up-gradient and four down-gradient of the South Park Landfill) to fill data gaps identified in the RI/FS Work Plan.

The analytical results for detected constituents for the period from 2007 to 2009 are summarized in Table 3. Results of groundwater sampling conducted during completion of the RI in 2011 are presented in the RI/FS Report. Groundwater samples were analyzed for volatile organic compounds (VOCs), petroleum hydrocarbons, metals, and other COPCs. COPCs in groundwater at locations up- or down-gradient of the Interim Action Area include metals (arsenic and manganese), petroleum hydrocarbons, and VOCs (benzene, trichloroethylene, and vinyl chloride). Review of prior groundwater analytical data indicates the following significant results:

- An up-gradient source is contributing HVOCs to the Shallow Aquifer in the vicinity of monitoring well MW-12 up-gradient of the Interim Action Area.

- Low concentrations of HVOCs are present in groundwater at monitoring wells down-gradient to the east of the South Park Landfill. The concentrations of HVOCs have declined over time down-gradient of the South Park Landfill, as illustrated by charts provided in Appendix C of the RI/FS Work Plan showing vinyl chloride concentrations at monitoring wells MW-8 and MW-10. Monitoring well MW-8 is down-gradient of the Interim Action Area. The RI/FS Report presents an evaluation of results for groundwater sampling and evaluation of historical HVOC data collected from the former Glitsa property immediately down-gradient of the South Park Landfill at the southeast intersection of State Highway 99 and South Kenyon Street.
- Arsenic has been detected at concentrations exceeding screening criteria in groundwater at monitoring wells up- and down-gradient of the Interim Action Area.
- Petroleum hydrocarbon compounds have been detected at monitoring wells up- and down-gradient of the South Park Landfill. Results from RI work conducted in 2011 indicate that total petroleum hydrocarbons as gasoline and oil and benzene exceeded preliminary screening criteria at one location cross-gradient to the Interim Action Area on the Kenyon Industrial Park property, and that benzene exceeded preliminary screening criteria at one down-gradient location just outside the northeast corner of the South Park Landfill. These results are presented in the RI/FS Report.

Other COPCs have been detected in groundwater at monitoring wells situated up- or down-gradient of the South Park Landfill, and cross-gradient to the Interim Action Area, primarily monitoring well MW-25 and Kenyon Industrial Park monitoring well KMW-05. Chemicals of concern for groundwater at the South Park Landfill Site were identified in the RI/FS Report as vinyl chloride, iron, and manganese. Although not considered to be chemicals of concern, two additional chemicals will continue to be monitored to confirm that their concentrations remain below cleanup levels: benzene and cis-1,2 dichloroethylene. Arsenic historically has been detected at elevated levels in some monitoring wells. The RI/FS Report indicates that arsenic has not been retained as a chemical of concern for the South Park Landfill Site because it currently is not elevated above the regional background concentration, except where it is associated with cement kiln dust. Cement kiln dust is not considered to be a solid waste material deposited in the South Park Landfill.

The construction of an impervious landfill cap at the Interim Action Area will decrease infiltration of precipitation through the solid waste and the potential for transfer of contaminant mass from the vadose zone to the Shallow Aquifer, thus improving groundwater quality down-gradient of the Interim Action Area.

2.3.3 Surface Water and Material Deposited in the West Ditch

Surface water quality was assessed at 14 locations along the West Ditch and the East-West Channel between 1986 and 2005. While some locations were sampled only once, three were sampled more than 14 times, and were tested for metals and other COPCs. Concentrations of metals (arsenic, cadmium, copper, lead, mercury, nickel, and zinc), pesticides (4/4'DDD), and polychlorinated biphenyls (Aroclor 1254) have been reported in surface water samples collected from the West Ditch and the East-West Channel.

Ecology and Environment, Inc. (1988) presents chemistry data for samples of material deposited in the West Ditch collected during one sampling event in May 1988. These samples were collected from three locations along the West Ditch and three locations along the East-West Channel. Metals concentrations were generally higher in the East-West Channel than in the West Ditch and included arsenic, cadmium, copper, lead, manganese, mercury, and nickel.

General findings of the West Ditch sampling conducted during completion of the RI are presented in the RI/FS Report and are summarized as follows:

- Lithology of material deposited in the West Ditch consists of between 3.5 and more than 6 feet of recently deposited saturated, highly organic soil (referred to as "organic muck" in the RI/FS Report) overlying native soil. The recently deposited material was noted to generally consist of between 45 and 80 percent silt or clay. The underlying native soil at one location in the southern (upstream) part of the West Ditch is indicative of the silt overbank deposit consisting of organic silt with almost 95 percent silt or clay. At a second location in the northern (downstream) part of the West Ditch, native material consisted of sand with less than 25 percent silt or clay, indicative of an area where the silt overbank deposit does not exist, and the West Ditch likely is in hydraulic continuity with the A-Zone of the Shallow Aquifer.
- None of the samples of recently deposited materials or underlying native soil collected during completion of the RI contained concentrations of COPCs exceeding industrial levels, and are generally summarized from the RI/FS Report below. Refer to the RI/FS Report for presentation of data and details.
  - Carcinogenic polyaromatic hydrocarbons were detected in samples collected at all locations, and generally were reported at concentrations similar to Seattle background urban soil levels (Ecology 2011).
  - Non-carcinogenic polyaromatic hydrocarbons were detected in all samples. Dibenzofuran (a polyaromatic hydrocarbon-like chemical) was detected in 3 of the 11 samples. Phthalates were detected in approximately half of the samples, with bis(2-ethylhexyl)phthalate the most common. Pentachlorophenol was detected in one sample.
  - Polychlorinated biphenyls were detected in all samples and at all depths.
  - Herbicides were not detected in any of the West Ditch samples.
  - Concentrations of pesticides (Chlordane and dichlorodiphenyl-trichloroethane--DDT) were detected in all West Ditch samples, although concentrations in several samples were so low that confirmation or confirmation and quantification were difficult.
  - Diesel- and oil-range petroleum hydrocarbons were detected in all West Ditch samples; gasoline-range hydrocarbons were not detected. According to the RI/FS Report, detected residual fuel-range hydrocarbons may most likely be attributable to biologically derived organic molecules that were extracted and quantified during the analytical procedure.

- Metals were detected in the West Ditch samples. The lowest metal concentrations generally were detected in the deeper soil samples, while the greatest metal concentrations were detected in the shallower soil samples.

2.3.4 Landfill Gas

Landfill gas has been monitored periodically for approximately 25 years at the Kenyon Industrial Park property, Seattle South Recycling and Disposal Station, SPPD property, and at the perimeter of the landfill. King County installed 14 landfill gas probes within and at the perimeter of the landfill that were monitored approximately quarterly for over 5 years starting in 1999. Because limited data were available for landfill gas monitoring conducted at the Kenyon Industrial Park property and City of Seattle property, the RI/FS Work Plan specified that additional characterization of landfill gas be conducted during completion of the RI in 2011 including the installation of up to nine additional landfill gas monitoring probes, characterization of VOC constituents in landfill gas and periodic monitoring of landfill gas methane and carbon dioxide. Additional landfill gas monitoring in probes and in buildings in the vicinity of the South Park Landfill was completed as part of the RI/FS work on a quarterly basis in 2011, per the *South Park Landfill – Interim Gas Probe and Building Monitoring Plan* prepared by Herrera Environmental Consultants, Inc. (Herrera) (2011). Herrera (2012) presents results of the 2011 landfill gas monitoring, which were used for completion of the RI/FS Report.

Prior monitoring for landfill gas has demonstrated that methane levels were above the lower explosive limit of 5 percent by volume at some of the landfill gas probes within the South Park Landfill footprint. Herrera (2012) indicates methane concentrations ranging from 0.0 to 85.1 percent. The highest methane concentrations continue to occur beneath the Kenyon Industrial Park property and outside the South Park Landfill boundary and north of the Interim Action Area, and may be partially attributable to biodegradation of an underlying hydrocarbon plume not associated with the South Park Landfill, natural methane sources, and the South Park Landfill. The Kenyon Industrial Park property is paved, potentially trapping methane produced by decomposing solid waste at the property. Until 2011, analysis of soil vapor samples for VOCs such as benzene and chlorinated solvents has been limited to a few samples collected at the Kenyon Industrial Park portion of the South Park Landfill. VOC data in landfill gas samples collected in 2011 are provided in the RI/FS Report.

There currently are no measures to control potential migration of landfill gas at the Interim Action Area. Future activities at the SPPD property will involve construction of paved surfaces across most of the property, which will make subsurface conditions more conducive to accumulation of landfill gas in areas that are currently not capped. Installation of a landfill gas control system to collect landfill gas will mitigate the potential for accumulation in structures and/or migration in the subsurface beyond the boundaries of the Interim Action Area. In addition, a landfill gas control system may reduce the potential that concentrations of VOCs present in soil would eventually adversely affect groundwater quality through volatilization and extraction of these constituents by the landfill gas control system.

3.0 REGULATORY CONSIDERATIONS

This section describes the regulatory considerations related to the Interim Action, including ARARs, which are federal, state, and local requirements that apply to the Interim Action; agency guidance documents that may also be considered; and the relationship of the Interim Action to the planned private development of the SPPD property. The RI/FS Report presents ARARs pertaining to cleanup of the entirety of the South Park Landfill Site.

3.1 ARARS

ARARs are typically categorized as chemical-, location-, or action-specific requirements. Chemical-specific requirements identify human health- or ecological-based cleanup levels for media of potential concern. Location-specific requirements apply to the geographical or physical position of the site rather than the nature of the chemicals or cleanup actions at the site. Action-specific requirements specify acceptable containment, treatment, storage, and disposal criteria and procedures, as well as required permits and approvals needed to implement the Interim Action.

Table 4 lists the known chemical-specific, location-specific, and action-specific ARARs for this Interim Action. As noted previously, the Interim Action is being undertaken pursuant to the provisions of MTCA. Because it is understood that MTCA is the overarching regulation governing the Interim Action, MTCA is not listed in Table 4 as one of the ARARs.

Table 4 also does not specifically call out surface water quality or groundwater quality requirements. SPPD construction work triggers National Pollutant Discharge Elimination System (NPDES) permit requirements under the Washington State general construction permit. If future site use in the Interim Action Area triggers other NPDES permit requirements for the surface water control system, the NPDES permit will satisfy the requirements of the federal and state Water Pollution Control Acts (see Potential Action-Specific ARARs under Treatment, Discharge, and Disposal in Table 4).

The Landfill is a historical municipal landfill closed in 1966 under Title 10 of the Washington State Public Health Department. The landfill cap proposed as part of the Interim Action is a component of closure requirements that were adopted in 1972 with WAC 173-301. These requirements were revised in 1985 as WAC 173-304 (MFS). Solid waste landfills operating after October 1991 are required to meet yet another set of the landfill requirements, WAC 173-351, Criteria for Municipal Solid Waste Landfills. WAC 173-351 allows municipal solid waste landfills that stopped receiving waste prior to October 9, 1991 to use the closure and post-closure requirements of WAC 173-304. The MFS are minimum requirements for solid waste landfill closure under MTCA (WAC 173-340-710[7][c]). A groundwater monitoring program that addresses groundwater monitoring requirements for closed landfills (WAC 173-304-490) will be implemented for cleanup of the South Park Landfill Site.

Since the U.S. Environmental Protection Agency (EPA) (1991) issued the manual titled *Conducting Remedial Investigations/Feasibility Studies for CERCLA* [Comprehensive

Environmental Response, Compensation, and Liability Act] *Municipal Landfill Sites*, EPA developed a "presumptive remedy" for municipal landfill sites under CERCLA to expedite RI/FS and closure processes for CERCLA municipal landfill sites (EPA 1992a, 1992b, 1993). The presumptive remedy for CERCLA municipal landfill sites relates primarily to containment of the landfill mass, and collection and/or treatment of landfill gas. In addition, measures to control landfill leachate, affected groundwater at the perimeter of the landfill, and/or up-gradient groundwater causing saturation of the landfill mass may be implemented as part of the presumptive remedy. Components of the EPA presumptive remedy include:

1. A landfill cap (including stormwater controls);
2. Leachate collection and treatment;
3. Landfill gas collection and treatment; and/or
4. Institutional controls to supplement engineering controls.

The CERCLA presumptive remedy also includes a fifth component: source area groundwater control to contain the groundwater contamination plume outside landfill boundaries, if necessary. The CERCLA presumptive remedy guidance does not address remedial actions for groundwater beyond the source area (the landfill boundary) or specific requirements for long-term monitoring, although these are required under MFS and MTCA. Issues related to groundwater contamination down-gradient of the South Park Landfill and associated long-term monitoring were addressed in the RI/FS Report for the South Park Landfill Site.

The RI/FS Report used concepts from the CERCLA municipal landfill presumptive remedy to refine MTCA remedial actions for the South Park Landfill Site, while continuing to treat MFS as a key ARAR. The RI/FS Report and this Interim Action Work Plan follow the concepts of MTCA, MFS, and use the term "presumptive remedy" to remind the reader of the large body of knowledge that exists regarding solid waste landfills and their long-term care.

Requirements for the disposition of soil or solid waste removed from the landfill during implementation of the Interim Action are not included in Table 4. The proposed landfill cap will prevent human contact with soil or solid waste within the landfill. Therefore, it is assumed that solid waste and associated soil excavated from the landfill during implementation of the Interim Action would be re-interred in the landfill upon approval by Ecology and per the January 11, 2010 letter regarding Excavation and Reinterment of Solid Waste at the South Park Landfill Site, from Laurie G. Davies, Program Manager--Waste 2 Resources Program, to Ray Hoffman, City of Seattle, Seattle Public Utilities; and Robert Howie, South Park Property Development, L.L.C. (Ecology 2010).

This Interim Action will comply with the ARARs identified in Table 4. Pursuant to Section 090 of Chapter 70.105D of the Revised Code of Washington, PLPs conducting a remedial action under an agreed order with Ecology are exempt from some State-administered procedural requirements and the procedural requirements of any local laws requiring or authorizing local government permits or approvals for the remedial action. However, the substantive requirements of state and local laws requiring permits or approvals shall be complied with. The substantive requirements of the permits that are exempt, to the extent they are currently known, have been

incorporated into this Interim Action Work Plan. Therefore, the substantive requirements of state and local laws subject to the permit exemption will be met during the Interim Action.

3.2 GUIDANCE DOCUMENTS

In addition to the ARARs, various guidance documents may be taken into consideration in designing and implementing the Interim Action. These include non-promulgated criteria, advisories, and proposed standards issued by federal or state governments. Such guidance documents are not ARARs, and compliance with the guidance is not mandatory. These guidance documents are intended to complement the ARARs to the extent they are consistent with legal requirements.

3.3 RELATIONSHIP TO PLANNED PRIVATE DEVELOPMENT

The Interim Action would be implemented in conjunction with private development of the SPPD property. Current plans for development include construction of slab-on-grade buildings totaling approximately 32,000 square feet to be used for offices and shop space, and of parking areas for vehicles and equipment. The layout of the facility is shown on Figure 4, but is subject to revision per future tenant requirements.

Regulatory requirements applicable to the planned private development are not listed in Table 4. However, development will require, at a minimum, the following permits and approvals from the City of Seattle:

- Master Use permit, including conditional use approval;
- Grading permit;
- Drainage control plan;
- Building permits;
- Street use permit, with transportation concurrency; and
- Approvals for water, sewer, and electrical connections.

The current status of permits and approvals is summarized below:

- Master Use permit, including conditional use: Approved (No. 3009668);
- Grading permit: Final approval pending (No. 6216697);
- Drainage control plan: Plan for earlier design approved, current design plan to be submitted in the near future;
- Building permits: To be applied for once design is complete;
- Street use permit, with transportation concurrency: 60 percent design for road and sidewalk improvements approved; 90 percent design review is in process; and
- Approvals for water, sewer, and electrical connections: Availability certificates obtained.

4.0 EVALUATION OF ALTERNATIVES FOR INTERIM ACTION

The MTCA provisions pertaining to interim actions (WAC 173-340-430) require identification and evaluation of alternatives, though not at the detailed level of analyses conducted in support of final cleanup actions. The intent of this Interim Action is to perform work that is necessary to reduce a threat to human health and the environment by eliminating or substantially reducing one or more pathways for exposure to hazardous substances at the Interim Action Area. The results of extensive subsurface investigations conducted in the vicinity of the Interim Action Area confirmed the need to conduct a cleanup action prior to development to address conditions that may pose a threat to human health and the environment such as contact with soil contaminated by metals and other COPCs, exposure to landfill gas, or potential impacts to the quality of stormwater runoff.

Three cleanup alternatives were considered for the Interim Action:

- Alternative 1—No Action;
- Alternative 2—Excavation and Disposal of Solid Waste off the Site; and
- Alternative 3—Capping, Landfill Gas and Surface Water Controls, and Monitoring.

A brief description of each of these alternatives is presented below. Consideration of these alternatives was based on the known current conditions within the Interim Action Area and the planned development activities.

4.1 ALTERNATIVE 1—NO ACTION

A No Action alternative typically is included in the evaluation of cleanup alternatives to provide a basis for comparing the effectiveness of other alternatives. Inclusion of this alternative helps to ensure that the consequences of taking no action are fully understood.

Under this alternative, no proactive measures would be taken to meet the landfill closure requirements under WAC 173-304 MFS. Development of the Interim Action Area would not provide short- or long-term protectiveness of human health and the environment through either a removal action (Alternative 2) or the design of an effective cap, landfill gas collection system, and stormwater controls (Alternative 3). Therefore, the potential would exist for direct contact of workers at the Interim Action Area with contaminants and for contaminant migration and resultant impacts to groundwater, air, surface water, and soil. In addition, there would be no environmental monitoring to assess the effectiveness of natural attenuation processes in mitigating risks or to assess risks to human health and the environment under the No Action alternative.

4.2 ALTERNATIVE 2—EXCAVATION AND DISPOSAL OF SOLID WASTE OFF THE SITE

Under Alternative 2, solid waste and any associated contaminated soil in the Interim Action Area would be excavated and disposed at a permitted solid waste management facility. In some

locations of the Interim Action Area, the thickness of solid waste exceeds 20 feet. The excavation would include removing the solid waste suspected to be present beneath South Sullivan Street. Because groundwater levels are within the solid waste in some portions of the Interim Action Area, dewatering and treatment of extracted groundwater may be necessary to facilitate the excavation activities and to minimize off-property groundwater quality impacts due to disturbance of the A-Zone of the Shallow Aquifer. Following excavation and verification that the solid waste and associated contaminated soil were removed, clean fill would be placed in the excavated areas to restore the area in preparation for development. Following the excavation and restoration activities, compliance groundwater and surface water monitoring would be performed.

4.3 ALTERNATIVE 3—CAPPING, LANDFILL GAS AND SURFACE WATER CONTROLS, AND MONITORING

Alternative 3 would include placement of an impervious asphaltic concrete and/or membrane cap over the Interim Action Area where solid waste is present; collection of landfill gas; control of stormwater; implementation of institutional controls; and compliance monitoring of the effectiveness of the Interim Action. Some limited excavation of solid waste would be necessary under this alternative to facilitate grading, placement of the landfill cap, and installation of underground utilities, including the landfill gas collection system. Solid waste and associated landfill cover material disturbed during Interim Action activities would be re-interred below the landfill cap upon approval by Ecology (2010). Activities that may generate material for re-interment include grading of the surface to facilitate capping, excavation of trenches for subsurface utilities (storm drains, sanitary sewer, water supply, and other utilities) and the landfill gas collection system, and grading for surface water controls in the West Ditch.

Following capping, installation of the surface water runoff control system, and start-up of the landfill gas control system, landfill gas migration and surface water compliance monitoring would be conducted.

In accordance with WAC 173-340-440, Alternative 3 may include implementation of institutional controls that limit or prohibit activities that may interfere with the integrity of the Interim Action or that may result in exposure to hazardous substances at the Interim Action. Institutional controls may be required at the Interim Action Area if hazardous substances remain at concentrations that exceed applicable cleanup levels or if a conditional point of compliance is established as the basis for measuring compliance with the cleanup standards that will be established by the RI/FS process for the South Park Landfill Site. Institutional controls may include physical measures such as fencing to limit access, recording an environmental covenant on the property title restricting use of groundwater, requiring a soil cleanup action in areas where contamination is present if the cap is removed in the future, or stipulating required procedures if the landfill cap is penetrated either accidentally or as part of a future construction plan.

4.4 EVALUATION OF ALTERNATIVES

MTCA (WAC 173-340-360[2][a]) stipulates that the following minimum criteria be met when selecting cleanup alternatives and this framework was used in evaluating the alternatives for this Interim Action:

- Protection of human health and the environment;
- Compliance with cleanup standards (WAC 173-340-700 through -760);
- Compliance with other ARARs; and
- Performance of compliance monitoring.

Alternative 1 (No Action) does not include actions to address the potential direct contact exposure pathway by humans or the transport of contaminants to surface water or groundwater. This alternative would not provide for verification of organic contaminant degradation through natural attenuation processes or assess organic or inorganic contaminant transport to surface water or groundwater. Therefore, Alternative 1 is not protective of human health and the environment and is eliminated from further consideration due to the inability to meet this threshold criterion.

Alternative 2 (Excavation and Disposal of Solid Waste Off the Site) would provide long-term protection of human health and the environment by preventing potential exposure via the direct contact pathway with the solid waste or contaminants in the Interim Action Area. However, Alternative 2 poses substantial short-term risks during the removal of solid waste and any associated contaminated soil by excavation due to the potential for worker exposure by direct contact or through inhalation of VOCs or contaminated particulates. In addition, the large volume of material that would need to be removed would result in ancillary risks due to large-scale shoring requirements, operation of heavy equipment, and transporting a large volume of material from the Interim Action Area to a disposal facility. These ancillary risks would also result from the placement of clean fill in areas where waste was removed. Once completed, this alternative would provide long-term protection from exposure in the Interim Action Area due to the removal of solid waste and potentially contaminated soil. This alternative would achieve compliance with cleanup standards and ARARs, and would allow for implementation of a compliance monitoring program.

Although project cost is not a defined evaluation criterion for the Interim Action, Alternative 2 is cost-prohibitive due to the volume of material to be handled, transported, and disposed. Preliminary engineering cost estimates for Alternative 2 exceed the costs for Alternative 3 by at least two orders of magnitude.

Alternative 3 (Capping, Landfill Gas and Surface Water Controls, and Monitoring) would achieve compliance with landfill closure standards and risk management in the Interim Action Area. Alternative 3 has substantially less potential risk of exposure during implementation than the risk posed under Alternative 2 because an intent of this alternative is to minimize the generation of solid waste and contaminated soil while effectively addressing existing risks to human health and the environment. In most areas, cover soil or clean fill will be placed to

facilitate placement of the asphaltic concrete or membrane cap, which will limit the potential for direct contact with contaminated material. The impervious landfill cap will limit infiltration of precipitation through the solid waste and contact of surface water runoff with the existing landfill cover, thereby minimizing or eliminating potential groundwater or surface water degradation. Surface water controls would provide additional protection that stormwater would not mobilize concentrations of COPCs associated with solid waste, if any, or associated with the recently-deposited material within the West Ditch. This alternative would comply with MTCA and the identified ARARs, and will include compliance monitoring following implementation of the Interim Action. Alternative 3 addresses the primary components of the CERCLA presumptive remedy for municipal landfill sites described in Section 3.1, ARARs.

Alternative 3 is the selected Interim Action alternative for the Interim Action Area because this alternative:

- Is protective of human health and the environment by limiting the potential for direct contact with contaminants, and minimizing the potential for degradation of groundwater and surface water at the Interim Action Area. In addition, landfill gas migration will be controlled by a landfill gas collection system.
- Provides for Interim Action compliance monitoring through development and implementation of monitoring programs to confirm attainment of operational requirements and compliance with permit requirements for each medium of concern.
- Poses substantially less short-term risk to human health than Alternative 2, which would expose workers to contaminated solid waste or soil during the removal action, and has other ancillary risks from shoring, use of heavy equipment, and transporting a large volume of material off the Interim Action Area for disposal.

4.5 REQUIREMENTS FOR LANDFILLS UNDER MTCA

As discussed in the RI/FS Report, MTCA allows for containment to be the preferred remedy for historical landfill sites and uses WAC 173-304 (MFS) as a relevant and appropriate requirement. Closed landfills are considered under MTCA to be sites that have used "containment of hazardous substances" as the preferred remedy. Under WAC 173-340-740(6)(f), MTCA states that containment sites will comply with cleanup standards if they meet the following requirements:

> The department recognizes that, for those cleanup actions selected under this chapter that involve containment of hazardous substances, the soil cleanup levels will typically not be met at the points of compliance specified in (b) through (e) of this subsection. In these cases, the cleanup action may be determined to comply with cleanup standards, provided:
>
> (i) The selected remedy is permanent to the maximum extent practicable using the procedures in WAC 173-340-360;
>
> (ii) The cleanup action is protective of human health. The department may require a site-specific human health risk assessment conforming to the requirements of this chapter to demonstrate that the cleanup action is protective of human health;

(iii) The cleanup action is demonstrated to be protective of terrestrial ecological receptors under WAC 173-340-7490 through 173-340-7494;

(iv) Institutional controls are put in place under WAC 173-340-440 that prohibit or limit activities that could interfere with the long-term integrity of the containment system;

(v) Compliance monitoring under WAC 173-340-410 and periodic reviews under WAC 173-340-430 are designed to ensure the long-term integrity of the containment system; and

(vi) The types, levels, and amount of hazardous substances remaining on-site and the measures that will be used to prevent migration and contact with those substances are specified in the draft cleanup action plan.

5.0 INTERIM ACTION COMPONENTS

This section presents a description of the components of the selected Interim Action alternative, Alternative 3 (Capping, Landfill Gas and Surface Water Controls, and Monitoring). Components of the selected Interim Action alternative include construction of an impervious landfill cap, landfill gas collection and surface water control systems, and implementation of institutional controls. Interim Action compliance monitoring and reporting procedures are summarized in Section 6, Compliance Monitoring and Reporting.

Components of the selected Interim Action alternative will be implemented within the Interim Action Area prior to implementation of the final remedy for the South Park Landfill Site encompassing the Interim Action Area. The landfill cap, landfill gas and surface water control systems, institutional controls, and Interim Action compliance monitoring procedures will be designed so as to not foreclose reasonable alternatives for the cleanup action for the South Park Landfill Site per WAC 173-340-430(3).

The South Park Landfill was closed in 1966, years before the promulgation of WAC 173-301. WAC 173-301 was superseded by WAC 173-304 (MFS) in 1985. The requirements set forth in WAC 173-304 are the current applicable minimum requirements for closure of municipal solid waste landfills. Although the closure of the South Park Landfill was accomplished prior to the promulgation of the MFS, the SPPD interim action is designed to be compliant with the MFS. The MFS ensures that a landfill is closed in a manner that:

- Minimizes the need for further maintenance;
- Controls, minimizes, or eliminates threats to human health and the environment from post-closure escape of municipal solid waste constituents, leachate, landfill gas, and contaminated rainfall or waste decomposition products to the ground, groundwater, surface water, and the atmosphere; and
- Prepares the site for the post-closure period, allowing for continued facility maintenance and monitoring of air, land, and water as long as necessary for the facility to stabilize and protect human health and the environment.

Components of the CERCLA presumptive remedy summarized in Section 3.1, ARARs, include:

- A landfill cap (including stormwater controls);
- Leachate collection and treatment;
- Landfill gas collection and treatment; and/or
- Institutional controls to supplement engineering controls.

The RI/FS Report concludes that no leachate treatment or control system is needed at the South Park Landfill Site, and indicates that leachate at the South Park Landfill no longer contributes contaminants of concern greater than cleanup levels. The mass of solid waste has decomposed and degraded. The leachate no longer contains organic acids and is near neutral; its salt content is now less than concentrations naturally occurring at the base of the Shallow Aquifer.

Contaminants of concern, vinyl chloride, iron, and manganese, are not considered to be leachate issues. The RI/FS Report indicates that improvement of leachate conditions will not change down-gradient conditions, as groundwater samples collected from wells within the boundaries of the South Park Landfill are already in compliance, or close to compliance in the case of vinyl chloride. The RI/FS Report indicates that leachate mitigation measures (other than those provided by a landfill cap, landfill gas controls, surface water controls, and institutional controls) are not necessary, and therefore are not included in the preferred alternative. However, the preferred alternative for the South Park Landfill Site described in the RI/FS Report does include monitoring natural attenuation down-gradient of the South Park Landfill.

The following sections describe the Interim Action components, including:

- The landfill cap;
- Landfill gas control;
- Surface water control; and
- Institutional controls.

5.1 LANDFILL CAP

This section presents the general characteristics and design elements required for design of the impervious landfill cap that will be constructed over the Interim Action Area. Detailed design of landfill cap elements were prepared by others under the direction of qualified licensed engineers and geotechnical professionals.

SPPD recognizes that the MFS for solid waste handling requires that a landfill cap be installed per WAC 173-304 upon closure. Under MFS, a landfill cap is intended to perform two functions:

- Minimize infiltration of stormwater into the solid waste, thereby creating additional leachate; and
- Mitigate risk to human health and the environment by preventing direct contact exposure with solid waste.

To achieve these functions, MFS indicates that at closure, the landfill cap consist of either:

- A minimum of 2 feet of low-permeability soil (permeability of less than 10^{-6} centimeters per second) plus a 6-inch topsoil vegetative layer; or
- A geomembrane layer acting as a barrier to infiltrating stormwater and marking the depth below which solid waste occurs, plus a 6-inch topsoil vegetative layer.

Two cap designs are to be used for this interim action, described in greater detail in the following sections:

- Asphaltic Concrete Cap over gently sloping areas of the Interim Action Area where development plans call for large-vehicle access and parking, and construction of administrative and shop buildings; and
- Low-Permeability Membrane Cap over steeper areas to be landscaped along the west, south, and eastern sides of the Interim Action Area.

Whereas the two interim action landfill cap designs satisfy the two primary functions required under the MFS listed above, the proposed landfill cap design for the majority of the Interim Action Area, the asphaltic concrete cap, does not consist of either 2 feet of low-permeability soil or a geomembrane layer, and does not include a 6-inch vegetative layer. Therefore, Ecology's concurrence to vary from the closure methods set forth in WAC 173-304-460 was requested per WAC 173-340-710(5) which allows for variances, or waiver, of provisions that are included in other applicable regulations. Ecology (2012) granted the request. Allowing the asphaltic concrete cap to vary from the provisions of the MFS is appropriate for the Interim Action Area in this specific situation considering the following information:

- Although the asphaltic concrete cap does not provide a minimum of 2 feet of low-permeability soil of less than 10^{-6} centimeters per second or a geomembrane layer per the MFS, the asphaltic cap system is a relatively impervious surface that provides erosion protection measures and minimizes infiltration of stormwater into the solid waste, and therefore leachate production. Because the South Park Landfill is unlined and solid waste has been in contact with groundwater for decades in some areas, the importance of reducing stormwater infiltration with an impervious cap system is reduced.
- The South Park Landfill was closed in 1966 in accordance with applicable regulations at the time. The cover in the Interim Action Area was maintained under WAC 173-301, the governing regulation for solid waste landfill closures, until WAC 173-301 was superseded by the MFS in 1985.
- Portions of the South Park Landfill Site were developed prior to adoption of the MFS set forth in WAC 173-304 in 1985. These properties have operated without documented incidents concerning the direct contact exposure pathway.
- The asphaltic concrete cap will serve the two primary functions of a landfill cap per the MFS: effectively minimize stormwater infiltration, and prevent direct exposure with solid waste and affected media.

More detailed rationale for the variance, or waiver, of provisions in the MFS for the asphaltic concrete cap provided to Ecology in October 2012 is provided in Appendix B.

Impervious surfaces such as landfill caps will affect landfill gas by reducing discharge of landfill gas to the atmosphere and by increasing the effective radius of influence of components of the landfill gas control system described in Section 5.3, Landfill Gas Control. Impervious surfaces such as landfill caps will reduce infiltration of stormwater and increase runoff, and necessitate installation of the surface water controls described in Section 5.4, Surface Water Controls. The

landfill cap must accommodate future actions as well as maintain the integrity of the drainage system as differential settlement occurs. To enhance and control surface water drainage, fill will be placed at low-lying and steeply sloped areas of the landfill prior to construction of the landfill cap. Up to 10 feet of fill may be required in select areas, with the exception of the East-West Channel, which will require placement of up to 20 feet of fill to match the surrounding grade.

5.1.1 Asphaltic Concrete Cap

The asphaltic concrete landfill cap is designed to address structural requirements to support redevelopment, reduce the infiltration of stormwater, and mitigate risk to human health and the environment by preventing direct contact exposure with solid waste. The asphaltic concrete cap will be constructed across the majority of the Interim Action Area where the final topographic surface has a slope of 6 percent or less. This type of cap system will also provide a functional working surface and requires specific design considerations to address surface water controls and to provide for durability, flexibility, and operational compatibility for development use. Application of an asphaltic concrete cap will include a maintenance program consisting of periodic inspections and re-sealing to maintain imperviousness.

The asphaltic concrete cap will be composed of a minimum of three layers:

1. Twenty-four-inch minimum-thickness compacted structural fill that may or may not include existing cover soil, depending on existing cover thickness and geotechnical properties;
2. Minimum 12 inches of crushed rock; and
3. Four- to 6-inch minimum-thickness asphalt cover.

The asphaltic concrete cap will be constructed on the existing soil cover that previously was placed over solid waste (with variable thickness reported to range from 0 to 48 inches). Additional layers consisting of the following may be constructed at the direction of the Project Geotechnical Engineer:

- Geotextile or geogrid material over yielding existing cover soil encountered during construction; and/or
- An approximately 12-inch structural section beneath roadways and/or building foundations to be included within the 24-inch-minimum compacted fill layer.

Therefore, the total thickness of the asphaltic concrete cap will be a minimum of 40 inches, depending on the thickness and geotechnical properties of the existing cover soil and the thickness of asphalt.

5.1.2 Low-Permeability Membrane Cap

The low-permeability membrane cap will cover side-slopes greater than 6 percent and up to 33 percent grade around portions of the west, south, and east perimeters of the Interim Action Area. The low-permeability membrane cap will act as a barrier to infiltrating stormwater and will mitigate risk to human health and the environment by preventing direct contact exposure with solid waste. This type of cap system requires specific design considerations to address drainage

controls and to provide for durability. Application of a low-permeability membrane cap on side slopes will include a maintenance program consisting of periodic inspections and repairs to maintain imperviousness.

The low-permeability membrane cap will be composed of a minimum of three layers:

1. A 6-inch minimum-thickness compacted fill bedding layer;
2. A minimum 50-mil-thickness high-density polyethylene (HDPE) membrane; and
3. An 18-inch-thick-minimum drainage and vegetative soil layer consisting of granular top soil, and planted with grass as indicated in landscaping plans.

The low-permeability membrane cap will be constructed on the existing soil cover that previously was placed over solid waste (with variable thickness reported to range from 0 to 48 inches). Therefore, the total thickness of the low-permeability membrane cap will be a minimum of 24 inches, not including the thickness of the existing landfill cover.

A minimum 6-inch-thick layer of compacted fill bedding layer will be placed over the exiting cover material. The geomembrane will be installed over the bedding layer and will serve as the primary infiltration barrier and as a distinct marker boundary. The minimum 50-mil-thick HDPE geomembrane will be textured on both sides to maintain the slope-stability of the membrane and cover soil, and will be anchored at the top of the slope. The properties of the HDPE geomembrane accommodate potential long-term settlement of the landfill due to the elongation-before-break characteristics of this material. The geomembrane liner will be covered by a granular drainage and vegetative soil layer providing drainage as well as substrate for grass landscaping that will reduce the potential for erosion. Drainage within this layer will be routed down-slope to a perforated pipe installed at the base of the slope. Collected water will be conveyed and discharged to the surface water control system.

5.2 LANDFILL GAS CONTROL

Decomposition of organic waste in a landfill produces various gases, principally methane and carbon dioxide. When organic waste is initially placed, it contains oxygen and decomposes aerobically for a short time, producing carbon dioxide. After the oxygen is depleted, anaerobic decomposition takes place, and both methane and carbon dioxide are produced, both of which are colorless and odorless. Trace amounts of odorous gases such as mercaptans may also be present. Due to the age of the South Park Landfill (over 40 years) and the fact that organic material was occasionally burned, only a small amount of landfill gas is expected to be produced from the Interim Action Area compared with a recently closed municipal landfill. However, a landfill gas control system will be constructed to limit the potential threat to human health due to potential landfill gas accumulation in structures that will be built for future development of the SPPD property or migration of landfill gas to properties adjacent to the Interim Action Area.

Landfill gas migration criteria under the MFS are defined in WAC 173-304-460 and King County Board of Health Title 10 regulations. The principal criteria relevant to the whole of the South Park Landfill Site include the following:

- Methane concentrations in soil at the facility boundary must not exceed 5 percent by volume, the lower explosive limit for methane;
- Methane concentrations inside buildings and structures on the landfill must not exceed 1.25 percent by volume, or 25 percent of the lower explosive limit; and
- Methane concentrations inside buildings and structures off the landfill must not exceed 100 parts per million volume.

The landfill gas control system will be composed of a network of horizontal and vertical gas collectors, piping to convey the extracted landfill gas to an equipment area, the vacuum blower and condensate knockout equipment area, carbon filters and gas discharge vent stack, and a condensate sump/pump system. In general, vertical gas collectors will be located in the interior of the Interim Action Area and horizontal gas collectors will be located at the perimeter of the Interim Action Area, adjacent to the boundary with the Seattle South Recycling and Disposal Station and on City property adjacent to the western side of 5th Avenue South, where landfill gas migration is most likely to occur. Vacuum/flow control valve assemblies equipped with gate valves and monitoring ports will be installed at the connection to each gas collector. The gate valves will be used to adjust the flow and vacuum, and the monitoring ports will be used to monitor gas composition and pressures. Horizontal collectors will be sloped so that condensate will drain to collection sumps located at select locations. The sumps will contain a pump that discharges to the sanitary sewer.

5.3 SURFACE WATER CONTROL

Goals for surface water controls associated with the Interim Action include:

- Capture stormwater and convey surface water out of the Interim Action Area before it has an opportunity to make contact with buried solid waste;
- Minimize the potential for disturbing, eroding, scouring, or otherwise mobilizing material deposited in the West Ditch or constituents associated with solid waste;
- Meet stormwater regulatory obligations with respect to conveyance, quantity, flow, and quality; and
- Convey stormwater runoff from areas of the City of Seattle Occidental Avenue South right-of-way and other private properties currently contributing stormwater flow to the West Ditch.

The Interim Action Area includes the West Ditch situated along the western margin of the South Park Landfill and portions of the West Ditch that lie both within the SPPD parcel and within the City of Seattle Occidental Avenue South right-of-way. For approximately 60 percent of the length of the West Ditch, its base is situated on the SPPD parcel. For the remaining approximately 40 percent of its length, the base of the West Ditch is situated at least partially -

within the City of Seattle right-of-way for Occidental Avenue South. As the West Ditch is a dominant surface water drainage feature proximate to the South Park Landfill, elements of the interim action at the West Ditch are included in this section regarding surface water controls. Interim action activities at the West Ditch are based on results of the RI as presented in the RI/FS Report and field evaluation of geotechnical conditions by the SPPD geotechnical engineer.

Appendix A, Interim Action Elements at the West Ditch—Engineering Design Drawings, contains current civil engineering drawings for the West Ditch portion of the Interim Action Area. The design criteria for stormwater controls were developed in accordance with the requirements of the Stormwater, Drainage, and Erosion Control regulations (Chapter 22.802 of the Seattle Municipal Code), current SPPD development plans, and anticipated future NPDES permit requirements for future tenants of the SPPD property. Surface water controls for the SPPD property include construction of a stormwater collection and conveyance system in the area of the East-West Channel flowing to the West Ditch area and construction of two bioswales, one on the north edge of the SPPD property (North Bioswale) and the second within the West Ditch (West Bioswale).

Interim action activities at the West Ditch, including surface water controls, consist of constructing the West Bioswale in the northern reach of the West Ditch, and raising the grade of the base of the West Ditch north and south of the West Bioswale is being considered. Except for in the two bioswales, stormwater will be conveyed with underground piping. Surface water discharge from the West Ditch currently is routed through a private stormwater conveyance line beneath the Kenyon Industrial Park, which discharges to a City of Seattle storm drain line in South Kenyon Street. The surface water control design entails construction of a new storm drain line to be installed in the public right-of-way along Occidental Avenue South, bypassing the Kenyon Industrial Park storm drain line, to convey stormwater flows from the SPPD property, including flows from both of the bioswales, and from current tributary inflows from areas west of the West Ditch. SPPD intends to submit revised drainage control plans for review by the City of Seattle in the near future. NPDES permit requirements will be satisfied by a future tenant(s) as appropriate for tenant business activities.

The West Ditch has been part of the stormwater system in the area that includes the South Park Landfill for decades, and will be modified during the interim action to continue to be used to convey stormwater from the redeveloped SPPD parcel. Planning for interim action activities at the West Ditch considered current geotechnical and environmental conditions in the West Ditch relevant to stormwater management at the SPPD property. During completion of the RI, samples of material deposited in the West Ditch were collected from locations below the mud-line along the West Ditch to assess the thickness of material recently deposited in the West Ditch, and particle size distribution of the material. The RI also evaluated the presence of hazardous substances in deposited material in the West Ditch. Findings regarding conditions along the West Ditch are presented in the RI/FS Report and are summarized in Section 2.3, Summary of Environmental Conditions.

During an on-site examination of the West Ditch in March 2012, geotechnical engineers observed the fine particle size, organic content, and high water content of the material. The SPPD geotechnical engineer describes the material as “muck,” and states that it is geotechnically

incompetent to support surface water control improvements in the West Ditch. The thickness of the soft, incompetent material was determined to range between 0 and 8 feet, with a representative average thickness of about 6 to 8 feet at the base of the West Ditch. It was evident that removal of the muck would present constructability concerns because of the high water content and concerns pertaining to undermining the stability of side slopes. Occidental Avenue South is situated at the top of the western slope, and South Park Landfill solid waste occurs in parts of the eastern slope. SPPD development plans include paving to the top of the eastern slope.

The SPPD consultant team, including geotechnical, civil, and environmental engineers, determined that the best approach is to solidify and grade the existing ditch, install a storm sewer, and elevate the ditch invert. This will be accomplished by: mixing portland cement into the recently deposited material in the West Ditch to increase geotechnical compressive strength and reduce mobility of chemical constituents; grading the solidified material; constructing the West Bioswale and western slope soil cover; installing a low-permeability membrane cap system on the eastern slope; conveying captured SPPD property stormwater in a buried pipe to the West Bioswale, and raising the grade north and south of the West Bioswale.

The SPPD consultant team identified the following construction elements to most-effectively and practicably mitigate conditions along the West Ditch to satisfy environmental, geotechnical, constructability, and ultimately surface water control objectives:

- Clear and grub the West Ditch to remove organic detritus, grasses, brush, and trees. This material will be removed, shredded, characterized for disposal, and disposed of off the SPPD property at an organic waste recycling facility or disposal facility, as appropriate. Removal of the organic material from the bottom and side slopes of the West Ditch will lower existing ground surface elevations by approximately 6 to 8 inches.
- Solidify organic-rich, high-liquid-content West Ditch material situated above and below the water table with portland cement to the depth of native soil interface using long-arm track-hoe, auger, or other mixing equipment. Portland cement solidification is a common method of improving the structural characteristics of high-water-content soil material, and a means of reducing mobilization of contaminants. Portland cement-solidified soil material typically can be expected to exhibit permeabilities between 10^{-5} and 10^{-8} centimeters per second (equivalent to silt or clay), and typical unconfined compressive strengths greater than 10 pounds per square inch, sufficient to enable finish grading and construct surface water control improvements. The actual mix design (i.e., how much cement to apply) will be determined using bench- or pilot-scale testing by a specialty contractor during the construction phase. Effective solidification typically is achieved with a 3 to 10 percent by weight portland cement mix.
- Construct a low-permeability membrane cap on the eastern slope entailing grading prior to placement, as described in Section 5.1.2, Low-Permeability Membrane Cap. If solid waste is encountered during subgrade preparation for the eastern slope low-permeability membrane cap, it will be reinterred beneath the landfill cap system on the SPPD property portion of the Interim Action Area.

- Construct a western slope soil cover entailing grading and placement of a minimum of 18 inches of cover material over the existing ground surface and on top of a marker fabric or other product. Solid waste is not known to occur on the western slope of the West Ditch. However, if solid waste is encountered during subgrade preparation for the western slope soil cover, it will be reinterred beneath the landfill cap system on the SPPD property portion of the Interim Action Area.
- Grade solidified material in the West Ditch, distributing material from areas currently above design grade (e.g., northern areas) to areas below design grade (e.g., southern areas); excess material, if any, would be re-interred under the new cap on the SPPD property as solidified material upon receipt of appropriate approvals from Ecology.
- Pre-load areas indicated by the geotechnical engineer prior to installation of stormwater infrastructure and/or in areas to receive soil fill to consolidate underlying soil and reduce future settlement.
- Install West Ditch collector storm drain piping consisting of 24-inch-nominal-diameter storm sewer piping along the western side of the ditch to pick up existing storm drain connections from west of Occidental Avenue South, and from catch basins installed along adjacent areas of Occidental Avenue South. This tight-line storm sewer will discharge to a 30-inch-nominal-diameter storm drain line and eventually into the storm drain line to be installed along Occidental Avenue South to bypass the privately owned Kenyon Industrial Park storm drain line currently receiving West Ditch discharge. If necessary for efficient operation of a landfill gas control system, piping will be backfilled at appropriate areas with low-permeability material to eliminate preferential pathways for landfill gas migration.
- Install 24-inch-nominal-diameter storm drain piping receiving stormwater discharge from the SPPD property collected in the storm drain system to be installed in the East-West Channel. This stormwater will be discharged into the south end of the West Bioswale. Discharge of treated stormwater from the north end of the West Bioswale will flow to the 30-inch-nominal-diameter storm drain line also receiving discharge from the collector storm drain, described above. If necessary for efficient operation of a landfill gas control system, piping will be backfilled at appropriate areas with low-permeability material to eliminate preferential pathways for landfill gas migration.
- Backfill the West Ditch north and south of the West Bioswale to provide a minimum of 18 inches of cover over storm sewer piping and per a finish grading plan included in the current civil engineering design as indicated in drawings provided in Appendix A.
- Construct the West Bioswale and drainage. The engineering design for the West Bioswale includes placement of 18 inches of fill at the base, and 6 inches of top soil along the base and side slopes. The bioswale will be a “wet” bioswale without a liner or under-drain.

Without drainage, easterly flowing groundwater encountering the solidified material will rise by some amount, increasing downward flux, and groundwater levels may rise up-gradient of the solidified mass. Current estimates of groundwater rise without drainage is 1 to 2 feet to the west

of the solidified material, and little or no rise to the east. Groundwater elevations to the east of the solidified mass may actually drop once infiltration recharge on the SPPD has been reduced with capping. The primary goals in providing drainage across the solidified material are 1) minimize changes in the groundwater flow regime caused by the solidified mass and 2) minimize the potential that groundwater would rise into the West Bioswale during high groundwater conditions and subsequently be conveyed to the City storm drain system. The general drainage plan is shown in Appendix A and consists of a system of cross-over drains notched into the top of the solidified mass. The drains will be filled with high-permeability drain rock. A layer of drain rock also will be placed beneath the West Bioswale to provide additional groundwater conveyance capacity and to hydraulically connect the cross-over drains. The conveyance capacity of the planned drainage system was calculated to be approximately twice that anticipated to be required to route existing groundwater flow over the solidified mass based on conservative assumptions.

See *West Ditch Interim Action Effects Evaluation, SPPD Property-Specific Work, Seattle, Washington* for an evaluation of potential effects on groundwater as a result of the solidification (Farallon 2012).

Figures 5 and 6 show schematic cross-sections at Occidental Avenue South station 27+00 and 24+00 respectively. See Sheet 1 of Appendix A for road stationing. Figure 5 shows schematic construction details in a section across the West Bioswale and side slopes. Figure 6 shows schematic construction details across a section south of the West Bioswale where stormwater is piped and the West Ditch invert is raised. The engineering design drawings in Appendix A show details of the current West Ditch interim action design.

5.4 INSTITUTIONAL CONTROLS

Institutional controls shall be implemented in accordance with WAC 173-340-440 to limit or prohibit activities that may diminish the integrity of the Interim Action or potentially result in exposure to hazardous substances at the Site. These institutional controls shall include recording an environmental covenant on the property title restricting the use of groundwater at the Interim Action Area, requiring that the cap be maintained in the future, requiring mitigation measures to prohibit potential exposure to hazardous substances if the cap is damaged in the future, and stipulating procedures in the case that the landfill cap is penetrated either accidentally or as part of a future construction plan.

6.0 COMPLIANCE MONITORING AND REPORTING

Compliance monitoring will be performed in accordance with the requirements of WAC 173-340-410, as described in the Compliance Monitoring Plan prepared for the Interim Action contained in Appendix C. A Compliance Monitoring Plan will also be prepared for the cleanup action selected for the South Park Landfill Site following completion of the RI/FS. The Interim Action Compliance Monitoring Plan, includes protection, performance, and confirmational monitoring requirements. The Interim Action Compliance Monitoring Plan includes landfill gas monitoring and other monitoring during construction of the Interim Action components such as the landfill cap, landfill gas control system, and stormwater control system. Monitoring of other media (e.g., stormwater, air emissions, discharge to sewer) will be addressed as required under facility-specific permits or other requirements for those media.

Results of the compliance monitoring and other construction monitoring will be provided in the Interim Action Report. The construction documentation will meet the requirements of WAC 173-340-400(6)(b).

7.0 SCHEDULE

The schedule for the Interim Action is indicated in the table below.

Milestone	Date
Engineering Design Report for the landfill gas control system, Operation & Maintenance Plans for Capping and Landfill Gas Control Systems	80 days from Ecology approval of the Interim Action Work Plan.
Initiation of Interim Action Compliance Monitoring	Within 90 days prior to start of construction
Start of Construction—Interim Action Elements	September 6, 2012, or 10 days from receipt of requisite permitting and Ecology approval of this Interim Action Work Plan, whichever is later. Construction is also pursuant to execution of a legal agreement between SPPD and the City of Seattle.
Interim Action Report	60 days from completion of construction of interim action elements with annual addenda documenting ongoing compliance monitoring and until compliance monitoring begins for the South Park Landfill Site.
Institutional Controls	60 days from completion of interim action construction elements.

8.0 REFERENCES

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9.0 LIMITATIONS

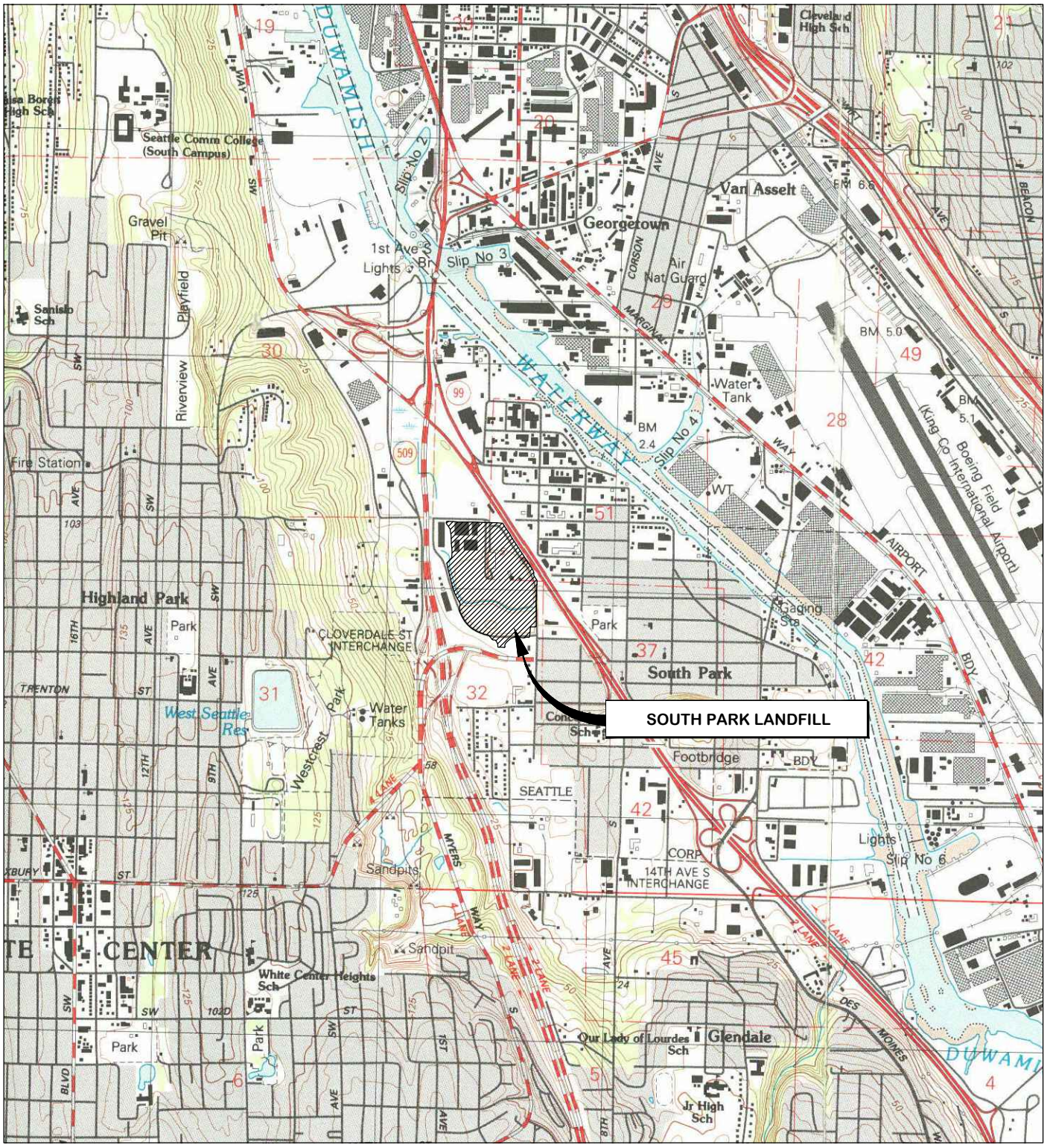
The conclusions and recommendations contained in this report/assessment are based on professional opinions with regard to the subject matter. These opinions have been arrived at in accordance with currently accepted hydrogeologic and engineering standards and practices applicable to this location and are subject to the following inherent limitation:

- **Accuracy of Information.** Certain information used by Farallon in this report/assessment has been obtained, reviewed, and evaluated from various sources believed to be reliable. Although Farallon's conclusions, opinions, and recommendations are based in part on such information, Farallon's services did not include verification of its accuracy or authenticity. Should such information prove to be inaccurate or unreliable, Farallon reserves the right to amend or revise its conclusions, opinions, and/or recommendations.

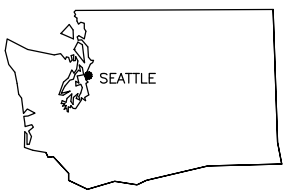
FIGURES

INTERIM ACTION WORK PLAN
South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002



REFERENCE: 7.5 MINUTE USGS QUADRANGLE SEATTLE SOUTH, WASHINGTON. DATED 1953 AND PHOTOREVISED 1981



FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027

FIGURE 1

SITE VICINITY MAP
SOUTH PARK LANDFILL SITE
SEATTLE, WASHINGTON

FARALLON PN: 408-002

Drawn By: DEW	Checked By: TC	Date: 5/1/12	Disk Reference: BASEMAPb

P:\Projects\408 South Park Prop Dev\408002 SPPD Property Specific Work\Drawings_Plots\BASEMAPb.dwg, 5/1/2012 3:31:04 PM

CITY OF SEATTLE
NEW SOUTH RECYCLING AND DISPOSAL STATION
(TO BE CONSTRUCTED; FORMERLY KNOWN AS THE
SOUTH KENYON STREET BUS YARD)

7901 2nd AVE S, L.L.C.
PARCEL NO. 3224049077
0.72 ACRES

HARSCH INVESTMENT PROPERTIES, L.L.C.
PARCEL NO. 3224049007
6.49 ACRES

SEATTLE SOUTH RECYCLING
AND DISPOSAL STATION
PARCEL NO. 7328400005
11.26 ACRES

SOUTH PARK PROPERTY DEVELOPMENT, L.L.C.
PARCEL NO. 3224049005
19.4 ACRES

KAHN FAMILY L.L.C
PARCEL NO. 3224049084
0.62 ACRES

LENCI FRANK CORPORATION
PARCEL NO. 3224049045
2.77 ACRES

DIETRICH AVE SW
SW KENYON ST
S KENYON ST
S HOLDEN ST
S PORTLAND ST
S CHICAGO ST
S MONROE ST
E ELMGROVE ST
S ROSE ST
S SULLIVAN ST
S CLOVERDALE ST
1st AVE S
OCCIDENTAL AVE S
2nd AVE S
5th AVE S
7th AVE S
STATE ROUTE 509
STATE ROUTE 99
STATE ROUTE 99 MEDIAN
WEST DITCH
FLOW
CULVERT (UNCONFIRMED PLUG)
CULVERT

KMW-7, KMW-6, KMW-3A, KMW-5, KMW-4, KMW-8, KMW-2, KMW-2B, KMW-1A
MW-25, MW-31, MW-30, MW-10, MW-32, MW-33, MW-26, MW-24, MW-8, MW-27, MW-12, MW-3, MW-14, MW-1, MW-18, MW-29, MW-4, MW-6
HMW-1
PZ-3, PZ-2, PZ-1

LEGEND

- SOUTH PARK LANDFILL BOUNDARY
- KING COUNTY TAX PARCEL BOUNDARY
- INTERIM ACTION AREA
- FENCE
- DITCH
- EXISTING BUILDING
- MONITORING WELL SCREENED IN UPPER ZONE OF SHALLOW AQUIFER (A-ZONE)
- MONITORING WELL SCREENED IN LOWER ZONE OF SHALLOW AQUIFER (B-ZONE)
- PIEZOMETER

NOTES:

1. FIGURE INCLUDES INFORMATION PRESENTED IN COLOR. PHOTOCOPIES MAY NOT DEPICT ALL INTENDED INFORMATION ON THE ORIGINAL DRAWING.
2. ALL LOCATIONS ARE APPROXIMATE

N

0 300
APPROXIMATE SCALE IN FEET

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027

FIGURE 2

SITE MAP SHOWING INTERIM ACTION AREA
AND PARCEL BOUNDARIES
SOUTH PARK LANDFILL SITE
SEATTLE, WASHINGTON

FARALLON PN: 408-002

Drawn By: DEW	Checked By: CS	Date: 2/15/13	Disk Reference: BASEMAPb

KENYON ST

S KENYON ST

OCCIDENTAL AVE S

STATE ROUTE 509

1st AVE S

KENYON BUSINESS PARK

2nd AVE S

STATE ROUTE 99

STATE ROUTE 99 MEDIAN

S MONROE ST

E ELMGROVE ST

5th AVE S

SEATTLE SOUTH RECYCLING AND DISPOSAL STATION

SPPD PROPERTY

EMERSON POWER PRODUCTS

S SULLIVAN ST

KMW-7 (13.94)
KMW-6 (8.54)
KMW-3A (8.48)
KMW-5 (10.31)
KMW-4 (8.48)
KMW-8 (13.77)
KMW-2 (NM)
KMW-2B (NM)
KMW-1A (8.58)
MW-12 (12.70)
MW-3 (14.75)
MW-14 (16.50)
MW-1 (17.78)
MW-25 (6.55)
MW-10 (6.54)
MW-31
MW-30
MW-32
MW-33
MW-26 (6.60)
MW-24 (6.63)
MW-8 (6.79)
MW-27 (6.81)
HMW-1 (NM)
MW-18 (7.08)
MW-29
MW-4 (9.30)
PZ-3
PZ-2
PZ-1

CULVERT (UNCONFIRMED PLUG)
CULVERT

13.00 12.00 11.00 10.00 9.00 8.00 7.00 14.00 15.00 16.00 17.00

LEGEND

- SOUTH PARK LANDFILL BOUNDARY
- INTERIM ACTION AREA
- DITCH OR CHANNEL
- FENCE
- EXISTING BUILDING
- MONITORING WELL SCREENED IN UPPER ZONE OF SHALLOW AQUIFER (A-ZONE)
- MONITORING WELL SCREENED IN LOWER ZONE OF SHALLOW AQUIFER (B-ZONE)
- PIEZOMETER
- (6.89) GROUNDWATER ELEVATION (FEET ABOVE MEAN SEA LEVEL)
- (NM) NOT MEASURED
- 7.00 GROUNDWATER ELEVATION CONTOUR, DASHED WHERE INFERRED
- APPROXIMATE DIRECTION OF GROUNDWATER FLOW

NOTES:

1. FIGURE INCLUDES INFORMATION PRESENTED IN COLOR. PHOTOCOPIES MAY NOT DEPICT ALL INTENDED INFORMATION ON THE ORIGINAL DRAWING.
2. ALL LOCATIONS ARE APPROXIMATE

0 200

APPROXIMATE SCALE IN FEET

FIGURE 3

GROUNDWATER CONTOUR MAP
MARCH 30, 2009
SOUTH PARK LANDFILL SITE
SEATTLE, WASHINGTON

FARALLON PN: 408-002

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Drawn By: DEW | Checked By: CS | Date: 2/15/13 | Disk Reference: BASEMAPa

7901 2nd AVE S, L.L.C.
PARCEL NO. 3224049077
0.72 ACRES

HARSCH INVESTMENT PROPERTIES, L.L.C.
PARCEL NO. 3224049007
6.49 ACRES

SEATTLE SOUTH RECYCLING
AND DISPOSAL STATION
PARCEL NO. 7328400005
11.26 ACRES

SOUTH PARK PROPERTY DEVELOPMENT, L.L.C.
PARCEL NO. 3224049005
19.4 ACRES

KAHN FAMILY L.L.C
PARCEL NO. 3224049084
0.62 ACRES

LENCI FRANK CORPORATION
PARCEL NO. 3224049045
2.77 ACRES

S KENYON ST
S MONROE ST
E ELMGROVE ST
S SULLIVAN ST
OCCIDENTAL AVE S
1st AVE S
2nd AVE S
5th AVE S
STATE ROUTE 509
STATE ROUTE 99
STATE ROUTE 99 MEDIAN
ACCESS
BUILDING
BUS PARKING
FUELING STATIONS
MAINTENANCE
EMPLOYEE PARKING
STORMWATER TREATMENT BIOSWALES
FLOW
WEST DITCH

KMW-7
KMW-6
KMW-3A
KMW-5
KMW-4
KMW-8
KMW-2
KMW-2B
KMW-1A
MW-25
MW-10
MW-26
MW-24
MW-8
MW-27
HMW-1
MW-12
MW-3
MW-14
MW-1
MW-4
MW-18
PZ-3
PZ-2
PZ-1

LEGEND

- INTERIM ACTION AREA
- SOUTH PARK LANDFILL BOUNDARY
- KING COUNTY TAX PARCEL BOUNDARY
- FENCE
- DITCH OR CHANNEL
- EXISTING BUILDING
- MONITORING WELL SCREENED IN UPPER ZONE OF SHALLOW AQUIFER (A-ZONE)
- MONITORING WELL SCREENED IN LOWER ZONE OF SHALLOW AQUIFER (B-ZONE)
- PIEZOMETER

NOTES:
1. FIGURE INCLUDES INFORMATION PRESENTED IN COLOR. PHOTOCOPIES MAY NOT DEPICT ALL INTENDED INFORMATION ON THE ORIGINAL DRAWING.
2. ALL LOCATIONS ARE APPROXIMATE

N

0 300
APPROXIMATE SCALE IN FEET

FIGURE 4

GENERAL SITE DEVELOPMENT PLAN
SOUTH PARK LANDFILL SITE
SEATTLE, WASHINGTON

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027

FARALLON PN: 408-002

Drawn By: DEW	Checked By: CS	Date: 5/1/12	Disk Reference: BASEMAPb

WEST BIOSWALE AT APPROXIMATE ROAD SECTION 27+00

WEST SLOPE COVER SYSTEM | WEST BIOSWALE 17' | EAST SLOPE LOW-PERMEABILITY MEMBRANE CAP | ASPHALTIC CONCRETE CAP

OCCIDENTAL AVENUE SOUTH

APPROXIMATE PROPERTY BOUNDARY

APPROXIMATE LANDFILL BOUNDARY

APPROXIMATE ROAD ELEVATION +19'

PROPOSED SHOULDER IMPROVEMENTS

1.5' TO 3' IMPORTED FILL

EXISTING ASPHALT CONCRETE

MARKER FABRIC PLACED ON PREPARED EXISTING GROUND SURFACE

2.5:1

1.5' IMPORTED FILL

APPROXIMATE FINISHED ELEVATION +12.9'

24" COLLECTOR STORM SEWER TO CAPTURE CURRENT TRIBUTARY INFLOWS TO WEST DITCH (APPROXIMATE INVERT ELEVATION +11.9')

PRE-CONSTRUCTION APPROXIMATE GROUNDWATER ELEVATION: +10.5'

APPROXIMATE ELEVATION = +5'

SOLIDIFIED MATERIAL

APPROXIMATE TOP-OF-ASPHALT ELEVATION +24'

PROPOSED SPPD PROPERTY IMPROVEMENTS

6" TOPSOIL

1' IMPORTED FILL DRAINAGE LAYER

6" BEDDING LAYER

3:1

APPROXIMATE EXISTING GRADE

EXISTING SOIL COVER OVER SOLID WASTE (VARIABLE THICKNESS 0-48")

2' x 2' GRAVEL-FILLED GEOMEMBRANE ANCHOR

50 mil MINIMUM TEXTURED GEOMEMBRANE

SOLID WASTE

NATIVE MATERIAL

DRAINAGE (4' WIDE BY 2' DEEP TRENCH CUT INTO TOP OF SOLIDIFIED MASS AND FILLED WITH DRAIN ROCK)

ESTUARINE DEPOSIT (APPROXIMATE ELEVATION BELOW WEST DITCH -10')

A-ZONE OF ALLUVIAL AQUIFER

NOT TO SCALE
DRAFT

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027

FIGURE 5

SCHEMATIC CROSS-SECTION:
ROAD STATION 27+100
SOUTH PARK LANDFILL SITE
SEATTLE, WASHINGTON

FARALLON PN: 408-002

Drawn By: DEW	Checked By: CS	Date: 5/1/12	Disk Reference: DITCH_DET

P:\Projects\408 South Park Prop Dev\408002 SPPD Property Specific Work\Drawings_Plots\DITCH-DETAIL.dwg, 5/4/2012 11:06:17 AM

SOUTH OF WEST BIOSWALE AT APPROXIMATE ROAD SECTION 24+00

WEST SLOPE COVER SYSTEM

EAST SLOPE LOW-PERMEABILITY MEMBRANE CAP

ASPHALTIC CONCRETE CAP

APPROXIMATE LANDFILL BOUNDARY

OCCIDENTAL AVENUE SOUTH

APPROXIMATE ROAD ELEVATION +19'

PROPOSED SHOULDER IMPROVEMENTS

1.5' TO 3' IMPORTED FILL

EXISTING ASPHALT CONCRETE

MARKER FABRIC PLACED ON PREPARED EXISTING GROUND SURFACE

APPROXIMATE TOP-OF-ASPHALT ELEVATION +24'

PROPOSED SPPD PROPERTY IMPROVEMENTS

VARIABLE THICKNESS IMPORTED FILL

6" TOPSOIL

1' IMPORTED FILL DRAINAGE LAYER

6" BEDDING LAYER

APPROXIMATE EXISTING GRADE

EXISTING SOIL COVER OVER SOLID WASTE (VARIABLE THICKNESS 0-48")

2' x 2' GRAVEL-FILLED GEOMEMBRANE ANCHOR

50 mil MINIMUM TEXTURED GEOMEMBRANE

24" STORM SEWER FROM SPPD PROPERTY TO WEST BIOSWALE (APPROXIMATE INVERT ELEVATION +14.64')

SOLID WASTE

12" COLLECTOR STORM SEWER TO CAPTURE CURRENT TRIBUTARY INFLOWS TO WEST DITCH (APPROXIMATE INVERT ELEVATION +11.9')

PRE-CONSTRUCTION APPROXIMATE GROUNDWATER ELEVATION: +10.5'

SOLIDIFIED MATERIAL

APPROXIMATE ELEVATION = +5'

NATIVE MATERIAL

DRAINAGE (4' WIDE BY 2' DEEP TRENCH CUT INTO TOP OF SOLIDIFIED MASS AND FILLED WITH DRAIN ROCK)

A-ZONE OF ALLUVIAL AQUIFER

ESTUARINE DEPOSIT (APPROXIMATE ELEVATION BELOW WEST DITCH -10')

NOT TO SCALE

DRAFT

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027

FIGURE 6

SCHEMATIC CROSS-SECTION:
ROAD STATION 24+100
SOUTH PARK LANDFILL SITE
SEATTLE, WASHINGTON

FARALLON PN: 408-002

Drawn By: DEW	Checked By: CS	Date: 5/4/12	Disk Reference: DITCH_DET

TABLES

INTERIM ACTION WORK PLAN
South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002

Table 1
2007 through 2009 Groundwater Level Elevations
South Park Landfill Site
Seattle, Washington
Farallon PN: 408-002

Well Identification	Date Monitored	Monitored By	TOC Elevation (ft NAVD 88)[1]	Screened Interval (feet bgs)	Depth to Groundwater (feet)	Groundwater Elevation (ft NAVD 88)[1]
Monitoring Wells Screened in Upper Zone of Shallow Aquifer						
HMW-01	7/27/2009	Farallon	Unknown	Unknown	9.91	Unknown
	8/7/2009	Farallon			10.04	Unknown
MW-1	3/27/2007	Farallon	19.61	3 to 13	1.37	18.24
	9/26/2007	Farallon			3.60	16.01
	3/4/2008	Farallon			2.08	17.53
	4/22/2008	Farallon			2.00	17.61
	10/22/2008	Farallon			3.52	16.09
	3/30/2009	Farallon			1.83	17.78
	7/27/2009	Farallon			3.56	16.05
	8/7/2009	Farallon			3.64	15.97
MW-3	3/27/2007	Farallon	18.78	2 to 13	2.84	15.94
	9/26/2007	Farallon			5.34	13.44
	3/4/2008	Farallon			4.40	14.38
	4/22/2008	Farallon			4.36	14.42
	10/22/2008	Farallon			5.31	13.47
	3/30/2009	Farallon			4.03	14.75
	7/27/2009	Farallon			5.54	13.24
	8/7/2009	Farallon			5.53	13.25
MW-12	3/27/2007	Farallon	20.63	10 to 15	7.54	13.09
	9/26/2007	Farallon			8.64	11.99
	3/4/2008	Farallon			8.14	12.49
	4/22/2008	Farallon			8.06	12.57
	10/22/2008	Farallon			8.61	12.02
	3/30/2009	Farallon			7.93	12.70
	7/27/2009	Farallon			8.74	11.89
	8/7/2009	Farallon			8.75	11.88
MW-14	3/27/2007	Farallon	19.85	11.5 to 21.5	3.12	16.73
	9/26/2007	Farallon			4.64	15.21
	3/4/2008	Farallon			3.57	16.28
	4/22/2008	Farallon			3.53	16.32
	10/22/2008	Farallon			4.63	15.22
	1/8/2009	Farallon	19.87		2.85	17.02
	1/16/2009	Farallon			3.30	16.57
	1/22/2009	Farallon			3.49	16.38
	1/30/2009	Farallon			3.56	16.31
	2/5/2009	Farallon			3.61	16.26
	2/11/2009	Farallon			3.55	16.32
	3/30/2009	Farallon	19.85		3.35	16.50
	7/27/2009	Farallon			4.70	15.15
	8/7/2009	Farallon			4.72	15.13

Table 1
2007 through 2009 Groundwater Level Elevations
South Park Landfill Site
Seattle, Washington
Farallon PN: 408-002

Well Identification	Date Monitored	Monitored By	TOC Elevation (ft NAVD 88)[1]	Screened Interval (feet bgs)	Depth to Groundwater (feet)	Groundwater Elevation (ft NAVD 88)[1]
MW-25	3/27/2007	Farallon	20.09	22 to 27	12.64	7.45
	9/27/2007	Farallon			14.76	5.33
	3/4/2008	Farallon			13.63	6.46
	4/22/2008	Farallon			13.65	6.44
	10/22/2008	Farallon			14.67	5.42
	3/30/2009	Farallon			13.54	6.55
	7/27/2009	Farallon			14.30	5.79
	8/7/2009	Farallon			14.36	5.73
MW-26	3/27/2007	Farallon	15.94	15 to 25	8.36	7.58
	9/27/2007	Farallon			10.55	5.39
	3/4/2008	Farallon			9.42	6.52
	4/22/2008	Farallon			9.45	6.49
	10/22/2008	Farallon			10.58	5.36
	3/30/2009	Farallon			9.34	6.60
	7/27/2009	Farallon			10.08	5.86
	8/7/2009	Farallon			10.20	5.74
MW-27	3/27/2007	Farallon	14.76	10 to 20	6.97	7.79
	9/27/2007	Farallon			9.28	5.48
	3/4/2008	Farallon			8.10	6.66
	4/22/2008	Farallon			8.14	6.62
	10/22/2008	Farallon			9.33	5.43
	3/30/2009	Farallon			7.95	6.81
	7/27/2009	Farallon			8.80	5.96
	8/7/2009	Farallon			8.94	5.82
KMW-1A	4/22/2008	Farallon	18.03	5 to 21	9.55	8.48
	10/22/2008	Farallon			10.96	7.07
	3/30/2009	Farallon			9.45	8.58
	7/27/2009	Farallon			10.66	7.37
	8/7/2009	Farallon			10.85	7.18
KMW-3A	4/22/2008	Farallon	18.62	9 to 24	10.22	8.40
	10/22/2008	Farallon			11.38	7.24
	3/30/2009	Farallon			10.14	8.48
	7/27/2009	Farallon			10.85	7.77
	8/7/2009	Farallon			10.96	7.66
KMW-04	4/22/2008	Farallon	19.71	5 to 20	11.33	8.38
	10/22/2008	Farallon			12.28	7.43
	3/30/2009	Farallon			11.23	8.48
	7/27/2009	Farallon			11.95	7.76
	8/7/2009	Farallon			12.05	7.66
KMW-05	4/22/2008	Farallon	15.79	5 to 20	5.37	10.42
	10/22/2008	Farallon			6.59	9.20
	3/30/2009	Farallon			5.48	10.31
	7/27/2009	Farallon			6.10	9.69
	8/7/2009	Farallon			6.02	9.77

Table 1
2007 through 2009 Groundwater Level Elevations
South Park Landfill Site
Seattle, Washington
Farallon PN: 408-002

Well Identification	Date Monitored	Monitored By	TOC Elevation (ft NAVD 88)[1]	Screened Interval (feet bgs)	Depth to Groundwater (feet)	Groundwater Elevation (ft NAVD 88)[1]
KMW-06	4/22/2008	Farallon	17.77	5 to 20	9.34	8.43
	10/22/2008	Farallon			10.75	7.02
	3/30/2009	Farallon			9.23	8.54
	7/27/2009	Farallon			10.02	7.75
	8/7/2009	Farallon			10.21	7.56
KMW-07	4/22/2008	Farallon	19.64	5 to 20	5.63	14.01
	10/22/2008	Farallon			6.64	13.00
	3/30/2009	Farallon			5.70	13.94
	7/27/2009	Farallon			6.66	12.98
	8/7/2009	Farallon			6.76	12.88
KMW-08	4/22/2008	Farallon	19.76	5 to 20	5.95	13.81
	10/22/2008	Farallon			6.85	12.91
	3/30/2009	Farallon			5.99	13.77
	7/27/2009	Farallon			6.92	12.84
	8/7/2009	Farallon			7.00	12.76
PZ-01	1/8/2009	Farallon	18.86	3 to 13	2.11	16.75
	1/16/2009	Farallon			2.55	16.31
	1/22/2009	Farallon			2.74	16.12
	1/30/2009	Farallon			2.81	16.05
	2/5/2009	Farallon			2.85	16.01
	2/11/2009	Farallon			2.79	16.07
	3/30/2009	Farallon			2.61	16.25
	7/27/2009	Farallon			3.91	14.95
	8/7/2009	Farallon			3.91	14.95
PZ-02	1/8/2009	Farallon	14.50	2 to 8	1.50	13.00
	1/16/2009	Farallon			1.74	12.76
	1/22/2009	Farallon			1.80	12.70
	1/30/2009	Farallon			1.85	12.65
	2/5/2009	Farallon			1.86	12.64
	2/11/2009	Farallon			1.86	12.64
	3/30/2009	Farallon			1.74	12.76
	7/27/2009	Farallon			3.40	11.10
	8/7/2009	Farallon			2.25	12.25

Table 1
2007 through 2009 Groundwater Level Elevations
South Park Landfill Site
Seattle, Washington
Farallon PN: 408-002

Well Identification	Date Monitored	Monitored By	TOC Elevation (ft NAVD 88)[1]	Screened Interval (feet bgs)	Depth to Groundwater (feet)	Groundwater Elevation (ft NAVD 88)[1]
Monitoring Wells Screened in Lower Zone of Shallow Aquifer						
MW-4	3/27/2007	Farallon	21.98	40 to 50	11.64	10.34
	9/26/2007	Farallon			14.46	7.52
	3/4/2008	Farallon			12.77	9.21
	4/22/2008	Farallon			12.81	9.17
	10/22/2008	Farallon			14.22	7.76
	3/30/2009	Farallon			12.68	9.30
	7/27/2009	Farallon			14.05	7.93
	8/7/2009	Farallon			14.15	7.83
MW-6	7/28/2009	Farallon	Unknown	Unknown	11.99	Unknown
	8/7/2009	Farallon			12.22	Unknown
MW-8	3/27/2007	Farallon	14.76	35 to 45	7.02	7.74
	9/27/2007	Farallon			9.32	5.44
	3/4/2008	Farallon			8.13	6.63
	4/22/2008	Farallon			8.18	6.58
	10/22/2008	Farallon			9.45	5.31
	3/30/2009	Farallon			7.97	6.79
	7/27/2009	Farallon			8.94	5.82
	8/7/2009	Farallon			8.97	5.79
MW-10	3/27/2007	Farallon	19.35	35 to 45	11.92	7.43
	9/27/2007	Farallon			14.01	5.34
	3/4/2008	Farallon			12.91	6.44
	4/22/2008	Farallon			12.93	6.42
	10/22/2008	Farallon			13.95	5.40
	3/30/2009	Farallon			12.81	6.54
	7/27/2009	Farallon			13.67	5.68
	8/7/2009	Farallon			13.62	5.73
MW-18	3/27/2007	Farallon	22.03	30 to 40	13.91	8.12
	9/26/2007	Farallon			16.36	5.67
	3/4/2008	Farallon			15.11	6.92
	4/22/2008	Farallon			15.14	6.89
	10/22/2008	Farallon			16.26	5.77
	3/30/2009	Farallon			14.95	7.08
	7/27/2009	Farallon			15.95	6.08
	8/7/2009	Farallon			16.06	5.97
MW-24	3/27/2007	Farallon	15.13	35 to 45	7.55	7.58
	9/27/2007	Farallon			9.81	5.32
	3/4/2008	Farallon			8.65	6.48
	4/22/2008	Farallon			8.69	6.44
	10/22/2008	Farallon			9.83	5.30
	3/30/2009	Farallon			8.50	6.63
	7/27/2009	Farallon			9.43	5.70
	8/7/2009	Farallon			9.43	5.70

Table 1
2007 through 2009 Groundwater Level Elevations
South Park Landfill Site
Seattle, Washington
Farallon PN: 408-002

Well Identification	Date Monitored	Monitored By	TOC Elevation (ft NAVD 88)[1]	Screened Interval (feet bgs)	Depth to Groundwater (feet)	Groundwater Elevation (ft NAVD 88)[1]
PZ-03	1/8/2009	Farallon	29.91	32.5 to 47.5	22.20	7.71
	1/16/2009	Farallon			22.34	7.57
	1/22/2009	Farallon			22.47	7.44
	1/30/2009	Farallon			22.65	7.26
	2/5/2009	Farallon			22.70	7.21
	2/11/2009	Farallon			22.88	7.03
	3/30/2009	Farallon			22.81	7.10
	7/27/2009	Farallon			23.79	6.12
	8/7/2009	Farallon			NM	--
Staff Gauge	1/8/2009	Farallon	12.79	None	1.68	11.11
	1/16/2009	Farallon			1.98	10.81
	1/22/2009	Farallon			2.08	10.71
	1/30/2009	Farallon			2.15	10.64
	2/5/2009	Farallon			2.21	10.58
	2/11/2009	Farallon			2.28	10.51

NOTES:

[1]ft NAVD 88 = elevation in feet relative to North American Vertical Datum 1988

bgs = below ground surface
Farallon = Farallon Consulting, L.L.C
NM = not measured
TOC = top of casing

Table 2
Summary of Prior Investigations
South Park Landfill Site
Seattle, Washington
Farallon PN: 408-002

Reference	Explorations	Media Assessed					Other
		Soil	Groundwater	Surface Water	Sediment	Landfill Gas	
Seattle-King County Public Health Dept (1984)	11 Landfill Gas Probes			X		X	
Seattle-King County Public Health Dept (1986) and Environmental Toxicology International, Inc. (1986)	4 Surface Water Locations 7 Surface Soil Locations 19 Landfill Gas Probes	X		X		X	
Ecology and Environment, Inc. (1988)	7 Borings 6 Surface Water Locations	X		X			
Unknown (1989)	4 Borings	X					
Golder Associates, Inc. (1989)	4 Borings 3 Monitoring Wells 9 Landfill Gas Probes	X	X			X	Assessed 4 buildings for landfill gas
RZA Agra, Inc. (1992a)	6 Borings	X					
RZA Agra, Inc. (1992b)	10 Borings 8 Monitoring Wells	X	X				Aquifer test at monitoring well MW-8
Diagnostic Engineering, Inc.	8 Borings 5 Monitoring Wells	X	X			X	
Udaloy Environmental Services (1997)	14 Test Pits 3 Borings	X					
Seattle Public Utilities Materials Laboratory (1998)	20 Borings						No analytical data was documented
Associated Earth Sciences, Inc. (1998)							Compiled existing information and identified data gaps
Associated Earth Sciences, Inc. (1999a)	43 Test Pits	X					Also presented results for 24 test pits sampled previously
Associated Earth Sciences, Inc. (1999b)							Addressed geotechnical issues for redevelopment
Associated Earth Sciences, Inc. (2000)	8 Monitoring Wells 14 Landfill Gas Probes		X			X	
R. W. Beck, Inc. (1999)							Evaluated stormwater issues related to development
Associated Earth Sciences, Inc. and Aspect Consulting LLC (1999 to 2004)			X	X		X	Conducted periodic groundwater, surface water, and landfill gas monitoring events (no report)
Aspect Consulting LLC (2006)	3 Monitoring Wells		X				
Farallon Consulting, L.L.C. (2007)	25 Test Pits	X					
Farallon Consulting, L.L.C. (2007 and 2010a)			X				Semiannual groundwater monitoring

NOTES:
Full references cited above are listed in Section 8.

Table 3
2007 through 2009 Groundwater Analytical Results for Detected Constituents
South Park Landfill Site
Seattle, Washington
Farallon PN: 408-002

Sample Location	Sample Identification	Sample Date	Sampled By	Groundwater Analytical Results (micrograms per liter)													
				Halogenated Volatile Organic Compounds[1]								Total Metals[2]		Dissolved Metals[2]		Methane[3]	Ethane[3]
				Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl Chloride	Chlorobenzene	1,2-Dichlorobenzene	1,1-Dichloroethane	1,1,1-Trichloroethane	Arsenic	Lead	Arsenic	Lead		
MW-1	MW1-032707	3/27/2007	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	**18**	<1.1	**9.0**	<1	—	—
	MW1-092607	9/26/2007	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	**26**	<1.1	**14.0**	<1	—	—
	MW1-102208	10/22/2008	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	**37**	**2.9**	**18.0**	<1	—	—
	MW1-033009	3/30/2009	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	**21**	**1.8**	<3.0	<1	—	—
MW-3	MW3-032707	3/27/2007	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	—	—
	MW3-092607	9/26/2007	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	<1.1	**3.2**	<1	—	—
	MW3-102208	10/22/2008	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	**2.7**	<3.0	**1.5**	—	—
	MW3-033009	3/30/2009	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	—	—
MW-4	MW4-032707	3/27/2007	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	—	—
	MW4-092607	9/26/2007	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	—	—
	MW4-030408	3/4/2008	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	**170**	<10
	MW4-102308	10/23/2008	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	**3.1**	<3.0	**1.2**	—	—
	MW4-033109	3/31/2009	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	—	—
MW-8	MW8-032707	3/27/2007	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	**1,600**	<250
	MW8-092707	9/27/2007	Farallon	<0.20	**0.28**	<0.20	**0.26**	<0.20	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	**2,900**	<10
	MW8-030508	3/5/2008	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	**980**	<50
	MW8-102308	10/23/2008	Farallon	<0.20	<0.20	<0.20	<0.20	**0.20**	<0.20	<0.20	<0.20	<3.3	**2.1**	<3.0	**2**	**1,500**	<50
	MW8-033109	3/31/2009	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.9	<1.1	<3.0	<1	**880**	<0.50
MW-10	MW10-032707	3/27/2007	Farallon	<0.20	**0.83**	<0.20	**0.33**	**4.9**	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	**38**	**23**
	MW10-092707	9/27/2007	Farallon	<0.20	**0.84**	<0.20	**0.23**	**6.3**	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	**23**	**15**
	MW10-030508	3/5/2008	Farallon	<0.20	**0.88**	<0.20	0.20	**8.5**	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	**13**	**11**
	MW10-102308	10/23/2008	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	**2.8**	<3.0	**1.3**	<0.50	<0.50
	MW10-033109	3/31/2009	Farallon	<0.20	**0.78**	<0.20	<0.20	**4.3**	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	**9.5**	**6.2**
MW-12	MW12-032707	3/27/2007	Farallon	**1.8**	**13**	<0.20	**0.29**	<0.20	<0.20	<0.20	<0.20	**19**	<1.1	<3.0	<1	—	—
	MW12-092607	9/26/2007	Farallon	**1.2**	**14**	<0.20	**0.3**	<0.20	<0.20	<0.20	<0.20	**8.2**	<1.1	**4.3**	<1	—	—
	MW12-030408	3/4/2008	Farallon	**1.1**	**13**	<0.20	**0.55**	<0.20	<0.20	<0.20	<0.20	**7.0**	<1.1	<3.0	<1	**210**	<10
	MW12-102108	10/21/2008	Farallon	**0.78**	**9.8**	<0.20	**0.44**	<0.20	<0.20	<0.20	<0.20	**4.0**	**3.7**	**3.7**	<1	—	—
	MW12-033109	3/31/2009	Farallon	**1.3**	**12**	<0.20	**0.28**	<0.20	<0.20	<0.20	<0.20	**14**	<1.1	<3.0	<1	—	—
MTCA Groundwater Cleanup Levels				**5[4]**	**16[5]**	**160[5]**	**0.2[4]**	**160[5]**	**720[5]**	**1,600[5]**	**200[4]**	**5[4]**	**15[4]**	**5[4]**	**15[4]**	**NA**	**NA**

Table 3
2007 through 2009 Groundwater Analytical Results for Detected Constituents
South Park Landfill Site
Seattle, Washington
Farallon PN: 408-002

Sample Location	Sample Identification	Sample Date	Sampled By	Groundwater Analytical Results (micrograms per liter)													
				Halogenated Volatile Organic Compounds[1]								Total Metals[2]		Dissolved Metals[2]			
				Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl Chloride	Chlorobenzene	1,2-Dichlorobenzene	1,1-Dichloroethane	1,1,1-Trichloroethane	Arsenic	Lead	Arsenic	Lead	Methane[3]	Ethane[3]
MW-14	MW14-032707	3/27/2007	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	—	—
	MW14-092607	9/26/2007	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	—	—
	MW14-030408	3/4/2008	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	**840**	<50
	MW14-102108	10/21/2008	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	**2.2**	<3.0	<1	—	—
	MW14-033109	3/31/2009	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	—	—
MW-18	MW18-032707	3/27/2007	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	—	—
	MW18-092607	9/26/2007	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	—	—
	MW18-030408	3/4/2008	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	**8,200**	<500
	MW18-102308	10/23/2008	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	**2.7**	<3.0	<1	—	—
	MW18-033109	3/31/2009	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	—	—
MW-24	MW24-032707	3/27/2007	Farallon	<0.20	<0.20	<0.20	<0.20	**0.55**	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	**4,300**	<250
	MW24-092707	9/27/2007	Farallon	<0.20	<0.20	<0.20	<0.20	**0.49**	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	**4,500**	<50
	MW24-030508	3/5/2008	Farallon	<0.20	<0.20	<0.20	<0.20	**0.46**	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	**2,400**	<500
	MW24-102308	10/23/2008	Farallon	<0.20	<0.20	<0.20	<0.20	**0.43**	<0.20	<0.20	<0.20	<3.3	**1.8**	<3.0	**1.9**	**3,500**	<100
	MW24-03109	3/31/2009	Farallon	<0.20	<0.20	<0.20	<0.20	**0.42**	<0.20	<0.20	<0.20	<3.3	<1.1	<3.0	<1	**4,700**	<500
MW-25	MW25-032707	3/27/2007	Farallon	**0.34**	**1.4**	**0.53**	**1.2**	**35**	**0.65**	<0.20	<0.20	<3.3	<1.1	<3.0	<1	**1,300**	<250
	MW25-092707	9/27/2007	Farallon	**0.26**	**0.90**	**0.44**	**1.2**	**36**	**0.55**	<0.20	<0.20	<3.3	<1.1	<3.0	<1	**850**	**5.4**
	MW25-030508	3/5/2008	Farallon	<0.20	**0.89**	**0.42**	**1.1**	**37**	**0.52**	<0.20	<0.20	<3.3	<1.1	<3.0	<1	**970**	**65**
	MW25-102308	10/23/2008	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	**1.9**	<3.0	**1.5**	**15**	<1.0
	MW25-033109	3/31/2009	Farallon	<0.40	**0.79**	**0.40**	**0.71**	**46**	**0.68**	<0.40	<0.40	<3.3	<1.1	<3.0	<1	**560**	<50
MW-26	MW26-032707	3/27/2007	Farallon	**0.41**	**0.31**	<0.20	<0.20	<0.20	<0.20	**0.29**	**0.32**	<3.3	<1.1	<3.0	<1	**0.71**	<0.50
	MW26-092707	9/27/2007	Farallon	**0.42**	<0.20	<0.20	<0.20	<0.20	<0.20	**0.32**	<0.20	<3.3	<1.1	<3.0	<1	**48**	<0.50
	MW26-030508	3/5/2008	Farallon	**0.39**	**0.25**	<0.20	<0.20	<0.20	<0.20	**0.47**	**0.30**	<3.3	<1.1	<3.0	<1	**5.0**	<0.50
	MW26-102308	10/23/2008	Farallon	**0.41**	<0.20	<0.20	<0.20	<0.20	<0.20	**0.28**	**0.34**	<3.3	**1.7**	<3.0	**2.1**	**180**	<15
	MW26-033109	3/31/2009	Farallon	**0.38**	**0.29**	<0.20	<0.20	<0.20	<0.20	**0.33**	**0.25**	<3.3	<1.1	<3.0	<1	**0.92**	<0.50
MTCA Groundwater Cleanup Levels				**5[4]**	**16[5]**	**160[5]**	**0.2[4]**	**160[5]**	**720[5]**	**1,600[5]**	**200[4]**	**5[4]**	**15[4]**	**5[4]**	**15[4]**	**NA**	**NA**

Table 3
2007 through 2009 Groundwater Analytical Results for Detected Constituents
South Park Landfill Site
Seattle, Washington
Farallon PN: 408-002

Sample Location	Sample Identification	Sample Date	Sampled By	Groundwater Analytical Results (micrograms per liter)													
				Halogenated Volatile Organic Compounds[1]								Total Metals[2]		Dissolved Metals[2]		Methane[3]	Ethane[3]
				Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl Chloride	Chlorobenzene	1,2-Dichlorobenzene	1,1-Dichloroethane	1,1,1-Trichloroethane	Arsenic	Lead	Arsenic	Lead		
MW-27	MW27-032707	3/27/2007	Farallon	<0.20	**0.69**	<0.20	**0.21**	<0.20	<0.20	<0.20	<0.20	**55**	<1.1	**6.0**	<1	470	<25
	MW27-092707	9/27/2007	Farallon	<0.20	**0.49**	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	**37**	<1.1	**23**	<1	500	<10
	MW27-030508	3/5/2008	Farallon	<0.20	**0.57**	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	**29**	<1.1	**22**	<1	520	<50
	MW27-102308	10/23/2008	Farallon	<0.20	**0.42**	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	**32**	**2**	**17**	**2.4**	330	<25
	MW27-033109	3/31/2009	Farallon	<0.20	**0.46**	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	**33**	<1.1	**25**	<1	510	<50
KMW-7	KMW07-102208	10/22/2008	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	**4.7**	**2**	**4.3**	**1.5**	—	—
KMW-8	KMW08-102208	10/22/2008	Farallon	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<3.3	**2**	<3.0	<1	—	—
MTCA Groundwater Cleanup Levels				**5[4]**	**16[5]**	**160[5]**	**0.2[4]**	**160[5]**	**720[5]**	**1,600[5]**	**200[4]**	**5[4]**	**15[4]**	**5[4]**	**15[4]**	**NA**	**NA**

NOTES:

Results in **bold** denote detected concentration.

Results highlighted and in **bold** denote concentrations above Washington State Model Toxics Control Act Cleanup Regulation (MTCA) cleanup levels for groundwater. Refer to the RI/FS Report for cleanup levels selected for the South Park Landfill Site.

Farallon = Farallon Consulting, L.L.C.

This table does not include most current data collected during completion of the remedial investigation in 2011. Refer to the RI/FS Report for this data and its interpretation.

— = denotes sample not analyzed

< = denotes analyte not detected at or above the reporting limit listed.

[1]Analyzed by U.S. Environmental Protection Agency (EPA) Method 8260B.

[2]Analyzed by EPA Method 6000/7000 Series.

[3]Analyzed by EPA Method 8015/Modified.

[4]Washington State MTCA Method A Cleanup Levels for Groundwater, Table 720-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, as revised November 2007.

[5]Washington State MTCA Cleanup Levels and Risk Calculations, Standard Method B Values for Groundwater, https://fortress.wa.gov/ecy/clarc/Reporting/ChemicalQuery.aspx

Table 4
Applicable or Relevant and Appropriate Requirements
Interim Action Area, South Park Landfill
Seattle, Washington
Farallon PN: 408-002

Potential Chemical-Specific ARARs[1]	Source	Description and Relevance
National Ambient Air Quality Standards	40 CFR 50	Specifies primary and secondary National Ambient Air Quality Standards, National Emission Standards for Hazardous Air Pollutants, and performance standards for new and existing stationary sources. National Ambient Air Quality Standards are applicable to those elements of the Interim Action pertaining to the collection and management of landfill gas.
Federal Regulations Implementing the Toxic Substances Control Act	40 CFR 700-799, as applicable	Specifies testing, handling and disposal requirements for materials contaminated with polychlorinated biphenyls (PCBs), dioxins/furans, etc. These regulations would apply to material generated during conduct of the Interim Action that is found to be contaminated with toxic substances regulated under TSCA.
State Dangerous Waste Regulations	WAC 173-303	Establishes regulatory requirements for the generation, handling, storage, transport, treatment, and disposal of dangerous wastes in the State of Washington under the provisions of the Washington State Hazardous Waste Management Act. These regulations apply to waste deemed dangerous or extremely hazardous to public health or the environment. The regulations would apply to material generated during conduct of the Interim Action that is found to be contaminated with dangerous waste, and requires treatment and disposal off the Site.
Washington State Minimal Functional Standards for Landfills	WAC 173-304-460	This regulation applies to facilities that dispose of solid waste in landfills, with the exception of inert, demolition, and wood waste landfills. It specifies limits on methane concentrations at the property boundary and in on-site and off-site structures, and requires compliance with ambient air quality standards and emission standards at the property boundary. This regulation applies only to solid waste landfills that operated after 1985, but it is a minimum requirement for solid waste landfill cleanups.
Puget Sound Clean Air Agency (PSCAA) Notice of Construction	Regulation I	Requires a Notice of Construction and Application for Approval before constructing or modifying an air contaminant source. This would apply to the Interim Action due to potential emissions of landfill gas.
PSCAA Emission Standards for Toxic Air Pollutants	Regulation III	Implements at a regional level the National Emission Standards for Hazardous Air Pollutants (NESHAPS). It requires best available control technology for sources of toxic air contaminants; and requires that toxic air contaminants be quantified and compared against acceptable source impact levels for each contaminant. PSCAA Emission Standard for Toxic Air Pollutants are applicable to air emissions from the landfill gas collection system.
King County Board of Health Regulations	Title 10	The requirements established in this regulation meet or exceed the requirements established by the Washington State Minimum Functional Standards for Solid Waste Handling . Applicable chemical-specific requirements are the same as those described for the Minimal Functional Standards (see WAC 173-304-460 above).

Table 4
Applicable or Relevant and Appropriate Requirements
Interim Action Area, South Park Landfill
Seattle, Washington
Farallon PN: 408-002

Potential Location-Specific ARARs[1]	**Source**	**Description and Relevance**
Federal Archeological Resource Preservation	RCW 27-53	This law addresses the discovery, identification, excavation, and study of archaeological resources; and the communication of information to state and federal agencies regarding the possible impact of constructions activities on Washington State archaeological resources. Although the Interim Action area has been extensively disturbed during operation of the landfill, this law is potentially applicable during implementation of the Interim Action.
State Permits for Archeological Excavation and Removal	WAC 25-48	Establishes application and review procedures for the issuance of archaeological excavation and removal permits, and for the issuance of civil penalties for violations. This law is potentially applicable in the event that archaeological resources are identified during implementation of the Interim Action.
Potential Action-Specific ARARs[1]	**Source**	**Description and Relevance**
Monitoring and Maintenance		
Federal Occupational Safety and Health Standards	29 CFR 1910.120	Requires that employers develop and implement a written safety and health program for their employees involved in hazardous waste operations. The program must be designed to identify, evaluate, and control safety and health hazards, and provide for emergency response for hazardous waste operations. This regulation is applicable to the implementation of the Interim Action.
State Occupational Health Standards	WAC 296-62	Establishes rules designed to protect the health of employees and help to create a healthy work place by establishing requirements to control health hazards. Requirements for chemical hazard communication programs, workplace lighting levels and exposure records are in the safety and health core rules of this chapter. This regulation is applicable to the implementation of the Interim Action.
Well Construction Standards	WAC 173-160 Part Two	Part Two of this regulation defines minimum standards for the construction and decommissioning of the water resource protection wells that will be installed as part of the groundwater monitoring program to be implemented as part of the Interim Action. Resource protection wells may not be used to withdraw or inject water for domestic, industrial, municipal, commercial, or agricultural purposes. The standards defined in this regulation are directly applicable to the Interim Action groundwater monitoring program.
Groundwater Monitoring Plan	WAC 173-304-490	This regulation addresses groundwater monitoring requirements for solid waste landfills, including provision for a minimum of one up-gradient and two down-gradient monitoring wells. The monitoring plan must specify procedures for sample collection, preservation and shipment, laboratory analysis and associated quality control protocols, and health and safety. Although this requirement applies only to landfills that operated after 1985, these monitoring requirements will be incorporated into the groundwater monitoring program that will be conducted as part of the RI/FS.

Table 4
Applicable or Relevant and Appropriate Requirements
Interim Action Area, South Park Landfill
Seattle, Washington
Farallon PN: 408-002

Potential Action-Specific ARARs (cont'd)	Source	Description and Relevance
Excavation and Filling		
State Particulate Matter Standards	WAC 173-470	Establishes maximum acceptable levels for particulate matter in ambient air based on the criteria defining particulate matter that have been developed by the U.S. Environmental Protection Agency. This regulation establishes requirements for monitoring, measuring, and reporting particulate matter data. It applies to dust-producing activities during implementation of the Interim Action, particularly excavation and filling.
PSCAA Fugitive Dust Standards	Regulation I	Establishes emission standards for fugitive dust. Like the previous ARAR, this regulation applies to dust-producing activities during implementation of the Interim Action, particularly excavation and filling.
Treatment, Discharge, and Disposal		
NPDES Permit	WAC 173-220	Establishes a state individual permit program, applicable to the discharge of pollutants and other wastes and materials to the surface waters of Washington State, operating under state law. Permits issued under this chapter are designed to satisfy the requirements for discharge permits under both the Federal Water Pollution Control Act and Washington State Water Pollution Control Act. This requirement is applicable to the control, collection, management, and discharge of stormwater runoff during and after construction of the Interim Action.
State Waste Discharge General Permit Program	WAC 173-226	Establishes a state general permit program, applicable to the discharge of pollutants, wastes, and other materials to waters of the state, including discharges to municipal sewerage systems. Permits issued under this regulation are designed to satisfy the requirements for discharge permits under the federal Water Pollution Control Act and the Washington State Water Pollution Control Act. Although this permit is not required because of MTCA's permit exemption, it will be obtained for the drainage control systems to be constructed as part of the Interim Action because an NPDES permit is required and Ecology issues a combined NPDES/state waste discharge permit.
Industrial Waste Discharge to Metropolitan King County Sewer System	KCC 28.84.060	Establishes rules and regulations applicable to water pollution abatement activities, including the disposal of sewage into the metropolitan sewer system, whether delivered from within or from without the county. Authorizes King County to develop and implement such procedures and to take any other actions as may be necessary to ensure that local public sewers and private sewers discharging or proposing to discharge into the metropolitan sewer system are constructed and developed in accordance with applicable laws, regulations and plans. This regulation applies to implementation of the drainage control elements of the Interim Action.

Table 4
Applicable or Relevant and Appropriate Requirements
Interim Action Area, South Park Landfill
Seattle, Washington
Farallon PN: 408-002

Potential Action-Specific ARARs (cont'd)	Source	Description and Relevance
Treatment, Discharge, and Disposal (cont'd)		
State Minimum Functional Standards for Solid Waste Handling	WAC 173-304-460	This regulation is applicable to facilities that dispose of solid waste in landfills with the exception of inert, demolition, and wood waste landfills. The regulation establishes standards for landfill cover, surface water control, landfill gas collection, access control, and compliance monitoring.
King County Board of Health Regulations	Title 10	The requirements established in this regulation meet or exceed the requirements established by the Washington State Minimum Functional Standards for Solid Waste Handling (see above), and are applicable to the Interim Action for compliance monitoring programs and as performance standards for the design of control systems.
City of Seattle Review (in numerical order by SMC title and chapter)		
Street Use	SMC Title 15, as applicable	Requires a written permit for any proposed activities that use City of Seattle street right-of-way (ROW), including construction activities and movement of equipment. Because the toe of the landfill extends in to City of Seattle ROW, it will be necessary to conduct work in the ROW to implement the Interim Action. City of Seattle review requirements are applicable for elements of the interim action.
Water Connection	SMC 21.04	Specifies an application and approval process for connecting to the City of Seattle water supply system. Water connection is potentially needed for dust control during grading.
Side Sewer Connection	SMC 21.16	Requires connection of all sources of polluted water with the nearest accessible sanitary sewer. Sewer connection will be needed for discharge of landfill gas condensate and possibly leachate.
Electrical Service Connection	SMC 21.49	Specifies an application and approval process for obtaining electrical service from Seattle City Light Department. Electrical service will be needed to power sump pumps for landfill gas condensate and blower motors for landfill gas control.
Building Codes	SMC Title 22, as applicable	Includes a number of requirements applicable to the Interim Action, including electrical, mechanical, fire, and energy codes; and regulations for grading, stormwater, drainage, and erosion control (see more detail below).
Stormwater, Drainage, and Erosion Control	SMC 22.802	Specifies a drainage control review and approval process for projects that involve land-disturbing activities or new or replaced impervious surface. The Interim Action will require a Drainage Control Plan and a Construction Stormwater Control Plan.

Table 4
Applicable or Relevant and Appropriate Requirements
Interim Action Area, South Park Landfill
Seattle, Washington
Farallon PN: 408-002

Potential Action-Specific ARARs (cont'd)	Source	Description and Relevance
City of Seattle Review (cont'd)		
Grading	SMC 22.804	Specifies a process for application and approval of a grading permit for earth-moving activities. Grading must preserve natural drainage patterns, and not create unstable slopes or contribute to increased turbidity or other forms of pollution in a watercourse.
Noise Control	SMC 25.08	Specifies maximum permissible noise levels for construction activities and facility operation in industrial zones, depending on the zoning designation of receiving properties.
Environmentally Critical Areas	SMC 25.09	Specifies development standards for actions affecting environmentally critical areas. Wetlands associated with drainage ditches were determined not to meet the city's wetland definition.

NOTES

[1]As noted in Section 3.1. Because it is understood that Washington MTCA is the overarching regulation governing all aspects of the Interim Action, it is not included in this table.

Pursuant to Section 090 of Chapter 70.105D of the Revised Code of Washington (RCW 70.105D.090), PLPs conducting a remedial action under an agreed order with Ecology are exempt from some state-administered procedural requirements and the procedural requirements of any local laws requiring or authorizing local government permits or approvals for the remedial action. However, the substantive requirements of state and local laws requiring permits or approvals shall be complied with.

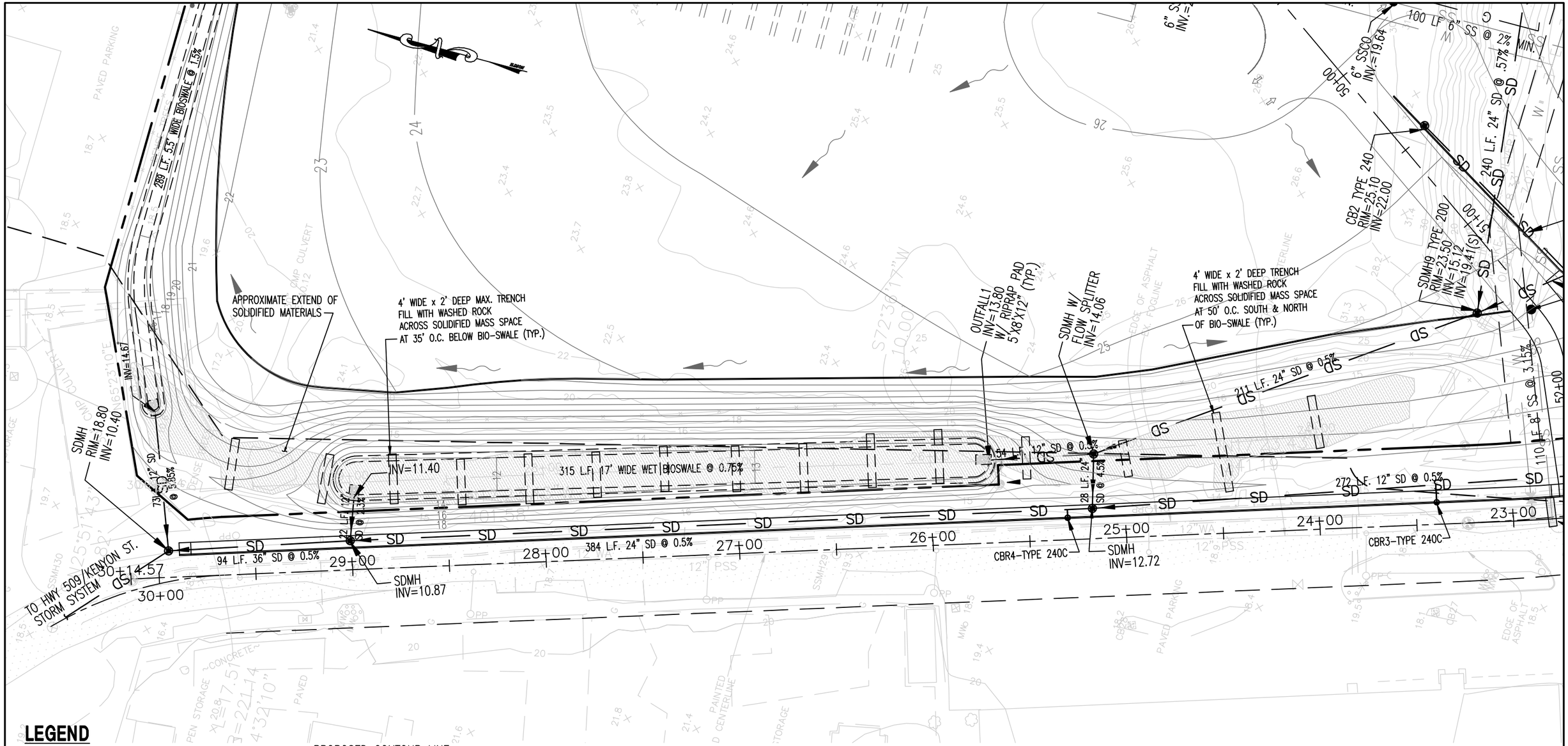
Pursuant to WAC 173-340-710(9), the state agencies and local governments that have potential permits subject to the permit exemption have been consulted. The substantive requirements of the permits that are exempt, to the extent they are currently known, have been incorporated into this Interim Action Work Plan. Therefore, the substantive requirements of state and local laws subject to the permit exemption will be met during the Interim Action.

ARARs = applicable or relevant and appropriate requirements
CFR = Code of Federal Regulations
KCC = King County Code
MTCA = Washington State Model Toxics Control Act Cleanup Regulation
NPDES = National Pollutant Discharge Elimination System
RCW = Revised Code of Washington
RI/FS = Remedial Investigation/Feasibility Study
SMC = Seattle Municipal Code
WAC = Washington Administrative Code

APPENDIX A
INTERIM ACTION ELEMENTS AT THE WEST DITCH--ENGINEERING DESIGN DRAWINGS

INTERIM ACTION WORK PLAN
South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002



LEGEND

- PROPOSED CONTOUR LINE
- EXISTING CONTOUR
- PROPERTY (R/W) LINE
- APPROXIMATE LIMITS OF SOLID WASTE
- PROPOSED STORM
- PROPOSED SANITARY SEWER
- CENTER LINE OF R/W

VERTICAL DATUM:

C-O-S BENCH MARK

(NAVD 88) FOUND BRASS CAP LOCATED AT THE INT. OF S. KENYON ST. AND OCCIDENTAL AVE. S. ELEVATION ON CAP = 20.41'

GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)

1 inch = 50 ft.

exeltech
Lacey, WA Seattle, WA

PROJECT: SOUTH PARK LANDFILL	WEST DITCH INTERIM ACTION AND PROPOSED GRADING	DRAWN: CMC	CHECK: CMC
		SCALE: AS SHOWN	DATE: 04-25-2012
CLIENT: SOUTH PARK DEVELOPMENT LLC		JOB NO: 0716	SHEET NO: 1
		REVISION:	

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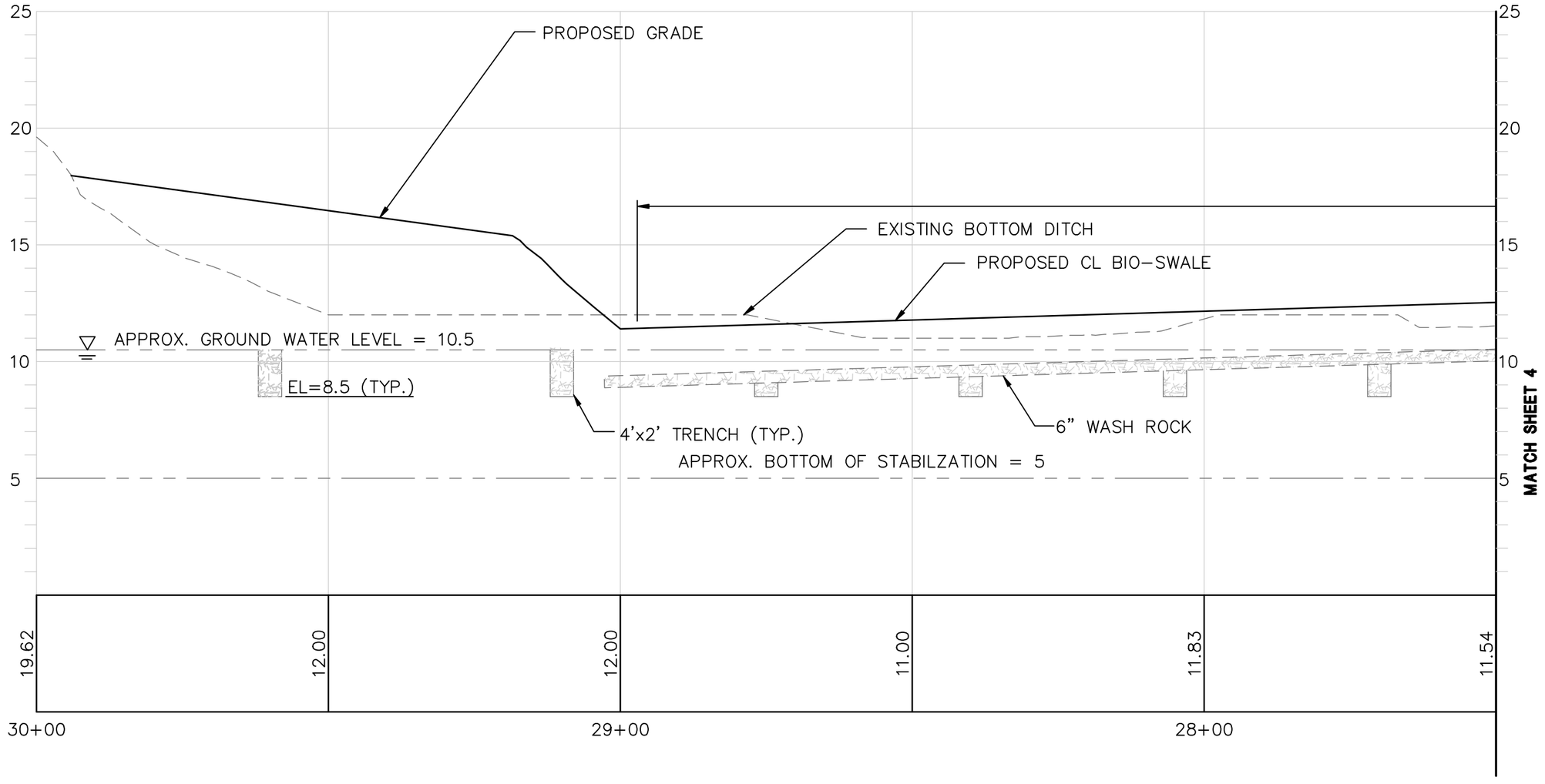

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)

1 inch = 20 ft. (H)

1 inch = 5 ft. (V)

exeltech
Lacey, WA Seattle, WA

PROJECT: SOUTH PARK LANDFILL	WEST DITCH INTERIM ACTION PROFILE	DRAWN: CMC	CHECK: CMC
		SCALE: AS SHOWN	DATE: 03-21-2012
CLIENT: SOUTH PARK DEVELOPMENT LLC		JOB NO: 0716	SHEET NO: 3
		REVISION:	

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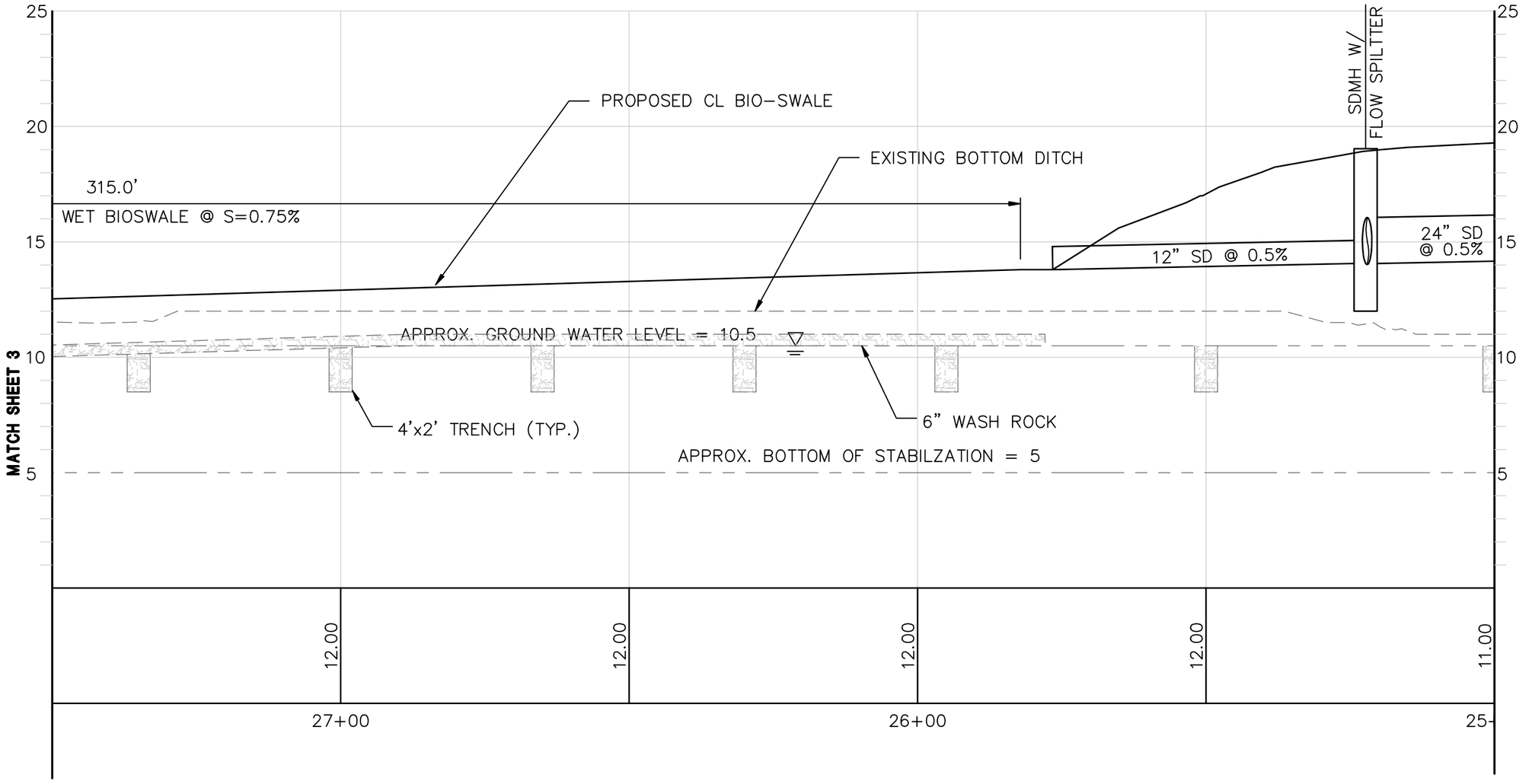

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)

1 inch = 20 ft. (H)

1 inch = 5 ft. (V)

exeltech
Lacey, WA Seattle, WA

PROJECT: SOUTH PARK LANDFILL

CLIENT: SOUTH PARK DEVELOPMENT LLC

WEST DITCH INTERIM ACTION PROFILE

DRAWN: CMC	CHECK: CMC
SCALE: AS SHOWN	DATE: 03-21-2012
JOB NO: 0716	SHEET NO: 4
REVISION:	

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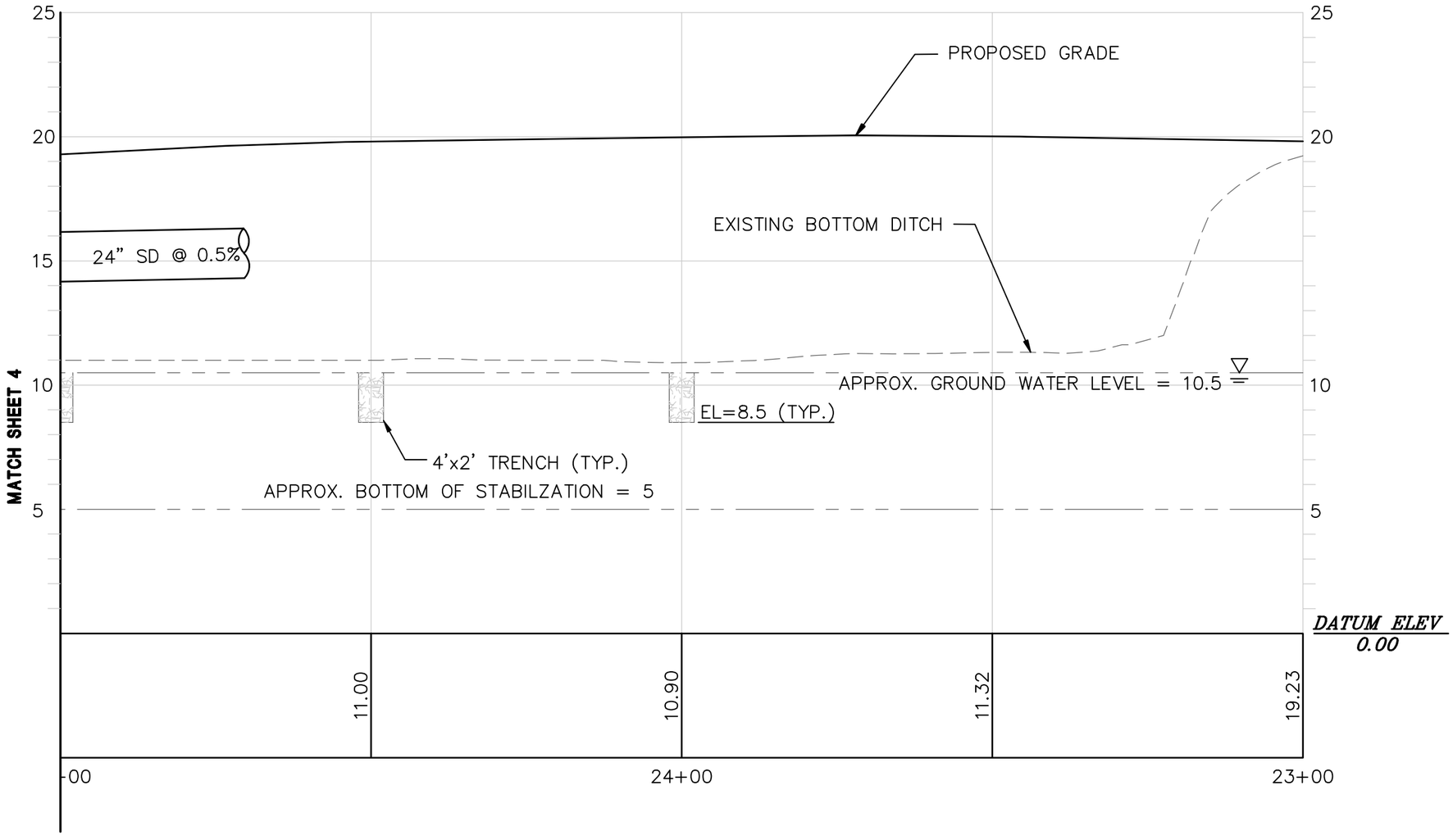

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)

1 inch = 20 ft. (H)

1 inch = 5 ft. (V)

exeltech
Lacey, WA Seattle, WA

PROJECT: SOUTH PARK LANDFILL	WEST DITCH INTERIM ACTION PROFILE	DRAWN: CMC	CHECK: CMC
		SCALE: AS SHOWN	DATE: 03-21-2012
CLIENT: SOUTH PARK DEVELOPMENT LLC		JOB NO: 0716	SHEET NO: 5
		REVISION:	

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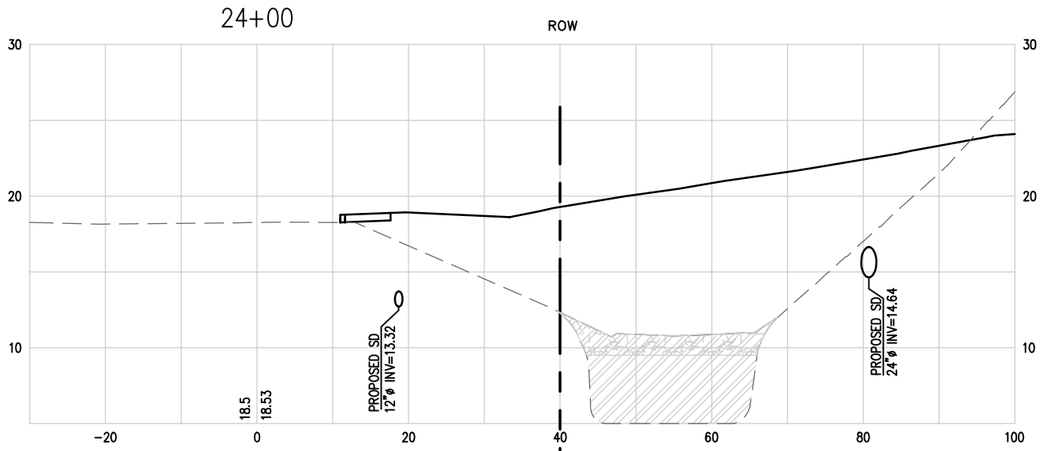
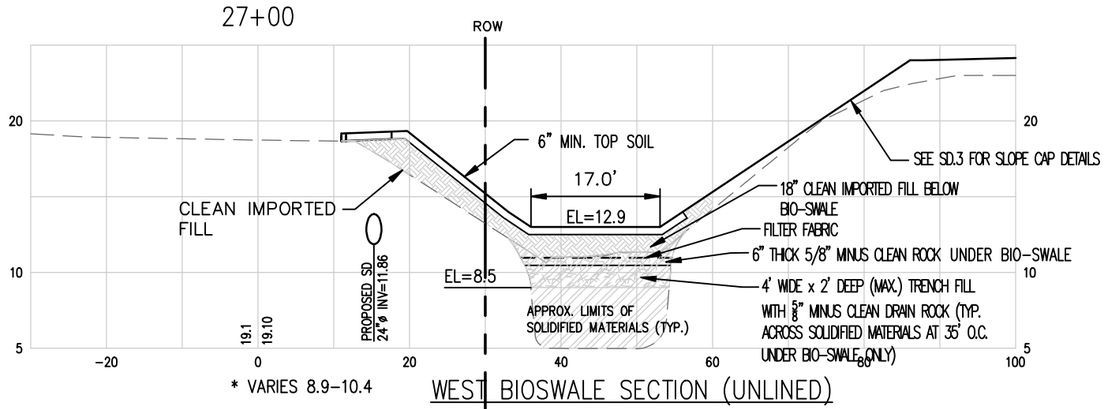
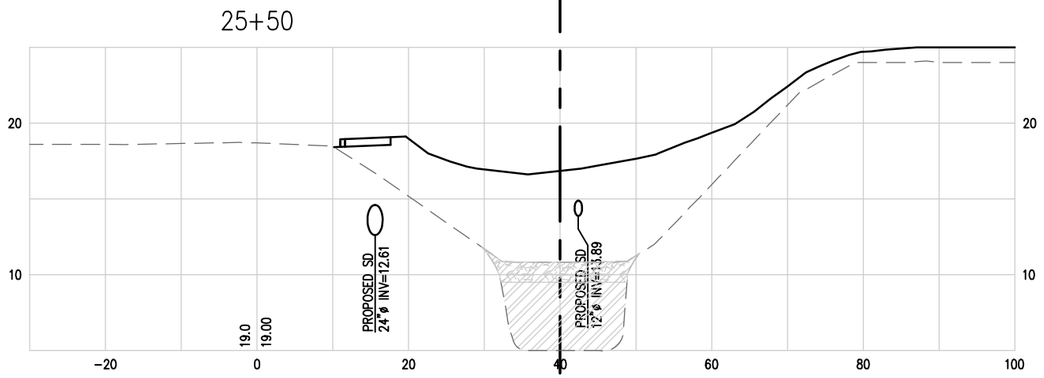
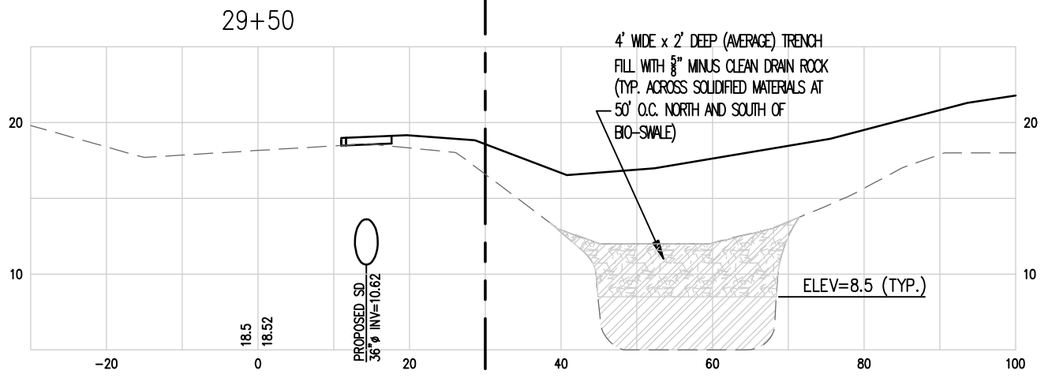


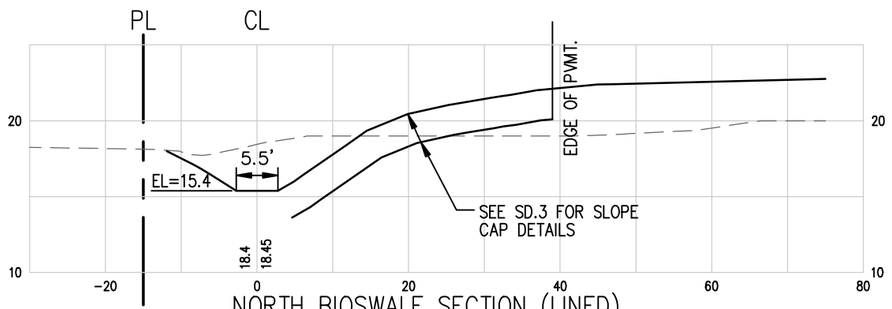


* VARIES 8.9-10.4

WEST BIOSWALE SECTION (UNLINED)







NORTH BIOSWALE SECTION (LINED)
(50' FROM END OF SWALE)

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft. (H)
1 inch = 10 ft. (V)

exeltech
Lacey, WA Seattle, WA

PROJECT: SOUTH PARK LANDFILL	WEST DITCH INTERIM ACTION CROSS SECTIONS	DRAWN: CMC	CHECK: CMC
		SCALE: AS SHOWN	DATE: 04-25-2012
CLIENT: SOUTH PARK DEVELOPMENT LLC		JOB NO: 0716	SHEET NO: 2
		REVISION:	

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APPENDIX B
RATIONALE PROVIDED TO THE WASHINGTON STATE DEPARTMENT OF ECOLOGY IN SUPPORT OF REQUEST TO ALLOW THE ASPHALTIC CONCRETE CAP TO VARY FROM PROVISIONS OF WAC 173-304, MINIMUM FUNCTIONAL STANDARDS FOR SOLID WASTE HANDLING

INTERIM ACTION WORK PLAN
South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002

APPENDIX B
Interim Action Work Plan
South Park Landfill Site
Seattle, Washington

RATIONALE PROVIDED TO THE WASHINGTON STATE DEPARTMENT OF ECOLOGY IN SUPPORT OF REQUEST TO ALLOW THE ASPHALTIC CONCRETE CAP TO VARY FROM PROVISIONS OF WAC 173-304, MINIMUM FUNCTIONAL STANDARDS FOR SOLID WASTE HANDLING

The Minimum Functional Standards for Solid Waste Handling regulation WAC-173-304 (MFS)-prescribed cover is that, at closure, the landfill cap consists of either:

- A minimum of 2 feet of low-permeability soil (permeability of less than 10^{-6} centimeters per second) plus a 6-inch topsoil vegetative layer; or
- A geomembrane layer acting as a barrier to infiltrating stormwater and marking the depth below which solid waste occurs, plus a 6-inch topsoil vegetative layer.

Two cap designs for the Interim Action are summarized as follows:

- **Asphaltic Concrete Cap** over gently sloping areas of the Interim Action Area where development plans call for large-vehicle access and parking, and construction of administrative and shop buildings. The asphaltic concrete cap will cover the majority of the Interim Action Area.

  This cap design does not comply with MFS criteria above as the design does not consist of either 2 feet of low-permeability soil or a geomembrane layer, and does not include a 6-inch vegetative layer.

- **Low-Permeability Membrane Cap** over steeper areas to be landscaped along the west, south, and eastern sides of the Interim Action Area.

  This design includes a 50-mil geomembrane and complies with MFS criteria above.

The cap systems as designed are considered to be protective of human health and the environment, and to allow for future use of the redeveloped property. The proposed design for the two types of caps planned for the Interim Action Area (plus the proposed stormwater control system capturing, treating, and conveying stormwater away from the Interim Action Area) minimizes stormwater infiltration of stormwater into the solid waste, thereby reducing production of additional leachate. The proposed cap designs also practicably mitigate risk to human health and the environment by preventing direct contact exposure with solid waste while still providing a working surface for the redeveloped property. The proposed landfill gas collection system will effectively control methane and other landfill gases from collecting beneath the caps and will control migration of landfill gases out of the Interim Action Area. The proposed cap designs satisfy the MFS objectives of preventing infiltration of stormwater and preventing direct contact exposure to solid waste, and are designed to enable maximum

flexibility in adapting to future measures that may be employed on adjacent parcels as the remedy for the South Park Landfill Site as a whole.

The asphalt pavement cover will be installed with a continuous slope, generally draining from south to north and will be designed so that rain will flow quickly across the pavement during a significant precipitation event. Within a few minutes after storm passage, the pavement will quickly drain and evaporate dry. This will significantly reduce the duration of any rainwater "head" above the pavement that would contribute to water penetration through the pavement. In contrast, a low permeability soil cap with surface vegetative layer will not promote overland flow to a storm water control system and could create a "water sponge" effect, retaining stormwater and creating a water "head" for prolonged seepage through the soil cover. Landfill cap operation and maintenance procedures, including periodic inspections, will help ensure pavement integrity and minimize stormwater infiltration. Protection measures for settlement, including underlayments of geotechnical reinforcing fabric and additional crushed rock, will prevent cracking of the asphaltic concrete where yielding soils are encountered during construction.

The Washington State Model Toxics Control Act Cleanup Regulation (MTCA), Section 710(5) of Chapter 173-340 of the Washington Administrative Code (WAC 173-340-710[5]) indicates that for purposes of MTCA, a regulatory variance or waiver is appropriate if the substantive conditions for a regulatory variance or waiver requirement in a potentially applicable state or federal law are met and that interim action and cleanup action are protective of human health and the environment. The provisions for variances in the MFS are contained in WAC 173-304-700, which indicates that a variance request would be granted if:

- The solid waste handling practices or location do not endanger public health, safety, or the environment; and
- Compliance with the regulation from which variance is sought would produce hardship without equal or greater benefits to the public.

As indicated and supported in the Interim Action Work Plan, allowing the asphaltic concrete cap to vary from the provisions of the MFS is appropriate for the Interim Action Area because the proposed design is protective of human health and the environment in this specific situation based on the following information:

- Although the asphaltic concrete cap does not provide a minimum of 2 feet of low-permeability soil of less than 10^{-6} centimeters per second or a geomembrane layer per the MFS, the asphaltic cap system is a relatively impervious surface that provides erosion protection measures and minimizes infiltration of stormwater into the solid waste, and therefore leachate production. Because the South Park Landfill is unlined and solid waste has been in contact with groundwater for decades in some areas, the importance of reducing stormwater infiltration with an impervious cap system is reduced.
- The South Park Landfill was closed in 1966 in accordance with applicable regulations at the time. The cover system in the Interim Action Area was maintained under WAC 173-301, the governing regulation for solid waste landfill closures, until WAC 173-301 was superseded by the MFS in 1985.

- Portions of the South Park Landfill Site were developed prior to adoption of the MFS set forth in WAC 173-304 in 1985. These properties have operated without documented incidents concerning the direct contact exposure pathway.
- The asphaltic concrete cap will serve the two primary functions of a landfill cap per the MFS: effectively minimizing stormwater infiltration and preventing direct exposure with solid waste and affected media.

With regard to the Ecology request for additional substantiation for the requested MFS variance for the asphaltic concrete cap design, and to the MFS WAC-173-304-700(1)(b) variance criterion that strict MFS compliance would present hardship without equal or greater benefits to the public, the following issues are pertinent.

Regarding use of *2 feet of low-permeability soil in the asphaltic concrete cap design*:

- Non-clay low permeability soil is not available locally and for practical purposes it is difficult to find sources that will dependably meet a permeability requirement of 10^{-6} centimeters per second in the quantities required for a 2-foot cover over an approximately 19.4-acre area. However, low permeability soil material has been produced by amending glacial till with 4 percent bentonite, mixed with pug mill and compacted in 4-inch layers at the Cedar Hills Landfill.
- Clay is not a competent structural soil for asphalt pavement design. The localized loads from heavy vehicles on the redeveloped property cannot be supported, and the clay will deform under heavy loads on asphalt paving with standard gravel sub-base and quickly cause cracking and failure of the asphalt pavement, even with standard asphalt concrete pavement over crushed rock.

Regarding use of an infiltration barrier *geomembrane layer plus a 6-inch topsoil vegetative layer* in the asphaltic concrete cap design:

- The asphaltic concrete cap does contain a provision for a geotextile and supplementary crushed rock if bearing soils are determined to be geotechnically yielding during cap construction. While this geotextile is not a 50-mil minimum low permeability geomembrane, it would provide protection against settlement and subsequent cracking and breaching of the integrity of the asphaltic concrete cap.
- While a 50-mil minimum geomembrane infiltration barrier could be considered in the asphaltic concrete cap design, it would add significant cost and will not provide the geotechnical protection against differential settlement offered by the geotextile in the design. Retaining any infiltrating stormwater below the asphaltic cap and above the geomembrane would adversely affect the integrity of the asphaltic concrete cap with its intended use as a working surface on the redeveloped property.
- Reducing the permeability of the asphaltic concrete cap by incorporating a membrane within the asphaltic concrete was considered. Constructability concerns were identified related to high temperature applications, punctures, and achievable reductions in permeability.
- With regard to an overlying vegetative layer, this would not be suitable as a working surface for the redeveloped property.

Regarding hardship imposed with strict compliance with MFS in the asphaltic concrete cap design without equal or greater benefit to the public:

- If glacial till is amended with bentonite to create a low-permeability soil, approximately 55,000 cubic yards would be required. Purchasing and delivering glacial till, amending the material with 4 percent bentonite mixing in a pug mill and placement with compaction in 4-inch lifts with quality control testing would add an incremental cost to the proposed design on the order of $3,700,000, providing little, if any, benefit to the public.
- If low-permeability soil is to be used in the asphaltic concrete design, approximately 55,000 cubic yards would be imported. Importing 55,000 cubic yards of bentonite clay from Wyoming, including rail shipping, truck in-haul, compaction and quality control, geotechnical fabric, and extra crushed rock to achieve suitable geotechnical stability, would add an incremental cost to the proposed design on the order of $15,800,000, providing little, if any, benefit to the public.
- As the finish grade would be higher with 2 feet of low permeability material beneath the asphaltic concrete cap, there would be an incremental cost to the proposed design on the order of $63,000 for rock-filled gabion basket retaining walls.
- The extra weight of 5 feet of additional imported material (2 feet of clay plus 3 feet of crushed rock) will cause additional settlement of the old solid waste and renew settlement of compressible soils beneath the landfill. The solid waste and compressible soils settlement will likely be differential and unpredictable, and range from 1 to 12 inches. The settlement due to compressible soils will be slow and prolonged, occurring over as much as 10 to 15 years. Due to the compressible soils settlement, the asphalt pavement will begin cracking and breaking up quickly after placement, and related asphalt pavement problems will persist over the duration of the compressible soils settlement.
- The extra thickness of additional imported material will necessitate redesign of the grading plan, the stormwater control system, and the landfill gas control system. Perimeter elevations need to match surrounding surface elevations. Grades will change in some areas, and new surface elevation contours will need to be redeveloped. The estimate cost for the redesign sums to approximately $63,000.
- Reducing the permeability of the asphaltic concrete cap by incorporating a membrane within the asphaltic concrete would add an estimated incremental cost of approximately $900,000 with uncertain results and would provide little, if any, benefit to the public.
- Building up the finish grade of the redeveloped property to accommodate the thickness of additional cap material would result in a reduction of approximately 5,000 square feet of usable surface to allow for side slopes and extension of ingress and egress road ramps.

APPENDIX C
INTERIM ACTION COMPLIANCE MONITORING PLAN

INTERIM ACTION WORK PLAN
South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002

975 5th Avenue Northwest, Issaquah, Washington 98027
Tel: (425) 295-0800 Fax: (425) 295-0850
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INTERIM ACTION COMPLIANCE MONITORING PLAN
APPENDIX C OF INTERIM ACTION WORK PLAN
SOUTH PARK LANDFILL SITE
SEATTLE, WASHINGTON

INTERIM ACTION AREA OF THE SOUTH PARK LANDFILL SITE
SEATTLE, WASHINGTON

Submitted by:
Farallon Consulting, L.L.C.
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Issaquah, Washington 98027

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For:
South Park Property Development, L.L.C.
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February 22, 2013

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ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

Agreed Order	Agreed Order No. 6706 between the Washington State Department of Ecology, the City of Seattle, and South Park Property Development, L.L.C.
City	City of Seattle
Ecology	Washington State Department of Ecology
Farallon	Farallon Consulting, L.L.C.
GEM 2000	LandTec GEM 2000 (Plus) Gas Analyzer
Interim Action Work Plan	*Interim Action Work Plan, South Park Landfill Site, Seattle, Washington* dated January 16, 2013, prepared by Farallon Consulting, L.L.C.
MFS	Minimum Functional Standards for Solid Waste Handling, as established in Chapter 173-304 of the Washington Administrative Code
MTCA	Washington State Model Toxics Control Act Cleanup Regulation
OSHA	Occupational Safety and Health Administration
Plan	Interim Action Compliance Monitoring Plan
PLPs	potentially liable persons
RI/FS	remedial investigation/feasibility study
RI/FS Report	*Draft South Park Landfill Remedial Investigation/Feasibility Study* prepared by Floyd|Snider dated April 16, 2012.
South Park Landfill Site	The locations where contamination caused by the release of hazardous substances from the South Park Landfill has come to be located.
SPPD	South Park Property Development, L.L.C.
WAC	Washington Administrative Code
WISHA	Washington Industrial Safety and Health Act

1.0 INTRODUCTION

This Interim Action Compliance Monitoring Plan (Plan) has been prepared by Farallon Consulting, L.L.C. (Farallon) on behalf of South Park Property Development, L.L.C. (SPPD) to describe compliance monitoring that will be performed in conjunction with the Interim Action to be conducted on a portion of the South Park Landfill (Interim Action). The South Park Landfill is located in the South Park neighborhood less than 5 miles south of downtown Seattle, Washington. The South Park Landfill is roughly bounded by South Kenyon Street to the north, State Route 99 and 5th Avenue South to the east, South Sullivan Street to the south, and Occidental Avenue South to the west. The South Park Landfill covers an area of approximately 39 acres, of which nearly half is currently developed. Figure 1 shows the general vicinity around the South Park Landfill, and Figure 2 shows the approximate boundaries of the South Park Landfill based on review of aerial photographs, information obtained from numerous subsurface investigations conducted in the area, and data collected during completion of the investigation conducted as part of the remedial investigation (RI) in 2011.

Details regarding the background, environmental conditions, and components of the Interim Action are presented in the *Interim Action Work Plan, South Park Landfill Site, Seattle, Washington,* dated January 16, 2013, prepared by Farallon (2013) (Interim Action Work Plan), and are not reiterated herein. The Interim Action Work Plan also describes regulatory considerations related to the Interim Action, including federal, state, and local requirements that apply to the Interim Action; agency guidance documents that also may be considered; and the relationship of the Interim Action to the planned development of the SPPD property.

1.1 INTERIM ACTION AREA

The Interim Action Area does not encompass the entire South Park Landfill footprint (Figure 2). The Interim Action Area includes the approximately 19.4-acre SPPD property and portions of the areas contiguous with the SPPD property where solid waste from South Park Landfill operation extends beneath City of Seattle (the City) street rights-of-way for 5th Avenue South and South Sullivan Street, as shown on Figure 2. The Interim Action Area extends beyond the SPPD property line and western edge of the South Park Landfill along some portions of Occidental Avenue South to include what is known as the West Ditch, a topographically low drainage feature, and other areas where SPPD plans include grading, drainage, and/or other improvements.

References to the South Park Landfill in this Plan are specific to the area where solid waste was placed during operation of the South Park Landfill (Figure 2). The South Park Landfill *Site* will not necessarily be co-extensive with the extent of solid waste within the landfill boundaries. In accordance with the provisions of the Washington State Model Toxics Control Act Cleanup Regulation (MTCA), as established in Chapter 173-340 of the Washington Administrative Code (WAC 173-340), the South Park Landfill Site will be defined by the locations where contamination caused by the release of hazardous substances from the South Park Landfill has come to be located. Further definition of the South Park Landfill Site is addressed in the *Draft South Park Landfill Remedial Investigation/Feasibility Study* dated April 16, 2012, prepared by

Floyd|Snider (2012) (RI/FS Report), which was submitted to Ecology on April 16, 2012 for review. The RI/FS Report was issued per Agreed Order No. 6706 between Ecology, the City, and SPPD (Agreed Order).

Although situated within the footprint of the South Park Landfill, the following parcels are not included in the Interim Action Area: the City of Seattle property occupied by the Seattle South Recycling and Disposal Station and adjacent unused land to the south and west, including King County Tax Parcel No. 7328400005; the Kenyon Industrial Park owned by Harsch Investment Properties, LLC, including King County Tax Parcel No. 3224049007; and the property at 7901 2nd Avenue South, including King County Tax Parcel No. 3224049077. The City of Seattle property, the Kenyon Industrial Park property, and the 7901 2nd Avenue South property will be addressed by the draft Cleanup Action Plan to be prepared for the South Park Landfill Site following Ecology approval of the RI/FS Report.

1.2 PURPOSE

SPPD acquired the 19.4-acre SPPD property in 2006 and has been working to attract long-term tenants and to obtain permits for SPPD property redevelopment. Redevelopment will be preceded by this Interim Action, which will include capping the landfill surface, controlling landfill gas, and constructing a stormwater collection and conveyance system. The Interim Action is designed so as to not foreclose reasonable alternatives for the cleanup action being considered for the South Park Landfill Site (WAC 173-340-430[3][b]). The Interim Action will be designed and implemented, with oversight by Ecology, to protect human health and the environment, and to mitigate potential exposure pathways that could occur from redevelopment and subsequent use of the SPPD property. The purpose of the Plan is to provide guidance regarding compliance monitoring as described in WAC 173-340-410 while Interim Action work is ongoing until the Cleanup Action Plan and the associated Compliance Monitoring Plan for the South Park Landfill Site are approved by Ecology. At that time, the monitoring requirements specified in the Compliance Monitoring Plan for the South Park Landfill Site will be instituted for the Interim Action Area.

1.3 SCOPE OF COMPLIANCE MONITORING

As discussed in Section 1.1 of the RI/FS Report, the South Park Landfill Site is a MTCA site where containment of hazardous substances is the preferred remedy. As a requirement under MTCA, compliance monitoring during the Interim Action will be performed in accordance with WAC 173-340-410 and includes protection, performance, and confirmational monitoring requirements. The Plan includes monitoring of landfill gas and observation of construction of the Interim Action components such as the landfill cap and the landfill gas control system.

Not included in this Plan is additional monitoring per facility-specific permits (e.g., stormwater, discharges to air and sewer). Also not included in this plan is Site-wide groundwater monitoring to be conducted by the potentially liable persons (PLPs) for the South Park Landfill Site during the period prior to approval of the Cleanup Action Plan for the South Park Landfill Site and implementation of a compliance monitoring program that will be developed for the South Park Landfill Site as a whole. The scope of the interim Site-wide groundwater monitoring program is

presented in a separate document, the *South Park Landfill Interim Site-wide Groundwater Monitoring Plan*, dated December 2012, prepared by Floyd|Snider (2012) (Interim Site-wide Groundwater Monitoring Plan), that has been submitted by the PLPs to Ecology for review and approval. Monitoring under the interim Site-wide groundwater monitoring program is planned to be conducted semi-annually, beginning by the end of the first quarter of 2013, and until a long-term Site-wide groundwater compliance monitoring program is implemented.

Protection monitoring per WAC 173-340-410(1) (a) will be performed to confirm that human health and environment are adequately protected during construction and the operation of the Interim Action. Protection monitoring is described generally in Section 3, and a detailed Health and Safety Plan is provided in Attachment A.

Performance monitoring per WAC 173-340-410(1)(b) will confirm that the Interim Action has attained cleanup standards and, if appropriate, other performance standards such as construction quality control measurements or monitoring necessary to demonstrate compliance with a permit. Performance monitoring for the asphaltic concrete cap and the low-permeability membrane cap is described in Sections 4.1.1 and 4.1.2, respectively. The landfill gas control performance monitoring is presented in Section 4.2.1. Specific details regarding performance monitoring sampling and analysis are provided in the Compliance Monitoring Sampling and Analysis Plan in Attachment B.

Confirmational monitoring per WAC 173-340-410(1)(c) will confirm the effectiveness of the Interim Action or other performance standards. Confirmational monitoring pertaining to the landfill cap and for landfill gas controls will commence after construction and start-up testing respectively and will continue until amended with implementation of a compliance monitoring program that will be developed for the South Park Landfill Site as a whole[1]. Interim Action confirmational monitoring of the asphaltic concrete cap and the low-permeability membrane cap are described in Section 4.1.3, and for landfill gas control in Section 4.2.2.

The Interim Site-wide Groundwater Monitoring Plan includes confirmational monitoring of groundwater levels and groundwater quality at the South Park Landfill Site monitoring well network for the period prior to approval of the Cleanup Action Plan for the South Park Landfill Site and implementation of the Compliance Monitoring Plan for the South Park Landfill Site as a whole. Confirmational groundwater monitoring for the Interim Action would be redundant with the interim Site-wide groundwater monitoring program; therefore, no confirmational groundwater monitoring program specific to the Interim Action is planned.

Results of construction-phase compliance monitoring activities and construction documentation will be provided in the Interim Action Construction Report per requirements of WAC 173-340-400(6)(b), Construction Documentation. Following construction, Annual Progress Reports will

[1] Current expectations are that long-term Site-wide monitoring requirements for landfill capping and landfill gas controls will be defined in the Final Cleanup Action Plan developed for the South Park Landfill Site as a whole. These requirements will be implemented through parcel-specific work plans. Reporting will also be parcel-specific.

be produced to document compliance monitoring and mitigation activities each calendar year. Further details regarding reporting are provided in Section 5.

2.0 INTERIM ACTION COMPONENTS

This section provides a general overview of Interim Action components. A detailed description of the Interim Action is presented in the Interim Action Work Plan. Per the Interim Action Work Plan, the Interim Action consists of four primary components:

- Landfill cap;
- Landfill gas control;
- Surface water control; and
- Institutional controls.

The landfill cap component of the Interim Action includes two types of caps to be constructed: an asphaltic concrete cap, and a low-permeability membrane cap. The asphaltic concrete landfill cap is designed to address structural requirements to support redevelopment, reduce infiltration of stormwater, and mitigate risk to human health and the environment by preventing direct contact exposure with solid waste. The asphaltic concrete cap will be constructed across the majority of the Interim Action Area where the final topographic surface has a slope of 6 percent or less, and will provide the working surface for the redeveloped property. The low-permeability membrane cap will cover side slopes greater than 6 percent and up to 33 percent grade around portions of the west, south, and east perimeters of the Interim Action Area. The low-permeability membrane cap will act as a barrier to infiltrating stormwater, and will mitigate risk to human health and the environment by preventing direct contact exposure with solid waste. Figure 3 shows the layout for the landfill cap in the Interim Action Area. Additional details regarding the asphaltic concrete cap and the low-permeability membrane cap relevant to performance and confirmational monitoring are presented in Sections 4.1.1 and 4.1.2, respectively.

The landfill gas control system is designed as an active system with a vacuum blower and emissions treatment. Figure 4 shows the final design for the landfill gas control system in the Interim Action Area. The landfill gas control system is convertible to a passive system if future performance monitoring indicates that methane concentrations in the Interim Action Area and adjacent properties are no longer high enough to require operation as an active system. The landfill gas control system will be composed of a network of horizontal and vertical gas collectors, piping to convey the extracted landfill gas to an equipment area, the vacuum blower and condensate knockout equipment area, carbon filters and gas discharge vent stack, and a condensate sump/pump system. In general, vertical gas collectors will be located in the interior of the Interim Action Area, and horizontal gas collectors will be located near the perimeter of the Interim Action Area. As shown on Figure 4, adjacent to the western side of 5th Avenue South where landfill gas migration is most likely to occur, the perimeter landfill gas control system consists of two horizontal gas collectors, one at the top of slope and one at the bottom of slope, and one vertical gas collector[2]. Valving will be used to adjust the flow and vacuum, and

[2] The two horizontal and one vertical landfill gas collectors designed for the east side of the Interim Action Area are intended to prevent migration of landfill gas from the solid waste in the Interim Action Area toward the

monitoring ports will be used to monitor gas composition and pressures at various points in the system. Additional details regarding the landfill gas control system relevant to performance and confirmational monitoring are presented in Sections 4.2.1 and 4.2.2, respectively.

A primary topographic feature formerly at the SPPD property was an east-west-oriented channel (referred to as the East-West Channel) that was constructed in approximately 1967 to provide surface water drainage from properties east of the South Park Landfill to the West Ditch. The East-West Channel was up to 20 feet lower than the surrounding topography. Under a City Department of Planning and Development (DPD) Grading Permit, the East-West Channel was primarily filled in 2012 to pre-load and consolidate underlying soil in advance of redevelopment of the SPPD property. It is expected that the remainder of the East-West Channel will be filled in 2013.

Surface water controls for the SPPD property include construction of a stormwater collection and conveyance system for the landfill cap surfaces, and construction of two bioswales: one on the north edge of the SPPD property (North Bioswale) and the second within the West Ditch (West Bioswale). Except in the two bioswales, stormwater will be conveyed with underground piping, and work will include raising the elevation of the invert of the current West Ditch north and south of the West Bioswale to achieve sufficient cover over underground conveyance piping. Figure 5 shows the layout for modifications to the West Ditch, including the bioswales and associated piping.

Surface water discharge from the West Ditch currently is routed through a private stormwater conveyance line beneath the Kenyon Industrial Park, which discharges to a City of Seattle storm drain line in South Kenyon Street. The surface water control design entails construction of a new storm drain line to be installed in the public right-of-way along Occidental Avenue South, bypassing the Kenyon Industrial Park storm drain line, to convey stormwater flow from the SPPD property, including flows from both of the bioswales, and from current tributary inflows from areas west of the West Ditch. To facilitate stormwater conveyance and treatment, unconsolidated material recently deposited in the West Ditch will be solidified to improve geotechnical conditions and to reduce the potential for its off-site migration. Underground drainage will be constructed to route shallow groundwater across the solidified material to minimize changes in the groundwater flow regime caused by the solidified mass, and to minimize the potential for groundwater to rise into the West Bioswale during high groundwater conditions and subsequently be conveyed to the City storm drain system. The Interim Action Work Plan contains construction details regarding modifications to be implemented in the area of the West Ditch and Figure 5 shows the approximate area to be solidified. As discussed in Section 1.3, monitoring of groundwater levels and groundwater quality will be performed in accordance with the Interim Site-wide Groundwater Monitoring Plan.

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east and 5th Avenue South. However, the Interim Action landfill gas control system was not specifically designed to capture all of the landfill gas generated from the solid waste beneath 5th Avenue South. While it is expected that the Interim Action landfill gas control system will reduce the eastward migration of landfill gas generated by solid waste beneath 5th Avenue South, its effectiveness at reducing or preventing eastward migration of this landfill gas will be evaluated during Interim Action landfill gas compliance monitoring described in this Plan.

As indicated in the Interim Action Work Plan, institutional controls will be implemented in accordance with WAC 173-340-440 to limit or prohibit activities that may diminish the integrity of the Interim Action or potentially result in exposure to hazardous substances at the South Park Landfill Site. These institutional controls may include recording an environmental covenant on the SPPD property title restricting the use of groundwater at the Interim Action Area, requiring that the landfill cap be maintained in the future, requiring mitigation measures to prohibit potential exposure to hazardous substances if the landfill cap is damaged in the future, and stipulating procedures in the case that the landfill cap is penetrated either accidentally or as part of a future construction plan.

3.0 PROTECTION MONITORING

Per WAC 173-340-410(1)(a), the purpose of protection monitoring, is to confirm that human health and the environment are adequately protected during construction and the operation and maintenance period of an Interim Action or cleanup action as described in the Health and Safety Plan.

Protection monitoring will be addressed with project-specific Health and Safety Plans. Attachment A contains the Health and Safety Plan for Farallon tasks pertaining to:

- Observing construction of Interim Action elements; and
- Operating and maintaining the landfill cap and landfill gas control systems.

Worker health and safety measures will be implemented by all parties performing work in the Interim Action Area per WAC 173-340-810, Worker Safety and Health, which provides general provisions and requirements for health and safety plans for work at MTCA sites. General provisions are based on requirements under the Occupational Safety and Health Act (OSHA) of 1970 and the Washington Industrial Safety and Health Act (WISHA). General Occupational Health Standards for the State of Washington, as established in WAC 296-62, are applicable to work associated with construction activities at the Interim Action Area, and provide rules designed to protect the health of employees and help to create a healthy workplace by establishing requirements to control health hazards.

4.0 LANDFILL CAP AND LANDFILL GAS CONTROL COMPLIANCE MONITORING

The performance and confirmational monitoring for the Interim Action Area landfill cap and landfill gas control are provided below. Performance monitoring for this portion of the Interim Action is defined as observing and documenting the construction of the landfill cap and the landfill gas controls, and as conducting and documenting the start-up of the landfill gas control system. Confirmational monitoring will involve monitoring the long-term effectiveness of these components after construction and start-up. The elements of compliance monitoring for the Interim Action Area caps and landfill gas control will continue until amended with implementation of a compliance monitoring program that will be developed for the South Park Landfill Site as a whole. Current expectations are that long-term Site-wide monitoring requirements for landfill capping and landfill gas controls will be defined in the Final Cleanup Action Plan developed for the South Park Landfill Site as a whole. These requirements will be implemented through parcel-specific work plans. Reporting will also be parcel-specific.

4.1 LANDFILL CAP MONITORING

The landfill cap shown in plan view on Figure 3 will be constructed per the design plans and specifications described in the Interim Action Work Plan and summarized below. Landfill cap specifics from the Interim Action Work Plan are listed below.

4.1.1 Asphaltic Concrete Cap Performance Monitoring

The asphaltic concrete cap, to be constructed where final grades are less than 6 percent and over most of the Interim Action Area, will be composed of a minimum of three layers:

- Twenty-four-inch minimum-thickness compacted structural fill that may or may not include existing cover soil, depending on existing cover thickness and geotechnical properties;
- Minimum 12 inches of crushed rock; and
- Four- to 6-inch minimum-thickness asphalt cover.

The asphaltic concrete cap will be constructed on the existing soil cover that previously was placed over solid waste (with variable thicknesses reported to range from 0 to 48 inches). Additional layers consisting of the following may be constructed at the direction of the Project Geotechnical Engineer:

- Geotextile or geogrid material over yielding existing cover soil encountered during construction; and/or
- An approximately 12-inch structural section beneath roadways and/or building foundations to be included within the 24-inch-minimum compacted fill layer.

Therefore, the total thickness of the asphaltic concrete cap will be a minimum of 40 inches, depending on the thickness and geotechnical properties of the existing cover soil and the thickness of asphalt.

Performance monitoring for the asphaltic concrete cap will entail construction quality control measures which will include observation of cap construction, ensuring that it occurs per construction plans and specifications, and measuring and observing surface preparations and placement of the asphalt surface. In the case of the asphaltic concrete cap, seams and seals must be properly constructed per standard paving practices and in such a way that no cracks or weak seams occur during construction that would be conduits for transmitting infiltrating stormwater or short-circuiting the landfill gas collection system, or that would present an exposure pathway to the soil beneath.

4.1.2 Low-Permeability Membrane Cap Performance Monitoring

The low-permeability membrane cap, to be constructed where final grades are greater than or equal to 6 percent, primarily around the periphery of the Interim Action Area, will be composed of a minimum of three layers:

- A 6-inch minimum-thickness compacted fill bedding layer;
- A minimum 50-mil-thickness, textured on both surfaces, high-density polyethylene (HDPE) membrane; and
- An 18-inch-thick-minimum drainage and vegetative soil layer consisting of granular top soil, and planted with grass, as indicated in landscaping plans.

The low-permeability membrane cap will be constructed on the existing soil cover that previously was placed over solid waste (with variable thicknesses reported to range from 0 to 48 inches). Therefore, the total thickness of the low-permeability membrane cap will be a minimum of 24 inches, not including the thickness of the existing landfill cover.

Performance monitoring for the low-permeability membrane cap will entail construction quality control measures which will include observing cap construction, ensuring that it occurs per construction plans and specifications; and measuring and observing surface preparations and placement of the membrane surface. In the case of the low-permeability membrane cap, seams and seals must be properly constructed per manufacturer directives and in such a way that no cracks occur that would be conduits for transmitting infiltrating stormwater or short-circuiting the landfill gas collection system, or that would present an exposure pathway to the soil beneath.

4.1.3 Landfill Cap Confirmational Monitoring

Confirmational monitoring for the landfill cap will involve periodic inspections conducted according to procedures in a landfill cap Operation and Maintenance Plan scheduled for completion in the first quarter of 2013. The landfill cap Operation and Maintenance Plan will describe long-term operation, monitoring, and maintenance procedures for the two types of caps

to be constructed at the Interim Action Area: the asphaltic concrete cap; and the low-permeability membrane cap. The primary goal of the landfill cap Operation and Maintenance Plan will be to prevent uncontrolled exposure to solid waste, short-circuiting of the landfill gas control system, and infiltration of stormwater. The landfill cap Operation and Maintenance Plan will:

- Establish an inspection and monitoring program to identify damaged cap systems and evaluate remedy effectiveness;
- Provide for timely repair and replacement needed to restore damaged or intruded cap systems;
- Specify measures to minimize the potential for disturbances of solid waste; and
- Specify requirements for record-keeping of inspections and repairs, and reporting.

4.2 LANDFILL GAS CONTROL MONITORING

This section describes landfill gas compliance monitoring to be conducted by SPPD in support of the Interim Action within and proximate to the Interim Action Area. Compliance landfill gas monitoring will be conducted by SPPD using the landfill gas control system collectors, sanitary sewer manholes, and landfill gas probes within and outside of the perimeter of the Interim Action Area along 5th Avenue South, South Sullivan Street, and Occidental Avenue South and along the northern boundary of the Interim Action Area (Perimeter Probes). Pre-construction baseline landfill gas monitoring will include two additional existing landfill gas probes in the interior of the Interim Action Area. Landfill gas probes placed to monitor landfill gas generated from solid waste on other parcels within the South Park Landfill footprint and outside of the Interim Action Area will be the responsibility of the owners of those parcels (i.e., the Harsch Investments Properties, LLC Kenyon Industrial Park and the City of Seattle South Recycling and Disposal Station).

Landfill gas migration criteria under WAC 173-304, Minimum Functional Standards for Solid Waste Handling (MFS), are defined in WAC 173-304-460 and King County Board of Health Title 10 regulations. The principal MFS performance criteria relevant to the landfill gas control system in the Interim Action Area are the following:

- Methane concentrations in soil gas at the boundary of solid waste must not exceed 5 percent by volume, the lower explosive limit for methane (LEL). This criterion applies to Perimeter Probes, as listed in Table C-1 and shown on Figure 2.
- Methane concentrations inside buildings and structures on the landfill must not exceed 1.25 percent by volume, or 25 percent of the LEL. While there are no buildings currently within the Interim Action Area, this criterion will apply to buildings constructed within the Interim Action Area in the future as part of the SPPD redevelopment plans.

- Methane concentrations inside buildings and structures off the landfill must not exceed 100 parts per million volume (ppmv) (0.01 percent by volume and 0.2 percent of the LEL).

The operational goal of the landfill gas collection and control system is to optimize system operation to prevent off-site gas migration resulting in methane above 5 percent in Perimeter Probes, prevent landfill gas in onsite and offsite buildings, and prevent any surface emission of gas from the landfill that would create an explosion or fire hazard, or odors. Other performance monitoring criteria have been developed for the construction phase and the post-construction operational phase of the Interim Action landfill gas control system, as described below.

4.2.1 Landfill Gas Control Performance Monitoring

The SPPD redevelopment general work sequence pertaining to construction of the landfill gas control system is summarized as follows:

- Placement of soil material on existing grade per engineering design for the landfill cap and other redevelopment plans;
- Installation of underground components of the landfill gas control system, including gas collection wells and laterals, connector piping, and pipe mains, per engineering design; and
- Construction of landfill caps.

A network of 20 Perimeter Probes (16 existing and 4 new) was selected for Interim Action compliance monitoring as indicated in Table C-1. Two additional landfill gas probes within the Interim Action Area will be used to monitor pre-construction baseline conditions. These landfill gas probes were selected based on their spatial distribution around the Interim Action Area and on their being within, or within about 200 feet, of the Interim Action Area. Other existing landfill gas probes are shown on Figure 2.

In addition, two sanitary sewer manholes on the east and west boundaries of the Interim Action Area were selected for compliance monitoring and are indicated as locations MH-01 and MH-02 in Table C-1 and shown on Figure 2. One sanitary sewer manhole is in 5th Avenue South and the second is in Occidental Avenue South.

Compliance monitoring will begin with a baseline landfill gas monitoring event prior to construction. The baseline event will include landfill gas monitoring in the Perimeter Probes, two existing landfill gas probes located in the interior of the Interim Action Area (landfill gas probes GP-01 and GP-02), and the two sanitary sewer manholes. Baseline landfill gas monitoring will include monitoring of hydrogen sulfide in addition to parameters listed below.

Performance monitoring by SPPD in Perimeter Probes and the two sanitary sewer manholes, but not gas probes GP-01 and GP-02 monitored during the baseline landfill gas monitoring event, listed in Table C-1 and shown on Figure 2, will commence with initiation of construction of the

landfill gas control system. Changing ground surface conditions along the perimeter of the Interim Action Area has the potential to affect how landfill gas migrates within and outside the Interim Action Area. As noted in the RI/FS Report, landfill gas has not been measured to be under pressure with current conditions, and the primary mechanism causing landfill gas movement is barometric pumping. Placement of subgrade material and landfill cap surfaces likely will have some effect on how barometric pumping influences landfill gas migration.

Perimeter Probes and sanitary sewer manholes will be monitored using methodology detailed in Attachment B, Compliance Monitoring Sampling and Analysis Plan. Perimeter Probes will be monitored on a daily basis initially, decreasing to twice weekly according to the judgment of the supervising engineer, for testing of the following parameters: methane, carbon dioxide, oxygen, temperature, and pressure. Sanitary sewer manholes will be monitored on a weekly basis initially, decreasing according to the judgment of the supervising engineer, for testing of methane and carbon dioxide. As landfill gas collection wells and laterals are installed, they will be added to the monitoring network and additional parameters will be tested: vacuum pressure and gas flow. Based on monitoring parameters, landfill gas control system valving will be adjusted to optimize the effect of each collection well/lateral and to operate the system within safety limits. Likewise, if an increasing trend in methane concentration is measured in Perimeter Probes during Interim Action construction, landfill gas control system valving will be adjusted and/or system configuration adjustments made until the methane concentration trend in Perimeter Probes is stabilized or reversed.

Landfill gas will be tested using a Landtec Gem 2000 (Plus) landfill gas monitoring instrument (GEM 2000) capable of monitoring for methane, carbon dioxide, carbon monoxide, hydrogen sulfide, oxygen, temperature, percent of LEL, and pressure. Water vapor will be calculated by the GEM 2000 based on gas temperature, assuming the gas is saturated with water vapor.

To the extent possible, Perimeter Probe monitoring will be scheduled to occur after at least 12 hours of falling barometric pressure conditions, with a pressure drop of at least 0.25 inch of mercury. Significant changes in measured landfill gas parameters attributable to construction activities will be noted, and the following performance criteria will be used as "triggers" for performance monitoring mitigation measures:

- Residual nitrogen[3] in landfill gas collection wells or laterals exceeds 20 percent. If residual nitrogen exceeds 30 percent, combustion of buried solid waste is a risk.

[3] Residual nitrogen is calculated from measured concentrations of methane, oxygen, and carbon dioxide as follows: Sum concentrations of methane, oxygen, carbon dioxide. Subtract this sum from 100 to obtain an estimate of total percent nitrogen concentration. Multiply the measured oxygen concentration by 3.76 to estimate the amount of nitrogen associated with oxygen, and subtract from the estimated total percent nitrogen concentration. The resulting percent concentration is considered "residual nitrogen." Increasing flow in a collection well/lateral will result in a reduction of methane levels but residual nitrogen will increase. Experience has shown that 20 percent residual nitrogen is a safe, stable landfill gas control system operational parameter that will not start fires in buried solid waste. If necessary to control migrating methane in a

- Methane exceeds 1.25 percent (i.e., 25 percent of the LEL) in Perimeter Probes. If methane exceeds the LEL, combustion of landfill gas is a risk especially in areas with limited air circulation.

Mitigation measures will consist of adjustments to the landfill gas control system by throttling or opening individual collection well/ lateral flow valving in appropriate sectors of the system and, if necessary, landfill gas extraction in or as close as possible to areas exhibiting either or both of the two performance criteria (i.e., "hot spot" areas). During construction, mitigation measures may have to occur via a temporary landfill gas collection well and blower assembly. If required by the Puget Sound Clean Air Agency, these temporary landfill gas control system discharges to the atmosphere may need to be permitted and monitored. Emissions treatment is presumed. Landfill gas probes in the hot spot will be monitored frequently, initially at least daily and possibly decreasing to weekly during mitigation measures to ensure that methane and/or residual nitrogen levels in landfill gas control system collection wells/laterals drop to safe levels. Hot spot mitigation will continue at the direction of the supervising engineer until the landfill gas control system has been constructed and is fully operational, and methane and/or residual nitrogen levels drop to safe levels.

For the Perimeter Probes monitored by SPPD outside of the Interim Action Are and within 100 feet of buildings and structures off the landfill (i.e., GP-11, 13, 15, and 27 through 32), the following steps will be undertaken[4]:

- If methane exceeds 1.25 percent by volume (25 percent of the LEL), SPPD will make adjustments to the landfill gas control system components in place at the time to attempt to reduce methane concentrations below the ground surface and will monitor methane in Perimeter Probes in the area at least daily at the direction of the supervising engineer.

- If methane in Perimeter Probes persists at levels greater than the LEL and the supervising engineer concludes that methane cannot be effectively reduced by adjustments to the Interim Action landfill gas control system, SPPD will advise the PLP Group and make recommendations for further monitoring or response action(s) specific to monitoring results and conditions in the area. Recommendations will consider results of baseline landfill gas monitoring in landfill gas probes; indoor air in buildings proximate to

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Perimeter Probe, residual nitrogen up to 30 percent can be managed with more frequent monitoring of affected gas collection wells/laterals at least every two weeks.

[4] During completion of the remedial investigation in 2011, a year of baseline landfill gas data was collected from Site landfill gas probes with results provided in the RI/FS Report. Where methane exceeded the LEL in gas probes proximate to buildings, indoor air was also monitored for methane. Methane was never detected in indoor air during this baseline monitoring event and no relationship could be developed to correlate methane in landfill gas probes with methane in indoor air. However, methane concentrations in Perimeter Probes on the east side of 5th Avenue South slightly exceeding the LEL did not result in detectable methane concentrations in indoor air at proximate buildings; and methane concentrations in a landfill gas probe in Kenyon Industrial Park north adjacent to the Interim Action Area exceeded the LEL by nearly ten-fold and methane was not detected in indoor air of the nearest building.

monitored landfill gas probes; and the landfill gas response action protocol to be developed by the PLPs for implementation at the South Park Landfill Site in early 2013. The PLPs will discuss monitoring results, recommendations, and other Site-wide considerations and a consensus on response action(s) shall be reached, documented, and implemented by the PLPs.

- If 14 days after implementing the PLP Group's agreed upon response actions, methane in Perimeter Probes proximate to building and structures off the landfill persist above the LEL and greater than historical concentrations, the PLPs will make appropriate notifications to owners and/or operators of potentially affected properties. SPPD will make recommendations for additional response action(s) to the PLP Group which may include additional gas probe monitoring in existing or new gas probes and/or maximizing mitigation measures implementable with the SPPD landfill gas control system to the extent possible without risk of starting underground in-waste fires. SPPD recommended response action(s) to the PLPs may also include monitoring indoor air in the potentially affected building or structure using procedures described in Attachment B, Compliance Monitoring Sampling and Analysis Plan. The agreed to response action(s) will be documented and implemented by the PLPs.

- If maximized operation of the SPPD landfill gas control system and the implementation of any PLP Group's agreed upon response action(s) are not successful at keeping methane in indoor air below the 100 ppmv performance criterion, response action(s) appropriate to the building or structure as outlined in Figure 6.6 of the RI/FS Report, Interior Building Monitoring Process Decision Tree, including regulatory notifications to Ecology and the Departments of Health at the City of Seattle and King County, will be implemented.

Following approval of the South Park Landfill RI/FS, a CAP will be developed which will include a compliance monitoring plan for landfill gas within landfill gas probes at the South Park Landfill Site. However, the specific gas probe locations, frequency of monitoring, and specific monitoring requirements will be defined in Operations, Maintenance, and Monitoring Plans included as part of the design reports for each LFG control system implemented at the South Park Landfill Site. Measures indicated in these documents would supersede measures indicated in this plan.

4.2.2 Landfill Gas Control Confirmational Monitoring

Confirmational monitoring will involve post-construction monitoring of landfill gas once all components of the landfill gas control system have been installed and are operational and the landfill caps have been constructed. The post-construction phase will commence after start-up system testing and optimization, which will be described in the landfill gas control system Operation and Maintenance Plan scheduled for completion in the first quarter of 2013. The landfill gas control system Operation and Maintenance Plan will also describe long-term operational and maintenance procedures.

Landfill gas confirmational monitoring will be conducted using procedures described in Attachment B, Compliance Monitoring Sampling and Analysis Plan, for the following parameters: methane, carbon dioxide, oxygen, and pressure. Residual nitrogen will be calculated from monitoring data collected from monitoring ports in the landfill gas control system collection wells and laterals. Perimeter Probes that are listed in Table C-1 as selected for compliance monitoring for the Interim Action and shown on Figure 2 will be monitored as directed by the supervising engineer and possibly as frequently as daily to twice weekly during the first week of full-scale operation of the landfill gas control system, decreasing after the first week to weekly through the end of the first month, twice monthly through the second month, and ultimately monthly through the remainder of the first year. It is anticipated that after several months of operation, the well flow and concentrations will stabilize sufficiently that monitoring and adjustments can be performed once every 2 months. If operations and monitoring data indicate stable, safe, and optimal operation, monitoring may be reduced to a quarterly schedule. Selected landfill gas collection wells and laterals will be monitored for the same parameters and at the same frequency as Perimeter Probes to obtain operational data for use in system optimization. Two sanitary sewer manholes listed in Table C-1 will be monitored as frequently as monthly initially and decreasing according to the judgment of the supervising engineer. The landfill gas confirmational monitoring program will be re-evaluated as necessary, when elements of the remedies for the South Park Landfill Site are implemented to ensure optimal operation of the Interim Action landfill gas collection system and landfill gas collection systems installed on other parcels comprising the South Park Landfill Site.

To the extent possible, Perimeter Probe monitoring will be scheduled to occur after at least 12 hours of falling barometric pressure conditions, with a pressure drop of at least 0.25 inch of mercury. Significant changes in measured landfill gas parameters will be noted, and the following performance criteria will be used as triggers for confirmational monitoring mitigation measures:

- Residual nitrogen in landfill gas collection wells or laterals exceeds 20 percent. If residual nitrogen exceeds 30 percent, combustion of buried solid waste is a risk.
- Methane exceeds 1.25 percent (25 percent of the LEL) in Perimeter Probes. If methane exceeds the LEL, combustion of landfill gas is a risk especially in areas with limited air circulation.

Mitigation measures will consist of adjusting operation of the landfill gas control system by throttling or opening individual collection well/ lateral flow valving in appropriate sectors of the system to achieve optimal results and safe conditions.

For the Perimeter Probes monitored by SPPD outside of the Interim Action Are and within 100 feet of buildings and structures off the landfill (i.e., GP-11, 13, 15, and 27 through 32), the following steps will be undertaken:

- If methane exceeds 1.25 percent by volume (25 percent of the LEL), SPPD will make adjustments to the landfill gas control system components to attempt to reduce methane

concentrations below the ground surface and will monitor methane in Perimeter Probes in the area at least daily at the direction of the supervising engineer.

- If methane in Perimeter Probes persists at levels greater than the LEL and the supervising engineer concludes that methane cannot be effectively reduced by adjustments to the Interim Action landfill gas control system, SPPD will advise the PLP Group and make recommendations for further monitoring or response action(s) specific to monitoring results and conditions in the area. Recommendations will consider results of baseline landfill gas monitoring in landfill gas probes; indoor air in buildings proximate to monitored landfill gas probes; and the landfill gas response action protocol to be developed by the PLPs for implementation at the South Park Landfill Site in early 2013. The PLPs will discuss monitoring results, recommendations, and other Site-wide considerations and a consensus on response action(s) shall be reached, documented, and implemented by the PLPs.

- If 14 days after implementing the PLP Group's agreed upon response actions, methane in Perimeter Probes proximate to building and structures off the landfill persist above the LEL and greater than historical concentrations, the PLPs will make appropriate notifications to owners and/or operators of potentially affected properties. SPPD will make recommendations for additional response action(s) to the PLP Group which may include additional gas probe monitoring in existing or new gas probes and/or maximizing mitigation measures implementable with the SPPD landfill gas control system to the extent possible without risk of starting underground in-waste fires. SPPD recommended response action(s) to the PLPs may also include monitoring indoor air in the potentially affected building or structure using procedures described in Attachment B, Compliance Monitoring Sampling and Analysis Plan. The agreed to response action(s) will be documented and implemented by the PLPs.

- If maximized operation of the SPPD landfill gas control system and the implementation of any PLP Group's agreed upon response action(s) are not successful at keeping methane in indoor air below the 100 ppmv performance criterion, response action(s) appropriate to the building or structure as outlined in Figure 6.6 of the RI/FS Report, Interior Building Monitoring Process Decision Tree, including regulatory notifications to Ecology and the Departments of Health at the City of Seattle and King County, will be implemented.

Following approval of the South Park Landfill RI/FS, a CAP will be developed which will include a compliance monitoring plan for landfill gas within landfill gas probes at the South Park Landfill Site. However, the specific gas probe locations, frequency of monitoring, and specific monitoring requirements will be defined in Operations, Maintenance, and Monitoring Plans included as part of the design reports for each LFG control system implemented at the South Park Landfill Site. Measures indicated in these documents would supersede measures indicated in this plan.

Discharge from the landfill gas control system will be monitored at the Landfill Gas Vacuum Blower and Carbon Treatment Compound. Discharge will be treated with a carbon-scrubbing system prior to discharge to the atmosphere, as required by the Puget Sound Clean Air Agency permit to be obtained for the project. System discharge will be monitored using procedures presented in Attachment B, Compliance Monitoring Sampling and Analysis Plan, on a minimum monthly schedule for the following parameters both up- and down-stream of the carbon treatment unit: methane, carbon dioxide, oxygen, pressure, residual nitrogen, and temperature. The pressure drop across the carbon treatment unit and barometric pressure also will be measured and recorded.

To comply with Puget Sound Clean Air Agency permitting, discharge from the carbon filter will be sampled and analyzed using method TO-15 for volatile organic compounds on a monthly basis, or as required by permitting. If the discharge is found to exceed permit limits, the spent carbon in at least one of the carbon filters will be removed and replaced with clean granular carbon.

As buildings are constructed within the Interim Action Area according to the SPPD redevelopment plan, it is presumed that they will be constructed slab-on-grade. The building subgrades will be fitted with sub-slab depressurization systems plumbed into the landfill gas control system. Building interiors will be monitored for methane according to the procedures described in Attachment B, Compliance Monitoring Sampling and Analysis Plan, on a minimum monthly schedule for the first year the buildings are occupied. Monitoring frequency may be decreased to quarterly if methane measured during the first year remains at safe levels. The MFS performance criterion for interiors of buildings constructed on landfills will be in-place: methane concentrations inside buildings and structures on the landfill must not exceed 1.25 percent by volume, or 25 percent of the LEL. If this criterion is not met during any monitoring event, mitigation measures, including adjusting operation of the sub-slab depressurization system or the proximate sector(s) of the landfill gas collection system, will be implemented until indoor air is safe.

5.0 GROUNDWATER CONFIRMATIONAL MONITORING

Per WAC 173-340-410(1)(c), the purpose of confirmational monitoring is to confirm the long-term effectiveness of the Interim Action or cleanup action once cleanup standards and, if appropriate, remediation levels or other performance standards have been attained. The Interim Site-wide Groundwater Monitoring Plan includes monitoring groundwater levels and quality at the South Park Landfill Site monitoring well network for the period prior to approval of the Cleanup Action Plan for the South Park Landfill Site and implementation of the compliance monitoring program for the South Park Landfill Site as a whole. Confirmational groundwater monitoring specific to the Interim Action would be redundant with the interim Site-wide groundwater monitoring program. Therefore, no confirmational groundwater monitoring program specific to the Interim Action is planned. The Interim Site-wide Groundwater Monitoring Plan has been submitted to Ecology by the South Park Landfill PLP Group, and once approved by Ecology, that interim site-wide groundwater monitoring program will continue until the Final Cleanup Action Plan and the compliance monitoring program for the South Park Landfill Site are in effect.

6.0 REPORTING

Reporting for the Interim Action compliance monitoring program will include preparation of an Interim Action Construction Report documenting the construction of the Interim Action elements, which will be produced within 3 months of Interim Action construction completion. Once the Interim Action elements have been constructed and are operational, annual Interim Action Progress Reports will be prepared to document compliance monitoring and mitigation activities over the course of each calendar year. The content of Interim Action Progress Reports may be modified when the Compliance Monitoring Plan for the South Park Landfill Site comes into effect and monitoring for groundwater and landfill gas occurs for the entire South Park Landfill Site.

6.1 INTERIM ACTION CONSTRUCTION REPORT

Following the construction phase of the Interim Action, an Interim Action Construction Report will be prepared per WAC 173-340-400[6][b], Construction Documentation, and will include results of compliance monitoring through the construction phase, as-built information, and the opinion of the observing Professional Engineer based on testing results and inspections as to whether the Interim Action construction was performed in substantial compliance with the design. The Interim Action Construction Report will be based on construction-phase field documentation and results from construction-phase compliance monitoring activities, and will include as-built drawings of both the landfill cap and landfill gas control system components. The Interim Action Construction Report will also include records such as laboratory analytical reports and copies of permits obtained for discharge of landfill gas control system emissions to the atmosphere and condensate to the sanitary sewer.

6.2 ANNUAL PROGRESS REPORTING

After completion of construction, annual Interim Action Program Reports documenting Interim Action operation, monitoring, and activities associated with performance and confirmational compliance monitoring activities will be submitted to Ecology in March for the previous calendar year. Annual progress reporting will include monitoring results from landfill cap annual inspections, and landfill gas collection system monitoring. Progress reporting will summarize operation and maintenance activities, data, and mitigation measures, and will include analytical laboratory reports.

To comply with permit requirements for discharging treated landfill gasses to the atmosphere, separate annual reports providing results of monitoring and information regarding discharge treatment equipment maintenance will be submitted to the Puget Sound Clean Air Agency.

Progress reporting for Site-wide groundwater monitoring will be prepared as part of the interim Site-wide groundwater monitoring program for the period prior to implementation of the Final Cleanup Action Plan for the South Park Landfill Site and implementation of the compliance monitoring program for the South Park Landfill Site as a whole.

7.0 REFERENCES

Farallon Consulting, L.L.C. (Farallon). 2013. *Interim Action Work Plan, South Park Landfill Site, Seattle, Washington* . Prepared for South Park Property Development, L.L.C. January 16.

Freeze, R.A. and Cherry, J.A. 1979: Groundwater. Hemel Hempstead: Prentice-Hall International.

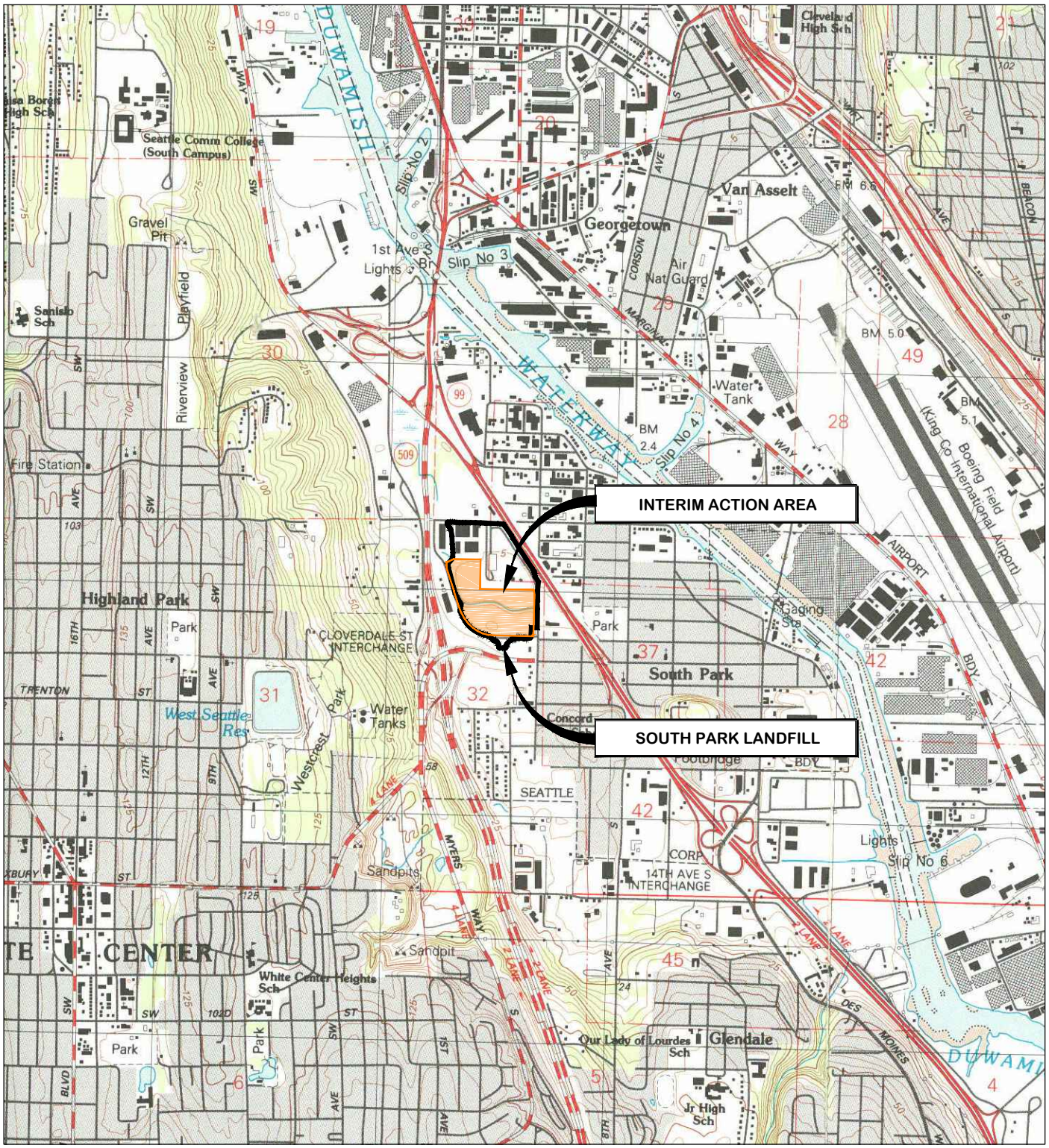
Floyd|Snider. 2012. *Draft South Park Landfill Remedial Investigation/Feasibility Study.* Prepared for City of Seattle, South Park Property Development, L.L.C. April 16.

———. 2012. *Draft South Park Landfill Interim Site-wide Groundwater Monitoring Plan*. Prepared for City of Seattle, South Park Property Development, L.L.C. December.

FIGURES

INTERIM ACTION COMPLIANCE MONITORING PLAN
APPENDIX C OF INTERIM ACTION WORK PLAN
South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002



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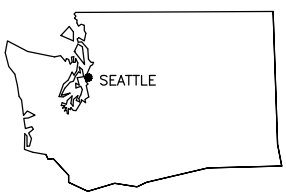

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Issaquah, WA 98027

FIGURE 1

VICINITY MAP
SOUTH PARK LANDFILL SITE
SEATTLE, WASHINGTON

FARALLON PN: 408-002

Drawn By: DEW	Checked By: TC	Date: 10/4/12	Disk Reference: BASEMAPb

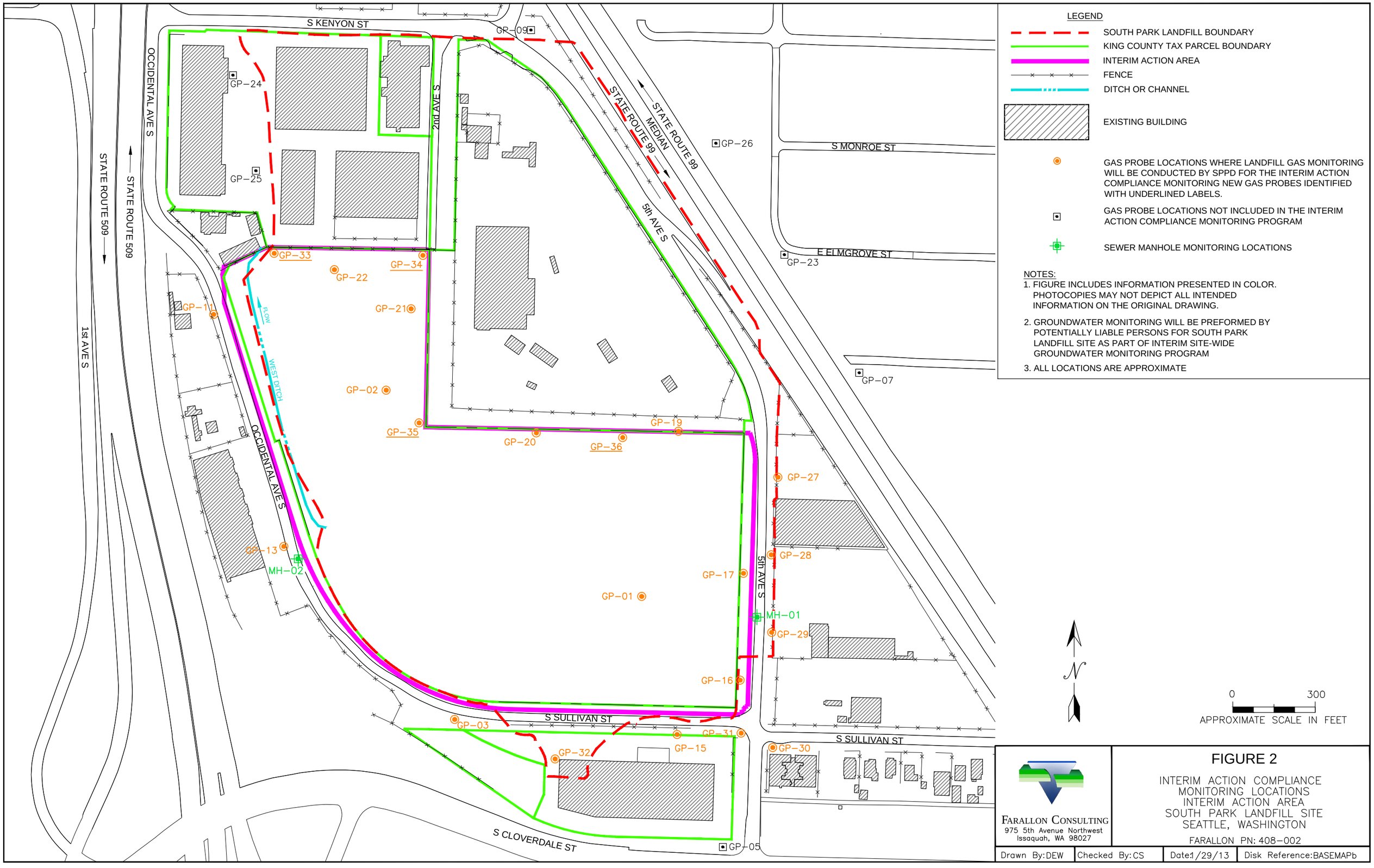

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FIGURE 2

INTERIM ACTION COMPLIANCE MONITORING LOCATIONS
INTERIM ACTION AREA
SOUTH PARK LANDFILL SITE
SEATTLE, WASHINGTON

FARALLON PN: 408-002

Drawn By: DEW	Checked By: CS	Date: 1/29/13	Disk Reference: BASEMAPb

LEGEND

SOUTH PARK LANDFILL BOUNDARY

INTERIM ACTION AREA

PROPERTY LINE

32 PROPOSED CONTOUR

RETAINING WAL

SAW CUT LINE

FENCE LINE

APPROXIMATE EXTENT OF ASPHALT COVER (SEE SOILS REPORT)

APPROXIMATE EXTENT OF GEOMEMBRANE LINER (SEE SOILS REPORT)

N

0 150

APPROXIMATE SCALE IN FEET

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FIGURE 3

PLAN SHOWING LANDFILL CAP AND STORMWATER CONVEYANCE AND TREATMENT FACILITIES
INTERIM ACTION AREA
SOUTH PARK LANDFILL SITE, SEATTLE, WA

FARALLON PN: 408-002

Drawn By: DEW	Checked By: CS	Date: 12/7/12	Disk Reference: revEN-2

LEGEND

- 6"ø SDR 21 HDPE LANDFILL GAS MAIN
- 6"ø GAS COLLECTION TRENCH
- 4"ø HDPE LANDFILL GAS CONNECTION PIPE
- GAS COLLECTION WELLS
- CONNECTION POINT
- 32 — CONTOUR AFTER SITE REGRADING
- X 17.6 — EXISTING CONTOURS AND SPOT ELEVATIONS

NOTES:

1. PERFORATED HORIZONTAL COLLECTION TRENCHES TO BE INSTALLED PRIOR TO SITE RE-GRADING. SITE RE-GRADING BY OTHERS.
2. BUILDING SUB-SLAB HORIZONTAL COLLECTION TRENCHES TO BE INSTALLED AFTER SITE RE-GRADING
3. LANDFILL GAS MAINS TO BE INSTALLED AT COMPLETION OF SITE RE-GRADING.
4. LANDFILL GAS COLLECTION PIPES MAY BE INSTALLED BEFORE OR AFTER RE-GRADING AT CONTRACTOR OPTION.
5. VERTICAL LANDFILL GAS WELLS MAY BE INSTALLED BEFORE OR AFTER RE-GRADING AT CONTRACTOR OPTION.
6. LANDFILL GAS MAIN SLOPE TO DRAIN.
7. ALL LANDFILL GAS CONNECTION PIPES SHALL BE INSTALLED AT A MINIMUM 2% SLOPE TO LANDFILL GAS MAIN.

N

0 150

APPROXIMATE SCALE IN FEET

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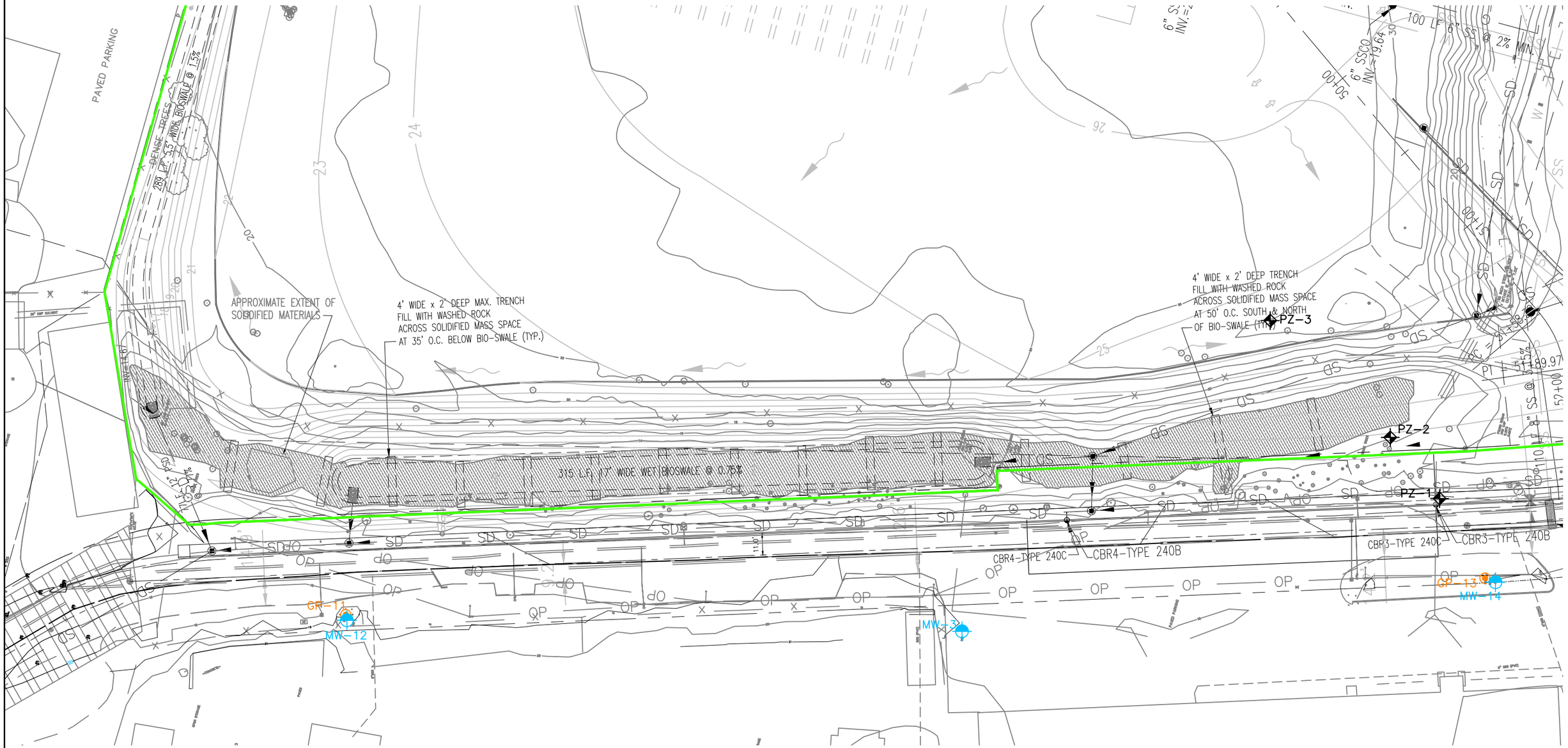
Issaquah, WA 98027

FIGURE 4

PLAN SHOWING
LANDFILL GAS CONTROL SYSTEM
INTERIM ACTION AREA
SOUTH PARK LANDFILL SITE
SEATTLE, WASHINGTON

FARALLON PN: 408-002

Drawn By: DEW	Checked By: CS	Date: 12/7/12	Disk Reference: revEN-2



LEGEND

- KING COUNTY TAX PARCEL BOUNDARY
- MONITORING WELL SCREENED IN UPPER ZONE OF SHALLOW AQUIFER (A-ZONE)
- PIEZOMETER
- GAS PROBE

NOTES:

1. FIGURE INCLUDES INFORMATION PRESENTED IN COLOR. PHOTOCOPIES MAY NOT DEPICT ALL INTENDED INFORMATION ON THE ORIGINAL DRAWING.
2. TOPOGRAPHIC SURVEY MAP AND DESIGN PROVIDED BY EXLTECH.

0 50

APPROXIMATE SCALE IN FEET

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FIGURE 5

WEST DITCH INTERIM ACTION AND PROPOSED GRADING
INTERIM ACTION AREA
SOUTH PARK LANDFILL SITE
SEATTLE, WASHINGTON

FARALLON PN: 408-002

Drawn By: DEW	Checked By: CS	Date: 11/12/12	Disk Reference: BASEMAPb

TABLE

INTERIM ACTION COMPLIANCE MONITORING PLAN
APPENDIX C OF INTERIM ACTION WORK PLAN
South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002

Table C-1
Monitoring Point Selection
Landfill Gas Compliance Monitoring Program
Interim Action Area, South Park Landfill Site
Seattle, Washington
PN: 408-002

Location Identification	Location Proximate to Interim Action Area	Facility/Area	Installed by	Selected for Compliance Monitoring[1]
GP-01	SPPD property interior	SPPD	Udaloy Environmental Services	Initial Event Only
GP-02	SPPD property interior	SPPD	Udaloy Environmental Services	Initial Event Only
GP-03	Within 100 feet and south of SPPD property	Vacant Lot/South Cloverdale St.	Associated Earth Sciences, Inc.	Yes
GP-05	Near vicinity south of SPPD property	Emerson Power Products	Associated Earth Sciences, Inc.	
GP-07	Near vicinity east of SPPD property	East of State Route 99	Associated Earth Sciences, Inc.	
GP-09	Near vicinity north of SPPD property	Right of Way State Route 99/5th Avenue South	Associated Earth Sciences, Inc.	
GP-11	Within 100 feet and west of SPPD property	Right of Way Occidental Avenue South/ International Construction Equipment	Associated Earth Sciences, Inc.	Yes
GP-13	Within 100 feet and west of SPPD property	Right of Way Occidental Avenue South/ North Star Ice Equipment	Associated Earth Sciences, Inc.	Yes
GP-15	Within 100 feet and south of SPPD property	Emerson Power Products	Associated Earth Sciences, Inc.	Yes
GP-16	Within 50 feet and east of SPPD property	5th Avenue South west right-of-way	Associated Earth Sciences, Inc.	Yes
GP-17	Within 50 feet and east of SPPD property	5th Avenue South west right-of-way	Associated Earth Sciences, Inc.	Yes
GP-19	SPPD property perimeter	SPPD	Associated Earth Sciences, Inc.	Yes
GP-20	SPPD property perimeter	SPPD	Associated Earth Sciences, Inc.	Yes
GP-21	SPPD property interior, within 100 feet of east property line	SPPD	Associated Earth Sciences, Inc.	Yes
GP-22	SPPD property interior, within 100 feet of north property line	SPPD	Associated Earth Sciences, Inc.	Yes
GP-23	Near vicinity east of SPPD property	Right of Way East of State Route 99	Associated Earth Sciences, Inc.	

Table C-1
Monitoring Point Selection
Landfill Gas Compliance Monitoring Program
Interim Action Area, South Park Landfill Site
Seattle, Washington
PN: 408-002

Location Identification	Location Proximate to Interim Action Area	Facility/Area	Installed by	Selected for Compliance Monitoring[1]
GP-24	Near vicinity north of SPPD property	Kenyon Industrial Park	South Park Landfill Site Potentially Liable Parties Common Consultant	
GP-25	Near vicinity north of SPPD property	Kenyon Industrial Park	South Park Landfill Site Potentially Liable Parties Common Consultant	
GP-26	Near vicinity east of SPPD property	Right of Way East of State Route 99	South Park Landfill Site Potentially Liable Parties Common Consultant	
GP-27	Within 100 feet and east of SPPD property	5th Avenue South east right-of-way	South Park Landfill Site Potentially Liable Parties Common Consultant	Yes
GP-28	Within 100 feet and east of SPPD property	5th Avenue South east right-of-way	South Park Landfill Site Potentially Liable Parties Common Consultant	Yes
GP-29	Within 100 feet and east of SPPD property	5th Avenue South east right-of-way	South Park Landfill Site Potentially Liable Parties Common Consultant	Yes
GP-30	Near vicinity southeast of SPPD property	5th Avenue South east right-of-way	South Park Landfill Site Potentially Liable Parties Common Consultant	Yes
GP-31	Near vicinity southeast of SPPD property	5th Avenue South west right-of-way	South Park Landfill Site Potentially Liable Parties Common Consultant	Yes
GP-32	Near vicinity south of SPPD property	Emerson Power Products	South Park Landfill Site Potentially Liable Parties Common Consultant	Yes
GP-33	Near vicinity northwest of SPPD property	SPPD	SPPD (new)	Yes
GP-34	Near vicinity northeast of SPPD property	SPPD	SPPD (new)	Yes

Table C-1
Monitoring Point Selection
Landfill Gas Compliance Monitoring Program
Interim Action Area, South Park Landfill Site
Seattle, Washington
PN: 408-002

Location Identification	Location Proximate to Interim Action Area	Facility/Area	Installed by	Selected for Compliance Monitoring[1]
GP-35	Near vicinity southeast of SPPD property	SPPD	SPPD (new)	Yes
GP-36	Near vicinity northeast of SPPD property	SPPD	SPPD (new)	Yes
MH-01	Sanitary sewer manhole east adjacent to SPPD property	5th Avenue South right-of-way	Others	Yes
MH-02	Sanitary sewer manhole west adjacent to SPPD property	Occidental Avenue South right-of-way	Others	Yes

NOTES:

[1] Gas probe field testing: methane, carbon dioxide, pressure; hydrogen sulfide during initial event only; Sanitary sewer manhole field testing: methane and carbon dioxide only

SPPD = South Park Property Development, LLC

ATTACHMENT A
HEALTH AND SAFETY PLAN

INTERIM ACTION COMPLIANCE MONITORING PLAN
APPENDIX C OF INTERIM ACTION WORK PLAN
South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002

975 5th Avenue Northwest, Issaquah, Washington 98027
Tel: (425) 295-0800 Fax: (425) 295-0850
www.farallonconsulting.com

This Health and Safety Plan has been prepared in accordance with Agreed Order No. 6706.

The Health and Safety Plan is written for the use of Farallon Consulting, L.L.C. and its employees while performing field activities at the South Park Landfill Site and is not intended for use by others

975 5th Avenue Northwest, Issaquah, Washington 98027
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HEALTH AND SAFETY PLAN

ATTACHMENT A OF INTERIM ACTION COMPLIANCE MONITORING PLAN

INTERIM ACTION AREA OF THE
SOUTH PARK LANDFILL SITE
SEATTLE, WASHINGTON

Submitted by:
Farallon Consulting, L.L.C.
975 5th Avenue Northwest
Issaquah, Washington 98027

Farallon PN: 408-002

For:
South Park Property Development, L.L.C.
165 Northeast Juniper Street, Suite 100
Issaquah, Washington 98027

February 22, 2013

HEALTH AND SAFETY PLAN
REVIEW AND APPROVAL

Client: South Park Property Development
Facility Name: South Park Landfill Site
Project Name: Interim Action Compliance Monitoring
Project Number: 408-002
Start Date: February 2013
End Date: To be determined

Plan Expiration Date: December 31, 2013

APPROVED BY:

Project Manager	_____	_____
	Signature	***Date***
Office Health and Safety Coordinator	_____	_____
	Signature	***Date***
Site Health and Safety Officer	_____	_____
	Signature	***Date***
Principal-in-Charge	_____	_____
	Signature	***Date***

This Health and Safety Plan (HASP) was written for the use of Farallon Consulting, L.L.C. (Farallon) and its employees while performing field activities at the South Park Landfill Site located in the South Park neighborhood of Seattle, Washington (herein referred to as the Site). It may also be used by trained and experienced Farallon subcontractors as a guidance document. However, Farallon does not guarantee the health and/or safety of any person entering this Site.

Due to the potentially hazardous nature of the Site and the activities occurring thereon, it is not possible to discover, evaluate, or provide protection for all possible hazards that may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but does not eliminate, the potential for injury. The health and safety guidelines in this HASP were prepared specifically for this Site, its conditions, purposes, dates of field work, and personnel, and must be amended if conditions change.

Farallon claims no responsibility for the use of this HASP by others. This HASP will provide useful information to subcontractors and will assist them in developing their own HASP, but it should not be construed as a substitute for their own HASP. Subcontractors must sign this HASP (see Attachment 1, Health and Safety Plan Acknowledgment and Agreement Form) as an acknowledgement of hazard information and as notice that this HASP does not satisfy any requirement to develop their own HASP.

CONTENTS

ATTACHMENTS

1.0 SCOPE OF WORK

This Health and Safety Plan (HASP) was prepared as a component of the Interim Action Compliance Monitoring Plan (Plan) for the South Park Landfill Site located in the South Park neighborhood less than 5 miles south of downtown Seattle, Washington (herein referred to as the Site). This HASP was prepared for the use of Farallon Consulting, L.L.C. (Farallon) personnel while performing the field activities described in the Plan. Specific details regarding each field activity are presented in the Plan and should be referenced with this HASP. Field activities at the Site are outlined below:

Construction Observation:

- Landfill Cap – Observation of the construction of the asphaltic concrete and low-permeability membrane landfill cap;
- Landfill Gas Controls – Observation of the construction of the landfill gas collection and control system; and
- West Ditch Solidification – Observation of the solidification of unconsolidated material recently deposited in the West Ditch.

Environmental Drilling:

- A-Zone Monitoring Well – Installation of shallow A-Zone monitoring wells; and
- A-Zone Piezometers – Installation of shallow A-Zone piezometers.

Operations and Maintenance:

- Landfill Cap
  - Annual Inspections
  - Periodic Repairs
- Landfill Gas Controls
  - System Start-up, Testing, and Optimization
  - Operations and Maintenance

Monitoring:

- Landfill Gas
  - Landfill Gas Probes
    - Perimeter Performance – Monitoring perimeter landfill gas probes during construction of the landfill; and
    - Optimization – Monitoring perimeter landfill gas probes during the adjustment to the landfill gas control system valving.
  - Future Interim Action Area Buildings Confirmation – Monitoring indoor air quality in future buildings constructed in the Interim Action Area.

Each activity will be conducted in a manner consistent with the requirements detailed in the Interim Action Compliance Monitoring Plan and related appendices.

2.0 BACKGROUND INFORMATION

Farallon has prepared this HASP to be implemented during field activities conducted according to the Plan for the Site. This HASP has been prepared as Appendix A of the Plan. The Plan describes compliance monitoring that will be performed in conjunction with the Interim Action to be conducted on a portion of the South Park Landfill (Interim Action). The South Park Landfill is located in the South Park neighborhood less than 5 miles south of downtown Seattle, Washington. The South Park Landfill covers an area of approximately 39 acres, of which nearly half is currently developed. Figure 1 of the Plan shows the general vicinity around the South Park Landfill, and Figure 2 of the Plan shows the approximate boundaries of the South Park Landfill. Sections 1 and 2 of the Plan describes the Interim Acton area and summarizes the project scope and Interim Action components which include capping the landfill surface, controlling landfill gas, and constructing a stormwater collection and conveyance system.

The sampling and analysis procedures that will be used are described in the Sampling and Analysis Plan (SAP—Appendix B of the Plan). The primary objective of the HASP is to ensure the safety of Farallon personnel during the field monitoring tasks.

3.0 DRUG AND ALCOHOL POLICY

It is Farallon's policy to maintain a drug-free workplace. Farallon has a responsibility to all of its staff members to provide a safe and inoffensive work environment, and a responsibility to its clients to provide accurate and consistent service. For these reasons, Farallon's drug and alcohol policy prohibits the following behavior by its staff members in the field:

- Use of any tobacco products at any time in sensitive, hazardous, or potentially hazardous areas that may pose a health and safety or environmental risk. The Site Health and Safety Officer (SHSO) may designate an area away from identified hazards that may be safe for tobacco use.
- Possession or consumption of alcohol, or being under the influence of alcohol during field activities.
- Abuse of prescription and/or over-the-counter drugs in such a manner as to negatively impact performance or field safety.
- Possession, use, sale, or being under the influence of illegal drugs while in the field or during any work hours.

Violation of the drug and alcohol policy described above is grounds for immediate removal from the project site and discipline in accordance with Farallon company policy. If an incident occurs, drug and alcohol testing of Farallon personnel may be performed in accordance with Farallon company policy.

4.0 WEAPONS POLICY

Farallon employees, contractors, subcontractors, and their employees or representatives working at the Site are to ensure that they do not bring weapons onto the work site. Weapons include but are not limited to firearms, ammunitions, knives, and explosives. Tools including but not limited to box knives, are exempt from this weapons policy as long as they are used specifically for and during the course of designated field activities. All vehicles and persons can be subjected to search by police and/or Farallon field personnel at any time while working at the Site.

Any violation or failure to comply with the weapons policy described above will result in disciplinary action for the individual(s) involved in accordance with Farallon company policy.

5.0 INCIDENT PREPAREDNESS AND RESPONSE

Farallon employees and subcontractors working at the Site must be prepared to respond appropriately to incidents involving injury, illness, death, spills, or utility breaches. This section outlines the degree of preparedness required for Farallon employees working at the Site and describes the actions to be taken in the event of a health and safety incident.

5.1 HEALTH AND SAFETY PREPAREDNESS

All individuals working at the Site are required to be familiar with the contents of this HASP. Additionally, the following health and safety preparedness list should be reviewed at each daily health and safety meeting prior to the commencement of field activities:

- The directions to the hospital (Attachment 2);
- The locations of the Farallon first aid and blood borne pathogens kit(s), personal eye wash kit(s), and fire extinguisher(s);
- The locations of the keys to the Farallon Site vehicle; and
- Hand signs or sign language that will be used to provide for the immediate stoppage of work (such as a horizontal hand movement in front of the neck).

Additional topics for daily health and safety meetings are included in Attachment 3, Potential Topics for Daily Health and Safety Meeting. Participation in each daily health and safety meeting will be documented in the Daily Health and Safety Briefing Log (Attachment 4).

5.2 INJURY OR ILLNESS

If an injury or illness occurs, the following actions should be taken, regardless of the severity of the injury or illness:

- Stop work.
- Determine whether emergency response staff (e.g., fire, ambulance) are necessary. If so, dial 911 on a cellular phone or the closest available telephone. Describe the location of the injured person and provide other details as requested. If an individual requires non-emergency medical care at a hospital, follow the directions to the nearest hospital (Attachment 2). IF EMERGENCY MEDICAL CARE IS NEEDED CALL 911.
- Administer first aid to the individual immediately, using the first aid kit provided in each Farallon Site vehicle. Use the bloodborne pathogens kit and personal eyewash, as needed.
- Notify the SHSO immediately. The SHSO is responsible for preparing and submitting an Incident Report form to Farallon's Health and Safety Coordinator (HSC) within 24 hours of the incident, and for notifying the employee's supervisor and the Principal in Charge. The Incident Report form is provided in Attachment 5.

- ***All incidents must be reported to the HSC within 24 hours; however, the actual investigation need not be completed within 24 hours.*** **A telephone message that includes the date, time, and the general circumstances of the incident should be left at one of the following numbers if the HSC cannot be reached directly:**
  - HSC work phone: (425) 295-0800
  - HSC cell phone: (425) 466-1032
  - If the HSC cannot be located contact the Principal-in-Charge at (425) 295-0800 (work) or (425) 765-3365 (cell).

- The SHSO will assume first responder responsibilities as practical during a medical emergency until emergency response personnel arrive at the site.

5.3 REPORTING PROCEDURES FOR MINOR CUTS, SCRATCHES, BRUISES, ETC.

Every occupational illness or injury must be reported immediately by the employee to the SHSO. The SHSO is to complete the Incident Report form (Attachment 5) and report the incident to the HSC.

5.4 NEAR MISSES

A near miss is defined as an incident from which no personal injury is sustained and no property damage is incurred, but where injury and/or property damage could have occurred under slightly different timing, location, or circumstances.

In the event of a near miss, the following actions are to be taken:

- Stop work.
- Immediately report the near miss to the SHSO.
- The SHSO is to report the near miss to the HSC and complete the Near Miss Report (Attachment 6).
- Resume work upon satisfactory resolution of the near-miss condition(s) and documentation of all corrective action(s) taken by the SHSO and other personnel.

5.5 MEDICAL INCIDENTS NOT REQUIRING EMERGENCY RESPONSE

Medical incidents not requiring emergency response services include injuries and conditions such as minor lacerations and sprains. In the event of an injury, illness, or a condition that does not require emergency response services; the following actions are to be taken:

- Stop work.
- Administer first aid as necessary to stabilize the individual for transport to the hospital.
- The SHSO is to facilitate prompt transportation of the individual to the hospital. Directions to the nearest hospital are provided in Attachment 2.

- A representative of Farallon or the subcontractor will drive the individual to the medical facility and remain at the facility until the individual is able to return to the Site, or arrangements for further care have been established.
- If the driver is not familiar with the route to the hospital, a second person who is familiar with the route will accompany the driver and the injured employee to the hospital.
- If it is necessary for the SHSO to accompany the injured employee to a medical facility, provisions must be made for another employee who is trained and certified in first aid to assume the duties of temporary SHSO and act as first responder before work activities at the Site are resumed.
- If the injured employee is able to return to the Site the same day, they must bring a statement from the doctor that provides the following information:
    - Date of incident
    - Employee's name
    - Diagnosis
    - Date he/she is able to return to work, and whether regular or light duty
    - Date he/she is to return to the doctor for a follow-up appointment, if necessary
    - The doctor's signature and contact information
- The SHSO is to complete the Incident Report form (Attachment 5) and report the incident to the HSC.
- If the injured employee is unable to return to the Site the same day, the employee who transported them should bring the statement from the doctor back to the Site. The information on this statement will be reported to the HSC immediately.

5.6 EMERGENCY CASES REQUIRING AMBULANCE SERVICE

In the event of an injury or illness that requires emergency response and transport to a hospital by ambulance the following actions should be taken:

- **Dial 911** to request ambulance service.
- Notify the SHSO.
- Administer first aid until emergency response personnel arrive.
- One designated Farallon representative should accompany the injured employee to the medical facility and remain there until final diagnosis, treatment plan, and other relevant information has been obtained.
- The SHSO is to complete the Incident Report form (Attachment 5) and report the incident to the HSC immediately.

5.7 EMPLOYEE DEATH OR IN-PATIENT HOSPITALIZATION OF ANY EMPLOYEE

The procedures outlined in Section 6.2 should be followed in the event of an employee injury or illness. If an employee fatality occurs, the HSC, local emergency response personnel and the coroner must be notified **immediately**. **In accordance with WAC 296-800-32005, the HSC will initiate the required State of Washington Deportment of Labor and Industries and Occupational Safety and Health Administration (OSHA) notifications within 8 hours of a fatal or possibly fatal injury; or an injury requiring in-patient hospitalization of any employee.**

5.8 RESPONSE TO SPILLS OR UNDERGROUND UTILITY BREACHES

To the extent practicable the location(s) of all proposed drilling/excavation locations; underground utilities such as gas, water, storm sewer, sanitary sewer, telephone, cable, and fiber optic lines; and facilities such as underground storage tanks, product lines, septic tanks and drainage fields, and utility vaults will be identified and marked with the appropriate color paint and/or pin flags prior to commencement of intrusive subsurface work activities. Farallon personnel will:

- File a public located request with the Utility Notification Center to have public utilities located beneath public areas such as right-of-ways, easements, etc., marked by the appropriate regulatory authority and/or utility company;
- Coordinate an appropriate private locating professional to complete a private locate at the Site to mark utilities located on private property. The private utility locate activities will be overseen by Farallon field personnel to ensure the proposed drilling/excavation locations both on and off the Site are clear of conductible underground utilities; and
- Identify and review reasonably attainable utility maps which may be available for the Site.

Specific Site circumstances may require that in addition to locating and identifying conductible utilities, the private utility locate and identify non-conductible subsurface utilities or facilities such as polyvinyl chloride (PVC) irrigation/water lines and concrete pipes or tanks. Information derived from the utility locate activities will be used to complete the Utility Clearance Log (Attachment 7).

If a utility line or tank is breached or a spill or release occurs, the incident will be documented on the Incident Report form (Attachment 5) as soon as possible. The date, time, name of the person(s) involved, actions taken, and discussions with other affected parties are to be included. The SHSO, Project Manager (PM), and client are to be notified immediately. The PM is to notify the appropriate regulatory authority and/or utility company, as necessary.

In the event of a spill or release from a utility vehicle or other equipment, the following actions should be taken:

1. Stay upwind of the spill or release.

2. Don appropriate personal protective equipment (PPE).
3. Turn off equipment and other sources of ignition.
4. Turn off pumps and shut valves to stop the flow or leak.
5. Plug the leak or collect drippings, when possible.
6. Use sorbent pads to collect the product and impede its flow, if possible.
7. Dial 911 or telephone the local fire department immediately if a fire or another emergency situation develops.
8. Inform the Farallon PM of the situation.
9. Determine whether the client would like Farallon to repair the damage or would rather use an emergency repair contractor.
10. Advise the client of spill discharge notification requirements, and establish who will complete and submit the required forms. ***Do not report or submit information to an agency without the client's consent.*** Document each interaction with the client and regulators; noting names, titles, authorizations, refusals, decisions, and commitments to any action.
11. Do not transport or approve transportation of contaminated soils or product until proper manifests have been completed and approved. Be aware that soil and/or product may meet criteria for hazardous waste.
12. Do not sign manifests as a generator of wastes. Contact the PM to discuss waste transportation.

5.9 NOTIFICATIONS

A spill or release requires completion of an Incident Report form (Attachment 5) per Farallon's Health and Safety program. **The PM must involve the client and/or generator in the incident reporting process. The client and/or generator is under obligation to report the incident to the appropriate government agency(ies). If the spill extends into waterways, the Coast Guard and the National Response Center must be notified immediately by the client or with their permission (1-800-424-8802).**

5.10 SHUTOFF VALVES AND/OR SWITCHES FOR UTILITIES AND PRODUCTS

Before starting work Farallon field personnel will locate and list below the location(s) of utility and product line shutoff valve(s) and switches at the Site. The location(s) of all shutoff valve(s) and switches will be reviewed with Farallon field personnel during the daily Health and Safety meeting prior to beginning work.

The shutoff valves and/or switches for electrical, natural gas, gasoline, water lines, etc. will be documented in the field before starting work. Documentation will include a written description of the location and type of valve(s) and/or switch(es) and a site plan depicting the location(s).

6.0 EMERGENCY RESPONSE AND EVACUATION PLAN

Farallon personnel and subcontractors working on Site are to be aware of Site-specific emergency and evacuation procedures, including alarm systems and evacuation plans and routes. If an incident occurs that requires emergency response, such as a fire or spill, **Call 911 and request emergency assistance**. Farallon personnel, subcontractors, and/or others working in an area where an emergency occurs are to evacuate to a safe location away from the incident area, preferably upwind, and take attendance.

For this project, the emergency evacuation gathering location is the west entrance of the Site on 5th Avenue South.

If the emergency causes the route to be obstructed, Farallon personnel and subcontractors are to move to an open area upwind of the hazard area, and remain there until instructed by emergency response personnel (e.g., police, fire, ambulance personnel, paramedics) to do otherwise.

Subcontractors have the responsibility to account for their own employees and provide requested information to emergency response personnel immediately upon request. Farallon staff, subcontractors, and/or contractors may not reenter the scene of the emergency without specific approval from emergency response personnel.

7.0 LOCAL EMERGENCY CONTACT NAMES AND TELEPHONE NUMBERS

Local emergency response personnel can be contacted at the following numbers. Directions and a map to the hospital are included in Attachment 2.

Emergency Contact	Name and Location	Telephone No.
Hospital	Harborview Medical Center 325 9th Avenue Seattle, Washington 98104-2420	**911** Or (206) 744-5100
Police	Seattle Police Department 2300 Southwest Webster Street Seattle, Washington	**911** Or (206) 733-9800
Fire	Seattle Fire Department 800 South Cloverdale Street Seattle, Washington	**911** Or (206) 386-1400
National Response Center		**1-800-424-8802**
Washington State Department of Ecology		**(360) 407-6300**
Poison Control		**1-800-424-5555**

8.0 PROJECT PERSONNEL AND RELEVANT INFORMATION

Questions about this project that are posed by neighbors, the press, or other interested parties should be directed to the Principal in Charge at Farallon: (425) 295-0800.

Fill in the table below before beginning any field work.

Project Job Title Name and Phone Number	General Project Responsibilities	Field Personnel Training Dates			Medical Surveillance Date
		40-Hour HAZWOPER	8-Hour Refresher	CPR/ First Aid	
Site Health and Safety Officer	Implement this HASP. Perform air quality tasks. Review subcontractor's HASP. Perform first responder duties.				
Farallon Personnel	Be familiar with HASP requirements and the Farallon Accident Prevention Program and Hazardous Waste Operations Program				
Project Manager	Oversee and direct field work. Support Site Health and Safety Officer with implementation of HASP and incident response.				
Subcontractor Project Manager	Oversee work of own staff. Ensure that their HASP is site-specific.				
Subcontractor Personnel	Be familiar with HASP requirements				
Principal-in-Charge	Provide immediate support upon notice of any incident.	NA	NA	NA	NA
Health and Safety Coordinator	Provide support in implementing HASP. Provide immediate support upon notice of any incident.	NA	NA	NA	NA
Client Contact	Provide known analytical data from work performed by others. Provide notice of site hazards. Provide access to site. Provide information regarding available emergency supplies at the site.	NA	NA	NA	NA
Others TBD					

9.0 POTENTIAL AIRBORNE CONTAMINANTS

The potential airborne contaminants of concern in the immediate vicinity at the Site are listed in the table on the following page. The table should be reviewed, and any questions directed to the SHSO. Protocols and action levels for air monitoring are identified in Attachment 8 of this HASP. Procedures for calibration and use of air monitoring equipment are identified in the Sampling and Analysis Plan, which is provided in Appendix B of the Plan.

POTENTIAL AIRBORNE CHEMICALS ON SITE FOR THIS PROJECT REVIEW THIS TABLE AND CONTACT THE SHSO WITH ANY QUESTION						
Chemical (or Class)	**OSHA PEL ACGIH TLV**	**Other Pertinent Limits**	**Properties**	**Routes of Exposure or Irritation**	**Acute Health Effects**	**Chronic Health Effects/ Target Organs**
Carbon dioxide	PEL - 5,000 ppm TLV - 5,000 ppm	NIOSH REL - 5,000 ppm IDLH - 40,000 ppm	Colorless, odorless gas; can be liquid or solid	Inhalation, dermal, eyes.	Headaches, dizziness, restlessness, paresthesia, dyspnea, sweating, malaise, increased heart rate, elevated blood pressure, pulse pressure, coma, asphyxia, convulsions, frostbite (dry ice)	Lungs, skin, CNS, eyes.
Methane	TLV - 1,000 ppm simple asphyxiate	LEL – 5 percent	Colorless, odorless gas; can be liquid.	Inhalation, dermal.	Headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, depression of senses frostbite (from liquid form)	Lungs, skin.
Polychlorinated biphenyls (PCBs)	PEL 0.5 - 1 mg/m^3 TLV 0.5 - 1 mg/m^3, depending on the species	NIOSH REL - 0.001 mg/m^3 NIOSH considers this material to be a carcinogen IDLH - 5 mg/m^3	Pale or dark yellow odorless liquid	Inhalation; dermal; ingestion. Skin absorption is a significant mode of exposure.	Irritation to eyes, skin, respiratory tract; chloroacne	May cause reproductive, CNS, CVS, skin, eye or liver effects, cancer (leukemia)

POTENTIAL AIRBORNE CHEMICALS ON SITE FOR THIS PROJECT REVIEW THIS TABLE AND CONTACT THE SHSO WITH ANY QUESTION						
Chemical (or Class)	**OSHA PEL ACGIH TLV**	**Other Pertinent Limits**	**Properties**	**Routes of Exposure or Irritation**	**Acute Health Effects**	**Chronic Health Effects/ Target Organs**
1,1,1-Trichloroethane (methyl chloroform)	PEL - TWA 350 ppm TLV - 350 ppm STEL - 450 ppm	NIOSH Ceiling - 350 ppm	Colorless liquid with a mild, chloroform-like odor	Inhalation; skin absorption; ingestion; eye contact	Irritation to eyes, skin; headache; lassitude (weakness, exhaustion); central nervous system depressant; depression; poor equilibrium; dermatitis	Cardiac arrhythmias; liver damage. **Target Organs:** eyes, skin, CNS, cardiovascular system, liver
1,1,2-Trichloroethane	PEL TWA - 10 ppm (45 mg/m^3) (skin) TLV - 10 ppm	NIOSH considers this compound to be a carcinogen REL TWA - 10 ppm (45 mg/m^3) (skin)	Colorless liquid with a sweet, chloroform-like odor	Inhalation; skin absorption; ingestion; eye contact	Irritation to eyes, nose; central nervous system depressant; depression; dermatitis	Liver, kidney damage; potential occupational liver carcinogen. **Target Organs:** eyes, respiratory system, central nervous system, liver, kidneys
1,2-Dichloroethene (dichloroethylene)	PEL - TWA 200 ppm TLV - TWA 200 ppm	IDLH - 1000 ppm	Solvent odor	Inhalation; skin absorption; ingestion; eye contact	Typical solvent symptoms	Liver, kidney, and CNS symptoms
1,1-Dichloroethene (vinylidene chloride)	No PEL TLV – 5 ppm	NIOSH considers this compound to be a carcinogen	Colorless liquid or gas (above 89°F) with a mild, sweet, chloroform-like odor	Inhalation; skin absorption; ingestion; eye contact	Irritation to eyes, skin, throat; dizziness; headache; nausea; dyspnea (breathing difficulty)	Liver, kidney dysfunction; pneumonitis; potential occupational liver and kidney carcinogen. **Target Organs:** eyes, skin, respiratory system, CNS, liver, kidneys

POTENTIAL AIRBORNE CHEMICALS ON SITE FOR THIS PROJECT REVIEW THIS TABLE AND CONTACT THE SHSO WITH ANY QUESTION						
Chemical (or Class)	**OSHA PEL ACGIH TLV**	**Other Pertinent Limits**	**Properties**	**Routes of Exposure or Irritation**	**Acute Health Effects**	**Chronic Health Effects/ Target Organs**
Tetrachloroethene (Perchloroethylene)	PEL - 100 ppm TLV - 25 ppm	PEL Ceiling - 200 ppm TLV STEL – 100 ppm IDLH - 150 ppm NIOSH considers this compound to be a carcinogen	Colorless liquid with a mild, chloroform-like odor	Inhalation; skin absorption; ingestion; eye contact	Irritation to eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; vertigo (an illusion of movement); dizziness; lack of coordination; headache; skin erythema (redness)	Somnolence (sleepiness, unnatural drowsiness); liver damage; potential occupational liver carcinogen. **Target Organs:** Eyes, skin, respiratory system, liver, kidneys, CNS
Toluene	PEL - 200 ppm TLV - 50 ppm	NIOSH REL = 100 ppm TWA; 150 ppm STEL ILDH = 500 ppm	Sweet, pungent, benzene-like odor	Eye contact	Skin (dermatitis); eye, respiratory tract irritant; headache; dizziness; weakness; fatigue	CNS; liver; kidneys; skin
Benzene	PEL - 1 ppm TLV 0.5 ppm (skin)	PEL STEL - 5 ppm IDLH=500 ppm	Characteristic benzene odor	Inhalation; dermal; ingestion; eye contact	Skin (dermatitis); eye, respiratory tract irritant; headache; dizziness; nausea	Carcinogen; CNS; eye damage; bone marrow; blood; skin; leukemia
Naphthalene	PEL - 10 ppm TLV - 10 ppm	TLV-STEL= 15 ppm NIOSH REL=10 ppm REL-STEL=15 ppm IDLH - 250 ppm	Mothball-like odor	Inhalation; dermal; ingestion; eye contact	Skin, eye, mucous membrane irritant; nausea	Eyes; blood; skin; liver; kidneys; RBC; CNS
Arsenic	PEL – 0.01 mg/m^3	Level for Respiration Use: 0.005 mg/m^3 Level for Work Stoppage: 1/2 IDLH – 2.5 mg/m^3	Properties vary	Inhalation; dermal; ingestion. Inhalation and ingestion are a significant mode of exposure.	Irritation to eyes, skin, nose; cough; dizziness; nausea	Liver; kidney; gastrointestinal damage; skin; lungs; potential carcinoma
Xylenes	PEL - 100 ppm TLV - 100 ppm	TLV STEL - 500 ppm NIOSH REL - 100 ppm NIOSH REL STEL - 100 ppm IDLH - 900 ppm	Aromatic odor	Inhalation; dermal; ingestion; eye contact	Throat and skin irritant (dermatitis); headache; nausea; drowsiness; fatigue	CNS; liver; kidneys; skin; gastrointestinal damage; eye damage

POTENTIAL AIRBORNE CHEMICALS ON SITE FOR THIS PROJECT REVIEW THIS TABLE AND CONTACT THE SHSO WITH ANY QUESTION						
Chemical (or Class)	**OSHA PEL ACGIH TLV**	**Other Pertinent Limits**	**Properties**	**Routes of Exposure or Irritation**	**Acute Health Effects**	**Chronic Health Effects/ Target Organs**
Ethylbenzene	PEL - 100 ppm TLV - 100 ppm	PEL STEL - 125 ppm TLV STEL - 125 ppm NIOSH REL - 100 ppm REL STEL - 125 ppm IDLH - 800 ppm	Pungent, aromatic odor	Inhalation; dermal; ingestion; eye contact	Skin, eye, mucous membrane irritant; headache; dizziness; drowsiness	Eyes; respiratory tract; skin; CNS; blood; kidneys; liver
Lead	PEL - 0.05 mg/m^3 TLV - 0.05 mg/m^3	IDLH - 100 mg/m^3	A heavy, flexible, soft, gray solid	Inhalation; dermal; ingestion; eye contact	Lassitude (weakness, exhaustion); abdominal pain; gingival lead line; tremor; irritation to eyes; hypotension	Insomnia; facial pallor; anorexia; weight loss; malnutrition; constipation; colic; anemia; paralysis: wrist, ankles; encephalopathy; kidney disease; potential for damage to eyes, gastrointestinal tract, CNS, kidneys, blood, gingival tissue
Vinyl chloride	PEL - 1 ppm TLV - 1 ppm	NIOSH considers this material to be a carcinogen	Liquid with a pleasant odor at high concentrations	Inhalation; dermal; eye contact	Weakness; abdominal pain; pallor or cyanosis of extremities; liquid—frostbite	Gastrointestinal bleeding; enlarged liver; potential occupational liver carcinogen; damage to CNS, blood, respiratory system, lymphatic system

POTENTIAL AIRBORNE CHEMICALS ON SITE FOR THIS PROJECT REVIEW THIS TABLE AND CONTACT THE SHSO WITH ANY QUESTION						
Chemical (or Class)	**OSHA PEL ACGIH TLV**	**Other Pertinent Limits**	**Properties**	**Routes of Exposure or Irritation**	**Acute Health Effects**	**Chronic Health Effects/ Target Organs**
Methylene chloride	PEL - 25 ppm TLV - 50 ppm	NIOSH considers methylene chloride to be a carcinogen	Colorless liquid with a chloroform-like odor	Inhalation; dermal; ingestion; eye contact	Irritation to eyes, skin; fatigue; weakness; somnolence (sleepiness, unnatural drowsiness); lightheadedness; numbness; tingling limbs; nausea	Potential occupational carcinogen. **Target Organs:** eyes, skin, cardiovascular system, CNS
Styrene	PEL - 100 ppm TLV - 20 ppm	PEL Ceiling - 200 ppm TLV STEL - 40 ppm NIOSH REL - 50 ppm	Colorless to yellow oily liquid with a sweet, floral odor	Inhalation; dermal; ingestion; eye contact	Irritation to eyes, nose, respiratory system; headache; fatigue; dizziness; confusion; malaise (vague feeling of discomfort); drowsiness; weakness; unsteady gait; narcosis	Defatting dermatitis; possible liver injury; reproductive effects
Trichloroethene (trichloroethylene)	PEL - 100 ppm TLV - 50 ppm	PEL Ceiling - 200 ppm NIOSH considers trichloroethylene to be a carcinogen	Colorless liquid (unless dyed blue) with a chloroform-like odor	Inhalation; dermal; ingestion; eye contact	Irritation to eyes, skin; headache; vertigo (an illusion of movement); visual disturbance; fatigue; giddiness; tremor; somnolence (sleepiness, unnatural drowsiness); nausea; vomiting; dermatitis	Cardiac arrhythmias; paresthesia; liver injury; potential occupational carcinogen of liver, kidney

POTENTIAL AIRBORNE CHEMICALS ON SITE FOR THIS PROJECT REVIEW THIS TABLE AND CONTACT THE SHSO WITH ANY QUESTION						
Chemical (or Class)	**OSHA PEL ACGIH TLV**	**Other Pertinent Limits**	**Properties**	**Routes of Exposure or Irritation**	**Acute Health Effects**	**Chronic Health Effects/ Target Organs**
2-Methylnaphthalene	Not established 2-Methylnaphthalene is part of the naphthalenes family, but is not considered as hazardous as naphthalene. Limits for naphthalene should be used as a conservative approach		Normally crystalline	Inhalation; dermal; ingestion; eye contact	Intoxication is most common following ingestion, but can occur after dermal or inhalation exposure. Eye irritant; conjunctivitis; superficial injury to cornea; diminished visual acuity; hypersensitivity; dermatitis; nausea and vomiting; skin irritation; photosensitization; headache; restlessness; lethargy; vomiting; fever; and acute renal failure are possible.	Anorexia; hemolysis; methemoglobinemia; hyperkalemia; anemia; cataracts. Seizures, coma may develop in severe intoxications

NOTES:
ACGIH = American Conference of Governmental Industrial Hygienists
AIHA = American Industrial Hygiene Association
AIHA WEEL = AIHA-set workplace environmental exposure limits
C = ceiling limit
CNS = central nervous system
CVS = cardiovascular system
IDLH = immediately dangerous to life or health
LEL = lower explosive limit
mg/m^3 = milligrams per cubic meter
NIOSH = National Institute for Occupation Safety and Health
OSHA = Occupation Safety and Health Administration
PEL = permissible exposure limit
ppm = parts per million
RBC = red blood cells
REL = recommended exposure limit set by National Institute for Occupational Safety and Health (NIOSH)
Skin = skin absorption
STEL = short-term exposure limit
TLV = threshold limit value set by ACGIH
TWA = time-weighted average

10.0 POTENTIAL SITE HAZARDS AND APPROPRIATE PRECAUTIONS

The following tables list potential hazards and appropriate precautions associated with planned field work:

10.1 ENVIRONMENTAL DRILLING

Job Steps	Personal Protective Equipment (PPE)	Potential Hazards	Critical Actions
Clear drilling locations	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, and work gloves.	Traffic hazards Overhead or underground installations Property damage Occupant inconvenience	• Refer to Utility Clearance Log (**Attachment 7**). • Coordinate with Site Manger (or designee) to minimize potential conflicts. • Review proposed locations against available construction drawings and known utilities, tanks, product lines, etc. • Visually clear proposed drilling locations of underground and/or aboveground utilities or impediments. • Mark out the proposed borehole locations. • Call underground utility locating service for public line location clearance and obtain a list of utilities being contacted. Coordinate private line locator for all drilling locations on private property. • Develop a traffic control plan with the client and local agencies, as applicable, which may include use of cones, barrier tape, jersey barriers, etc. • Complete Utilities and Structures checklist on the Utility Clearance Log (provided in **Attachment 7**) and adjust drilling locations as necessary.
Mobilize with equipment/supplies suitable for drilling	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, and work gloves.	Vehicle accident Lifting hazards Improper use of vehicles and/or equipment on the site.	• Begin each work day with tailgate safety meeting. • Follow safe driving procedures. • Employ safe lifting procedures. • Verify that subcontractors are aware of their responsibilities for labor, equipment, and supplies.

Job Steps	Personal Protective Equipment (PPE)	Potential Hazards	Critical Actions
Set up traffic controls as necessary	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, and work gloves.	Struck by vehicle during placement Vehicle accident resulting from improper placement of traffic control equipment	• Use buddy system for implementing traffic control plan, such as setting out cones and tape to define the safety area. • Ensure traffic control plans are followed as approved, without modification.
Assist with set up of rig	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, and work gloves.	Vehicle accident during rig movement Damage caused by rig while accessing set-up location Contact with overhead installations Soft terrain Unexpected rig movement	• All staff should know the location of the kill switch for the drilling rig. • Verify a clear pathway to the drilling location, and clearance for raising mast. • Provide hand signals and guidance to the driver, as needed, to place rig. • Visually inspect rig (fire extinguisher on board, no oil or other fluid leaks, cabling and associated equipment in good condition, pressurized hoses secured with whip-checks or adequate substitute, jacks in good condition). • Use wooden blocks under jacks to spread load, if necessary. Chock wheels.
Set up exclusion zone(s) and work stations (drilling and logging and/or sample collection)	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, and work gloves.	Struck by moving vehicle or equipment during setup Slip or fall hazards	• Implement exclusion zone set-up. Set up work stations with clear walking paths to and from rig. Use safety tape and cone(s).

Job Steps	Personal Protective Equipment (PPE)	Potential Hazards	Critical Actions
Clear upper 5 feet of drilling location using post-hole digger, hand auger, or air knife.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Back strain Exposure to chemical hazards Hitting an underground utility Repetitive motion	• Keep full-face respirator with organic vapor cartridges readily accessible. • Initiate air quality monitoring in accordance with the air monitoring protocol presented in **Attachment 8**. • Stand upwind to avoid exposure whenever possible. • Use the organic vapor monitor aggressively to track the airborne concentration of contaminants close to potential sources. • Evaluate any soil samples inside a resealable plastic bag at arm's length. DO NOT EVALUATE THE SAMPLE IN THE OPEN, IN ORDER TO AVOID UNNECESSARY EXPOSURE. • Use correct lifting techniques and tools. • Complete the Utility Clearance Log (Attachment 7). • Monitor for the presence of explosive vapors using FID.
Drilling	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required. Assisted ventilation or use of fans.	Back strain Eye injury Noise Exposure to chemical hazards Breaching an underground utility Trip or fall Injury due to equipment malfunction	• Stand clear of operating equipment. • Use correct lifting techniques. Monitor air quality in accordance with the air monitoring protocol presented in **Attachment 8**. Monitor drilling progress. • Keep work area clear of tripping or slipping hazards. • Perform periodic visual inspections of drill rig. • Use the organic vapor monitor aggressively to track the airborne concentration of contaminants close to potential sources, such as the core when it is being raised from the hole, the core is opened, etc. • Monitor for the presence of explosive vapors using FID.

Job Steps	Personal Protective Equipment (PPE)	Potential Hazards	Critical Actions
Collect samples in accordance with sampling plan Manage cuttings Backfill borehole	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Back strain Eye injury Noise Exposure to chemical hazards Trip or fall Eye injury from splashing or release of pressurized grout Back strain	• Use correct lifting techniques. Monitor air quality in accordance with the air monitoring protocol presented in **Attachment 8**. Monitor drilling progress. • Keep work area clear of tripping or slipping hazards. • Perform sample collection activities in accordance with the SAP. • Use appropriate PPE. • Mix grout to specification and completely fill the hole. • Use proper lifting techniques. • Keep work area clear of tripping hazards. • Verify need for authorization when required by grouting inspectors.
Develop well	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Physical injury from mechanical failure, drill rig, or air compressor Trip hazards. Exposure to contaminants Electric shock	• Verify that equipment is in good working order and that pressurized hoses are whip-checked. • Keep full-face respirator with organic cartridges readily accessible. • Keep work area orderly. • Any generators must be equipped with GFCI circuit.
Gauge water levels and product thickness in wells, where applicable	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Back strain Inhalation or dermal exposure to chemical hazards	• Have full-face respirator with organic cartridges readily accessible. • Conduct air quality monitoring in accordance with the protocol presented in **Attachment 8.** • Maintain a safe distance from the well head. • Bend at knees rather than at the waist.
Purge well(s) and collect purge water	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Back strain Inhalation or dermal exposure to chemical hazards Slip or fall Contaminated water spill	• Use proper lifting techniques. • Use PPE, and adhere to air monitoring guidelines as presented in **Attachment 8**. • Keep work area clear of tripping or slipping hazards. • Store purge water in appropriate containers.

Job Steps	Personal Protective Equipment (PPE)	Potential Hazards	Critical Actions
Dispose of or store any decontamination water on site	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Back strain Exposure to contaminants	• Use suitable equipment to transport water (e.g., pumps, drum dollies). • Have full-face respirator with organic cartridges within 3-5 feet of working location, and readily accessible. • Label storage containers properly, and locate in an isolated area away from traffic and other site functions.
Clean site; demobilize	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Traffic Lifting hazards	• Use buddy system to remove traffic control, as necessary. • Leave site clear of refuse and debris. • Clearly mark or barricade any borings that need topping off or curing at a later time. • Notify site personnel of departure, final well locations, and any cuttings and/or purge water left on site. • Use proper lifting techniques.
Package and deliver samples to laboratory		Back strain Traffic accidents	• Handle and pack bottles carefully (e.g., bubble wrap bags). Use proper lifting techniques. • Apply safe driving practices.
General site hazards	Steel-toed and -shank shoes, hard hat, safety glasses with side shields, hearing protection, reflective safety vest, leather gloves for non-chemical aspects of work Chemical-resistant gloves and apron if chemical exposure is suspected.	Weather-related incidents: automobile accidents, slips or falls	• Check weather reports daily. Project visits are not to be performed during inclement weather. Sampling may be performed during light rain mist. Wear raincoats. • Drive at speed limit or less, as needed, to keep a safe distance from vehicle in front. Avoid short stops.

Job Steps	Personal Protective Equipment (PPE)	Potential Hazards	Critical Actions
	Insulated dry clothing and PPE. Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Cold Stress	• For temperatures below 40°F, adequate insulating clothing must be worn. If the temperature is below 20°F, workers will be allowed to enter a heated shelter at regular intervals. Warm, sweet drinks should be available. Coffee intake should be limited. • No one should begin work or return to work from a heated shelter with wet clothes. Workers should be aware of signs of cold stress, such as heavy shivering, pain in fingers or toes, drowsiness, or irritability. Onset of any of these signs is an indication that immediate return to a heated shelter is needed. • Refer to ACGIH TLV Booklet for section on Cold Stress.
	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Sunscreen and shaded safety glasses.	Heat Stress	• Discuss health effects and symptoms during daily health and safety meetings. • Drink water regularly (at least one cup every 20-30 minutes, depending upon level of effort and the PPE worn). • Refer to ACGIH TLV booklet for heat stress guidance, especially regarding PPE, type of work and frequency of breaks. • Breaks should be taken in an area cooler than the work area. • Monitor temperature and relative humidity using WBGT meter.
	Chemical-resistant gloves and apron if chemical exposure is suspected. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Exposure to contaminants	• Decontaminate sampling equipment between each well (unless disposable). • Use proper lifting techniques. • Have full-face respirator with organic cartridges within 3-5 feet of working location, and readily accessible. • Label samples in accordance with sampling plan. • Keep samples stored in appropriate containers, at correct temperature, and away from work area. Handle bottles carefully.

Job Steps	Personal Protective Equipment (PPE)	Potential Hazards	Critical Actions
			• No eating, drinking, or smoking on site • No contact lenses to be worn on site • No facial hair that would interfere with respirator fit • A safety meeting is to be held every day, even if only one person is working on the project on a given day. Topics are to always include the work scheduled for the day and restatement of hazards and the means to avoid them. Other topics may include sampling in general, and advances in technology and how they may be applied to the project. Use the *Daily Health and Safety Briefing Log* in **Attachment 4** to log the topics discussed.

10.2 EXCAVATION ACTIVITIES

Job Steps	Personal Protective Equipment	Potential Hazard	Critical Actions
Clear excavation locations.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Traffic hazards, overhead and underground installations, product releases, property damage,	• Refer to Utility Clearance Log. • Coordinate with facility contact (or designee) to minimize potential conflicts. • Review proposed locations against available construction drawings and known utilities, tanks, product lines, etc. • Mark out the proposed excavation locations. • Call the underground utility locating service for public line location clearance. Obtain a list of utilities being contacted. If necessary, coordinate private line locator for private property.
Set up necessary traffic control.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Being struck by vehicle during placement. Vehicle accident as a result of improper traffic control equipment placement.	• Use buddy system to place traffic control. • Implement traffic control plan as required.
Set up exclusion zone(s) and stockpile area and establish work areas/heavy equipment pathways.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Injury or exposure to public or other onsite personnel. Slip or fall hazards. Onsite vehicular accident with heavy equipment.	• Implement exclusion zone set-up instructions. • Establish clear walking paths between work stations.

Job Steps	Personal Protective Equipment	Potential Hazard	Critical Actions
Hand digging/post-holing where necessary to expose and protect underground installations as needed.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Damage to lines and associated physical hazards or property damage. Back strain. Injury or vehicle damage from falling into a hole. Exposure to chemical hazards	• Use hand tools whenever possible. • Use proper lifting techniques. • Barricade or cover holes until job has been completed. • Decontaminate sampling equipment between each well (unless disposable). • Use proper lifting techniques. • Have full-face respirator with organic cartridges within 3-5 feet of working location, and readily accessible. • Label samples in accordance with sampling plan. • Keep samples stored in appropriate containers, at correct temperature, and away from work area. Handle bottles carefully.
Assist with set up of heavy equipment.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Damage caused by heavy equipment while accessing set-up location. Being struck by equipment.	• Verify a clear pathway to excavation and stockpiling locations. • Provide hand signals and guidance to driver as needed to place rig. • Visually inspect equipment (fire extinguisher on board, no oil or other fluid leaks, cabling and associated equipment in good condition, pressurized hoses secured with whip-checks or adequate substitute, jacks in good condition). • Maintain eye contact with operator.

Job Steps	Personal Protective Equipment	Potential Hazard	Critical Actions
Commence excavation.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Heat or cold exposure. Exposure to chemical hazards. Hitting an underground or overhead utility. Flammable or oxygen-deficient atmosphere from accumulated vapors. Trip or fall. Side wall cave-in. Noise.	• Monitor weather conditions and take breaks as needed for cold or hot weather. • Conduct air monitoring as presented in Attachment 8. Include Lower Explosive Limit (LEL) and oxygen (O2) monitoring. If >10% LEL or O2 <19.5%, discontinue work or ventilate area with explosion-proof equipment. • Maintain required excavation set-backs for workers and equipment. Monitor condition of side walls and surrounding ground conditions. • Keep work area clear of tripping or slipping hazards. Perform periodic visual inspections of heavy equipment and keep equipment a minimum of 5 feet from excavation edge, or one foot away from the edge for every foot of depth, if greater than 5 feet deep. • Perform necessary soil classification. Slope or bench walls, or shore excavation to prevent cave-in. Keep all spoils > 2 feet from excavation edge. Keep excavation entry controlled and equipped with required ladders and crosswalks.
Collect samples in accordance with sampling plan.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Cave-in of side wall if entering excavation. Injury from heavy equipment. Exposure to site contaminants.	• Stay out of excavation whenever possible (collect samples from backhoe bucket). • Use agreed-upon hand signals with heavy equipment operators. • Monitor air around excavation in accordance with the protocol presented in Attachment 8.
Store excavated materials according to site-specific requirements.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Exposure to public. Traffic hazard, obstruction. Improper storage or disposal.	• Have necessary storage containment and labeling available onsite. • Place materials in isolated location away from traffic and other site functions. • Stockpile excavated materials on suitable plastic or in appropriately designed container. Cover with plastic, and barricade access to waste in accordance with local regulations. •

Job Steps	Personal Protective Equipment	Potential Hazard	Critical Actions
Backfill excavation.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Being struck by heavy equipment. Side wall collapse. Damage or accidents resulting from subsequent subsidence.	• Use agreed-upon hand signals with heavy equipment operators. • Compact soils to meet specifications. • Maintain eye contact with equipment operators.
Clean site. Demobilize.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Traffic. Safety hazard left on site. Lifting hazards.	• Use buddy system to remove traffic control, as necessary. • Leave site clear of refuse and debris. • Notify business personnel of departure. • Use proper lifting techniques or use mechanical assistance.
Package and deliver samples to laboratory.		Back strain. Traffic accidents	• Handle and pack bottles carefully (e.g., bubble wrap bags). • Use proper lifting techniques. • Apply safe driving practices
General site hazards	Steel-toed and -shank shoes, hard hat, safety glasses with side shields, hearing protection, reflective safety vest, leather gloves for non-chemical aspects of work Chemical-resistant gloves and apron if chemical exposure is suspected.	Weather-related incidents: automobile accidents, slips or falls	• Check weather reports daily. Project visits are not to be performed during inclement weather. Sampling may be performed during light rain mist. Wear raincoats. • Drive at speed limit or less, as needed, to keep a safe distance from vehicle in front. Avoid short stops.

Job Steps	Personal Protective Equipment	Potential Hazard	Critical Actions
	Insulated dry clothing and PPE. Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Cold Stress	• For temperatures below 40°F, adequate insulating clothing must be worn. If the temperature is below 20°F, workers will be allowed to enter a heated shelter at regular intervals. Warm, sweet drinks should be available. Coffee intake should be limited. • No one should begin work or return to work from a heated shelter with wet clothes. Workers should be aware of signs of cold stress, such as heavy shivering, pain in fingers or toes, drowsiness, or irritability. Onset of any of these signs is an indication that immediate return to a heated shelter is needed. • Refer to ACGIH TLV Booklet for section on Cold Stress.
	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Sunscreen and shaded safety glasses.	Heat Stress	• Discuss health effects and symptoms during daily health and safety meetings. • Drink water regularly (at least one cup every 20-30 minutes, depending upon level of effort and the PPE worn). • Refer to ACGIH TLV booklet for heat stress guidance, especially regarding PPE, type of work and frequency of breaks. • Breaks should be taken in an area cooler than the work area. • Monitor temperature and relative humidity using WBGT meter.
	Chemical-resistant gloves and apron if chemical exposure is suspected. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Exposure to contaminants	• Decontaminate sampling equipment between each well (unless disposable). • Use proper lifting techniques. • Have full-face respirator with organic cartridges within 3-5 feet of working location, and readily accessible. • Label samples in accordance with sampling plan. • Keep samples stored in appropriate containers, at correct temperature, and away from work area. Handle bottles carefully.

Job Steps	Personal Protective Equipment	Potential Hazard	Critical Actions
			• No eating, drinking, or smoking on site • No contact lenses to be worn on site • No facial hair that would interfere with respirator fit • A safety meeting is to be held every day, even if only one person is working on the project on a given day. Topics are to always include the work scheduled for the day and restatement of hazards and the means to avoid them. Other topics may include sampling in general, and advances in technology and how they may be applied to the project. Use the *Daily Health and Safety Briefing Log* in **Attachment 4** to log the topics discussed.

10.3 MONITORING WELL SAMPLING/GAUGING

Job Steps	Personal Protective Equipment	Potential Hazard	Critical Actions
Mobilize with equipment/supplies suitable for sampling.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Vehicle accident. Lifting hazards. Delay or unsafe performance of work due to lack of necessary equipment on site.	• Follow safe driving procedures. • Use proper lifting techniques. • Review work plan to determine equipment/supply needs. • Verify that all sampling/gauging equipment has been decontaminated. • Review the HASP. • Gather the necessary PPE.
Set up necessary traffic control.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Struck by vehicle during placement. Vehicle accident as a result of improper traffic-control equipment placement.	• Use buddy system for placing traffic control. • Refer to the traffic control plan section of the HASP (which may include specific requirements based on encroachment permit).
Set up exclusion zone(s).	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Struck by vehicle. Slip or fall hazards to workers.	• Face incoming traffic. • Implement exclusion zone setup instructions of the HASP (e.g., barricades, caution tape, cones). • Set up work area free of trip hazards.
Gauge water levels and product thickness (where applicable) in wells.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Back strain. Inhalation of, or dermal exposure to, chemical hazards. Repetitive motion.	• Wear required PPE. • Initiate air quality monitoring in accordance with the HASP. • Maintain a safe distance from wellhead. • Bend at knees rather than at waist.
Purge well(s) and collect purge water.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Cross-contamination. Back strain. Inhalation of, or dermal exposure to, chemical hazards. Slip or fall. Contaminated water spill.	• Decontaminate purging equipment between each sampling location. • Use proper lifting techniques. • Use PPE and conduct monitoring in accordance with the HASP. • Keep work area clear of tripping or slipping hazards. • Store purge water in appropriate containers.

Job Steps	Personal Protective Equipment	Potential Hazard	Critical Actions
Collect samples in accordance with sampling plan.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Cross-contamination. Back strain. Inhalation of, or dermal exposure to, chemical hazards. Slip or fall. Improper labeling or storage. Injury from broken sample bottle (e.g., cut, or acid burn).	• Decontaminate sampling equipment between each well (unless disposable equipment). • Use proper lifting techniques. • Use PPE in accordance with the HASP. • Label samples in accordance with sampling plan. Keep samples stored in suitable containers, at correct temperature, and away from work area. • Handle bottles carefully.
Dispose of or store purge water on site.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Back strain. Exposure to contaminants. Damage or injury from improper use of on-site treatment system equipment. Improper storage or disposal.	• Use suitable equipment to transport water (e.g., pumps, drum dollies). • Wear PPE in accordance with the HASP. • Review any necessary instructions for use of on-site treatment systems. • Label storage containers properly and locate in an isolated area away from traffic and other site functions. • Coordinate off-site disposal, where applicable.
Clean site/demobilize	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Traffic. Safety hazard left on site. Lifting hazard.	• Use buddy system to remove traffic control, as necessary. • Leave site clear of refuse and debris. • Notify business personnel of departure, and of any purge water left on site. • Use proper lifting techniques.
Package and deliver samples to laboratory.		Bottle breakage. Back strain.	• Handle and pack bottles carefully (e.g., bubble wrap bags). • Use proper lifting techniques.

10.4 SOIL GAS SAMPLING

Job Steps	Personal Protective Equipment	Potential Hazard	Critical Actions
Mobilize with equipment/supplies suitable for sampling.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Vehicle accident. Lifting hazards. Delay or unsafe performance of work due to lack of necessary equipment on site.	• Follow safe driving procedures. • Use proper lifting techniques. • Review work plan to determine equipment/supply needs. • Verify that all sampling/gauging equipment has been decontaminated. • Review the HASP. • Gather the necessary PPE.
Set up necessary traffic control.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Struck by vehicle during placement. Vehicle accident as a result of improper traffic-control equipment placement.	• Use buddy system for placing traffic control. • Refer to the traffic control plan section of the HASP (which may include specific requirements based on encroachment permit).
Set up exclusion zone(s).	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Struck by vehicle. Slip or fall hazards to workers.	• Face incoming traffic. • Implement exclusion zone setup instructions of the HASP (e.g., barricades, caution tape, cones). • Set up work area free of trip hazards.
Collect samples in accordance with the SAP		Explosion	• Monitor explosive vapors using FID/gas meter.
Clean site/demobilize	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Traffic. Safety hazard left on site. Lifting hazard.	• Use buddy system to remove traffic control, as necessary. • Leave site clear of refuse and debris. • Notify business personnel of departure, and of any purge water left on site. • Use proper lifting techniques.
Package and deliver samples to laboratory.		Bottle breakage. Back strain.	• Handle and pack bottles carefully (e.g., bubble wrap bags). • Use proper lifting techniques.

11.0 WASTE CHARACTERISTICS

Waste anticipated to be generated on the project site:

Type(s): [x] Liquid [x] Solid [ ] Sludge [ ] Other_____

The approximate volume for each anticipated waste stream:

Waste: Purge and Decontamination Water Approximate Volume:_____

Waste: Soil Cuttings Approximate Volume:_____

Waste:_____ Approximate Volume:_____

Characteristics**:**

[ ] Corrosive [ ] Flammable/Ignitable [ ] Radioactive [x] Toxic

[ ] Reactive [ ] Unknown [ ] Other *(specify)*_____

12.0 TRAFFIC CONTROL

Project work will involve Farallon personnel or subcontractors to enter road rights-of-way and/or areas of uncontrolled traffic access, such as parking lots open to the public. When work is to be performed in these areas traffic control will be implemented.

When work is performed in road rights-of-way, a Traffic Control Plan will be prepared. The details regarding specific traffic control devices and layout for each work area will be in a Traffic Control Plan. Each Traffic Control Plan will be completed by an appropriate professional and will be provided in Attachment 9 once completed.

Work on this project will also be performed in areas of uncontrolled traffic access. Traffic control/warning devices will be placed around the work area to prevent undesirable interface between pedestrian and automotive traffic and project workers and equipment. These devices may include:

- Cones
- Tubular markers
- Barricades
- Temporary fencing
- Barricade tape

The traffic control/warning devices will be placed around the work in such a way that traffic access is inhibited (i.e. place cones less than 8-feet apart so cars cannot easily drive through work area without moving a cone). Barricade tape or temporary fencing will be used to inhibit access to the work area in locations where pedestrians will be encountered.

ATTACHMENT 1
HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT AND AGREEMENT FORM

HEALTH AND SAFETY PLAN
Appendix A of the Interim Action Compliance Monitoring Plan
Interim Action Area, South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002

HEALTH AND SAFETY PLAN ACKNOWLEDGMENT AND AGREEMENT FORM

(All Farallon and subcontractor personnel must sign)

This Health and Safety Plan (HASP) has been developed for the purpose of informing Farallon employees of the hazards they are likely to encounter on the project site, and the precautions they should take to avoid those hazards. Subcontractors and other parties at the site must develop their own HASP to address the hazards faced by their own employees. Farallon will make a copy of this HASP available to subcontractors and other interested parties to fully disclose hazards we may be aware of, and to satisfy Farallon's responsibilities under the Occupational Safety and Health Administration (OSHA) Hazard Communication standard. Similarly, subcontractors and others on site are required to inform Farallon of any hazards they are aware of or that their work on site might possibly pose to Farallon employees, including but not limited to Material Safety Data Sheets for chemicals brought on site. This plan should NOT be understood by contractors to provide information pertaining to all of the hazards that a contractor's employees may be exposed to as a result of their work.

All parties conducting site activities are required to coordinate their activities and practices with the project Site Health and Safety Officer (SHSO). Your signature below affirms that you have read and understand the hazards discussed in this HASP, and that you understand that subcontractors and other parties working on site must develop their own HASP for their employees. Your signature also affirms that you understand that you could be prohibited by the SHSO or other Farallon personnel from working on this project for not complying with any aspect of this HASP.

Name	Title	Signature	Company	Date

ATTACHMENT 2
DIRECTIONS TO HOSPITAL

HEALTH AND SAFETY PLAN
Appendix A of the Interim Action Compliance Monitoring Plan
Interim Action Area, South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002

MAPQUEST.

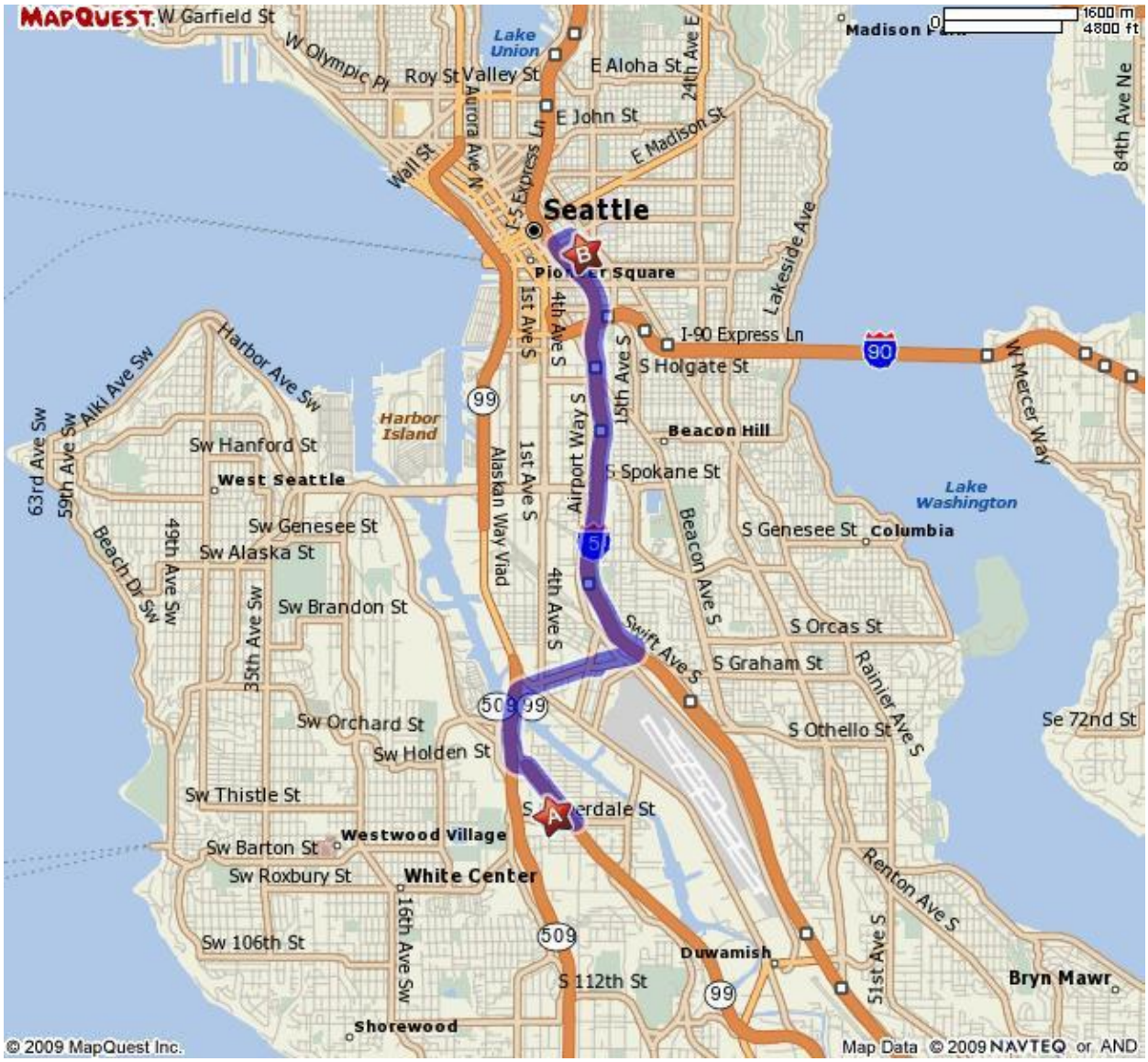
Total Travel Estimates: 12 minutes / 7.07 miles

A: 5th Ave S & S Sullivan St, Seattle, WA 98108

1:	Start out going **SOUTH** on **5TH AVE S** toward **S SULLIVAN ST**.	0.1 mi
2:	Turn **LEFT** onto **S CLOVERDALE ST**.	0.2 mi
3:	Merge onto **WA-99 N** via the ramp on the **LEFT**.	0.7 mi
4:	Merge onto **WA-509 N/WA-99 N/1ST AVE BRIDGE S** toward **SEATTLE**.	0.7 mi
5:	Take the **MICHIGAN ST** exit toward **I-5**.	0.2 mi
6:	Keep **LEFT** at the fork to go on **S MICHIGAN ST**.	0.5 mi
7:	**S MICHIGAN ST** becomes **S BAILEY ST**.	0.1 mi
8:	Merge onto **I-5 N** via the ramp on the **LEFT** toward **VANCOUVER BC**.	3.1 mi
9:	Take the **DEARBORN ST/JAMES ST** exit, **EXIT 164A**, toward **MADISON ST**.	1.0 mi
10:	Take the **JAMES ST** exit.	0.3 mi
11:	Turn **RIGHT** onto **JAMES ST**.	0.1 mi
12:	Turn **RIGHT** onto **9TH AVE**.	0.2 mi
13:	**325 9TH AVE # 1C18** is on the **RIGHT**.	0.0 mi

B: Harborview Medical Ctr: 325 9th Ave # 1C18, Seattle, WA 98104, (206) 744-5100

Total Travel Estimates: **12 minutes / 7.07 miles**


MAPQUEST
W Garfield St
Lake Union
W Olympic Pl
Roy St
Valley St
E Aloha St
24th Ave E
E John St
E Madison St
Aurora Ave N
Wall St
I-5 Express Ln
Seattle
Pioneer Square
1st Ave S
4th Ave S
15th Ave S
Lakeside Ave
84th Ave Ne
I-90 Express Ln
S Holgate St
90
W Mercer Way
Harbor Ave Sw
Alki Ave Sw
63rd Ave Sw
59th Ave Sw
Harbor Island
99
Beacon Hill
Sw Hanford St
West Seattle
Alaskan Way Viad
Airport Way S
S Spokane St
Lake Washington
Sw Genesee St
S Genesee St
Columbia
Beach Dr Sw
49th Ave Sw
Sw Alaska St
5
Beacon Ave S
Sw Brandon St
35th Ave Sw
S Orcas St
Swift Ave S
S Graham St
Rainier Ave S
509
Sw Orchard St
S Othello St
Se 72nd St
Sw Holden St
Sw Thistle St
Westwood Village
Sw Barton St
Sw Roxbury St
White Center
Renton Ave S
16th Ave Sw
Sw 106th St
Duwamish
S 112th St
51st Ave S
Bryn Mawr
Shorewood
© 2009 MapQuest Inc.
Map Data © 2009 NAVTEQ or AND
1600 m
4800 ft

ATTACHMENT 3
POTENTIAL TOPICS FOR DAILY HEALTH AND SAFETY MEETING

HEALTH AND SAFETY PLAN
Appendix A of the Interim Action Compliance Monitoring Plan
Interim Action Area, South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002

POTENTIAL TOPICS FOR DAILY HEALTH AND SAFETY MEETING

- ☐ Emergency response plan, emergency vehicle (full of fuel) and muster point
- ☐ Route to medical aid (hospital or other facility)
- ☐ Work hours. Is night work planned?
- ☐ Hand signals around heavy equipment
- ☐ Traffic control
- ☐ Pertinent legislation and regulations
- ☐ Above- and below-ground utilities (energized or de-energized)
- ☐ Material Safety Data Sheets
- ☐ Reporting an incident: to whom, what, why, and when to report
- ☐ Fire extinguisher and first aid kit locations
- ☐ Excavations, trenching, sloping, and shoring
- ☐ Personal protective equipment and training
- ☐ Safety equipment and training
- ☐ Emergency telephone location(s) and telephone numbers (in addition to 911)
- ☐ Eye wash stations and washroom locations
- ☐ Energy lock-out/tag-out procedures. Location of ~~"k~~ill switches," etc.
- ☐ Weather restrictions
- ☐ Site security. Site hazards. Is special waste present?
- ☐ Traffic and people movement
- ☐ Working around machinery (both static and mobile)
- ☐ Sources of ignition, static electricity, etc.
- ☐ Stings, bites, large animals, and other nature-related injuries and conditions
- ☐ Working above grade
- ☐ Working at isolated sites
- ☐ Decontamination procedures (for both personnel and equipment)
- ☐ How to prevent falls, trips, sprains, and lifting injuries
- ☐ Right to refuse unsafe work
- ☐ Adjacent property issues (e.g., residence, business, school, daycare center)

ATTACHMENT 4
DAILY HEALTH AND SAFETY BRIEFING LOG

HEALTH AND SAFETY PLAN
Appendix A of the Interim Action Compliance Monitoring Plan
Interim Action Area, South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002

DAILY HEALTH AND SAFETY BRIEFING LOG

Date	
Start Time	
Issues Discussed	
1.	
2.	
3.	
4.	
5.	
Attendees	
Print Name	**Signature**
Meeting Conducted by	
Name (Site Health and Safety Coordinator)	**Signature**

ATTACHMENT 5
INCIDENT REPORT FORM

HEALTH AND SAFETY PLAN
Appendix A of the Interim Action Compliance Monitoring Plan
Interim Action Area, South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002

INCIDENT REPORT

NEAR MISS, ACCIDENTAL INJURY, OCCUPATIONAL ILLNESS, OR WORK PLACE INCIDENT

INCIDENT TYPE **(TO BE COMPLETED BY HEALTH AND SAFETY COORDINATOR)** | **INCIDENT DATE**

- ☐ FATALITY
- ☐ LOST WORKDAY (LW)
- ☐ LW RESTRICTED DUTY
- ☐ OSHA MEDICAL OR ILLNESS WITHOUT LW
- ☐ FIRST AID
- ☐ INDUSTRIAL NON-RECORDABLE
- ☐ NON-INDUSTRIAL
- ☐ OFF-THE-JOB INJURY
- ☐ MOTOR VEHICLE ACCIDENT
- ☐ FIRE
- ☐ SPILL/LEAK
- ☐ PRODUCT INTEGRITY
- ☐ EQUIPMENT
- ☐ BUSINESS INTERRUPTION
- ☐ GENERAL LIABILITY
- ☐ CRIMINAL ACTIVITY
- ☐ NOTICE OF VIOLATION
- ☐ NEAR MISS

This report must be completed by the employee or Health and Safety Coordinator immediately upon learning of the incident. The completed report must be reviewed and signed by a Farallon Principal within 24 hours of the incident, even if employee is not available to review and sign. Employee or employee's doctor must submit a copy of the doctor's report, and any subsequent exams, to Richard McManus at Farallon within 24 hours of the initial exam. After hours or weekends, telephone Mr. McManus via cell phone: (425) 466-1032.

EMPLOYEE INFORMATION

LAST NAME	FIRST NAME AND MIDDLE INITIAL	TITLE	DATE OF BIRTH

EMPLOYMENT STATUS ☐ FULL-TIME ☐ PART-TIME ☐ HOURLY-AS-NEEDED | LENGTH OF EMPLOYMENT

DATE OF INJURY OR ONSET OF ILLNESS (MM/DD/YYYY) | TIME OF EVENT OR EXPOSURE ☐ AM ☐ PM

INJURY OR ILLNESS INFORMATION

EXACT LOCATION OF INCIDENT (GEOGRAPHICAL LOCATION, FLOOR, BUILDING, ETC.)

COUNTY | ON EMPLOYER'S PREMISES? ☐ YES ☐ NO

COMPLETE DESCRIPTION OF INCIDENT; INCLUDE SPECIFIC ACTIVITY AT TIME OF INCIDENT (e.g., Lifting, Pushing, Walking)

DESCRIBE THE EQUIPMENT, MATERIALS, OR CHEMICALS THAT DIRECTLY HARMED THE EMPLOYEE (e.g., the machine that the employee struck or that struck the employee; the vapor inhaled; the material swallowed; what the employee was lifting or pulling)

DESCRIBE THE SPECIFIC INJURY OR ILLNESS (e.g., cut, strain, fracture, skin rash)

BODY PART(S) AFFECTED (e.g., back, left wrist, right eye)

DATE EMPLOYER NOTIFIED | TO WHOM REPORTED

MEDICAL PROVIDER INFORMATION (e.g., hospital, doctor, clinic)

NAME AND ADDRESS OF MEDICAL CARE PROVIDER | TELEPHONE NO.

TREATED IN EMERGENCY ROOM? ☐ NO ☐ YES | HOSPITALIZED OVERNIGHT AS INPATIENT? ☐ NO ☐ YES

INCIDENT REPORT, CONTINUED

SEVERITY OF INJURY OR ILLNESS	TIME LOSS (Check all that apply)	PHASE OF WORKDAY
☐ NO TREATMENT REQUIRED	☐ NO TIME LOSS	☐ PERFORMING NORMAL WORK DUTIES
☐ FIRST AID ONLY	☐ RETURN TO WORK THE NEXT DAY	☐ MEAL PERIOD
☐ MEDICAL TREATMENT	☐ RESTRICTED ACTIVITY:	☐ REST PERIOD
☐ FATALITY (ENTER DATE):	BEGIN DATE	☐ ENTERING/LEAVING
	RETURN DATE	☐ CHRONIC EXPOSURE
	☐ LOST WORKDAY, NOT AT WORK:	☐ OTHER (SPECIFY):
	BEGIN DATE	
	RETURN DATE	

MOTOR VEHICLE ACCIDENT		PROFESSIONAL DRIVER? ☐ YES ☐ NO	
TOTAL YEARS DRIVING	COMPANY VEHICLE? ☐ YES ☐ NO	VEHICLE TYPE	
NO. OF VEHICLES TOWED	NO. OF INJURIES	NO. OF FATALITIES	

THIRD PARTY INCIDENTS		
NAME OF OWNER	ADDRESS	TELEPHONE NO.
DESCRIPTION OF DAMAGE		
INSURANCE INFORMATION		
WITNESS NAME	ADDRESS	PHONE NO.
WITNESS NAME	ADDRESS	PHONE NO.

REVIEWED BY			
NAME (PRINT)	SIGNATURE	TITLE	DATE

ATTACHMENT 6
NEAR MISS REPORT FORM

HEALTH AND SAFETY PLAN
Appendix A of the Interim Action Compliance Monitoring Plan
Interim Action Area, South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002

NEAR MISS REPORT

This report is to be filled out by any employee involved in or witnessing a near miss. A near miss is an incident that did not result in any personal injury, property damage, or work interruption. It is a very important indicator of potentially harmful future accident.

Project No. _____ Project Name _____

Project Address _____

Date of incident: _____ Time:_____ ☐ AM ☐ PM

Exact location of incident _____

_____

Description of incident or potential hazard _____

_____

_____

_____

_____

_____

_____

Corrective action taken _____

_____

_____

_____

_____

_____

Employee Signature _____ Date _____

Printed Name _____

Supervisor Signature _____ Date _____

Printed Name _____

ATTACHMENT 7
UTILITY CLEARANCE LOGS

HEALTH AND SAFETY PLAN
Appendix A of the Interim Action Compliance Monitoring Plan
Interim Action Area, South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002

UTILITY CLEARANCE LOG

Project: _____ **Project Number**:_____

Location: _____ **Date:** _____

Instructions: This log must be completed by a Farallon staff member prior to any Farallon-directed excavation (e.g., test pit excavation) or drilling operations.

DRILLING OR EXCAVATION WORK MAY NOT PROCEED UNTIL UTILITY LOCATES HAVE BEEN COMPLETED.

(See One-Call Notification Procedure on Reverse Side of This Form)

Farallon is responsible for having underground utilities and structures located and marked when drilling or directing test pit excavation operations. Any drilling or excavation within two feet of a marked utility must be done with hand tools.

Owners of underground utilities are required by law to mark underground facilities on public and private property. Owners of underground utilities are **not required** to mark existing service laterals or appurtenances. Utility owners in Washington are required to subscribe to the one call service.

Private utility locate services must be hired to locate service laterals and other buried utilities (e.g., on-site electric distribution lines, irrigation pipes) on private property.

Remark after 10 days or maintain as appropriate.

Locate Check List

Map attached showing drilling or excavation sites and known utilities ☐

Attach copy of One-Call Utility Notification Ticket (http://www.searchandstatus.com/) ☐

One-Call Utility Notification Ticket Number:_____

Attach copy of Private Locate Receipt ☐

Photos taken of all excavation/drilling locations (Download to project file) ☐

Facility Contact/Manager Approval: Name_____ Signature_____

Utilities and Structures

Type	Utility Name	Public Utilities Marked	Private Utilities/Laterals Marked	How Marked[1]
Petroleum product lines				
Natural gas line				
Water line				
Sewer line				
Storm drain				
Telephone cable				
Electric power line				
Product tank				
Septic tank/drain field				
Other				

[1]Flags, paint on pavement, wooden stakes, etc.

Farallon Consulting, L.L.C.

Field Team Leader_____ Date_____

Electric **RED**	*Gas-Oil-Steam* **YELLOW**	*Comm-CATV* **ORANGE**	*Water* **BLUE/PURPLE**	*Sewer* **GREEN**	*Temp Survey* **PINK**

ONE-CALL UTILITY LOCATE REQUEST PROCEDURE

THE ONE-CALL UTILITY LOCATE CENTER REQUIRES 48 HOURS TO MARK UTILITIES BEFORE YOU CAN DIG OR DRILL

In Washington Call 1-800-424-5555 In Oregon Call 1-800-332-2344

Washington state law requires that ~~"b~~before commencing **any** excavation" that the excavator or driller provide notice to all owners of underground utilities by use of the one-call locator service. Further, the law requires that the excavator/driller shall not dig/drill until all known utilities are marked. To fully comply with the law the following utility locate procedure is required:

1. **Call before you dig or drill** – Notify the One-Call Utility Notification Center (OCUNC) a minimum of two full business days before digging or drilling. Document your notification on a Utility Locate Telecon Form. Provide the following information (Bold indicates required information):
    a. **Your name, phone number, company name, mailing address, Farallon Account Number #25999**
    b. The name and phone number of an alternate contact person
    c. If the work is taking place within 10 feet of any overhead power lines.
    d. **What type or work is being done.**
    e. **Who the work is being done for.**
    f. **The county and city the work is taking place in.**
    g. **The address or the street where the work is taking place.**
    h. The nearest cross street.
    i. The distance and direction of the worksite from the intersection.
    j. **Marking instructions, (specific instructions as to where the work is taking place).**
    k. Township, range, section, and quarter section of the worksite.
2. **Record the utilities that will be notified** – OCUNC will tell you what utilities are on or adjacent to the site based on their database. Record the name of the utility on the reverse side of this form.
3. **Confirm the utilities notified have marked the utilities in the field** – Before digging or drilling walk the site and confirm that the utilities that were notified marked the utilities in the field.
4. **If a locate appears to be missing** – If a utility locate appears to be missing, and the utility has not notified you that there are no utilities in the area, call OCUNC and:
    a. **Provide the OCUNC locate number**
    b. **Clearly state which utility has not been marked. The call is being recorded.**
    c. **Ask for a contact at that utility.**
5. **Call contact(s) for missing utility(s)** – Call the contacts for missing utility locates and determine why no locate appears in field.
6. **Record reason(s) for missing locate(s)** – There may be reasons that locates do not appear in the field (e.g., no utilities are located on the site, utility has been abandoned).

Electric	*Gas-Oil-Steam*	*Comm-CATV*	*Water*	*Sewer*	*Temp Survey*
RED	**YELLOW**	**ORANGE**	**BLUE/PURPLE**	**GREEN**	**PINK**

Record the reason given. IF THEY ARE LATE – YOU WAIT TO DRILL OR DIG. If the utility failed to mark within the required two days they are liable for delay costs.

7. **Hand dig within two feet** – When digging or drilling within two feet of any marked utility the utility must be exposed first by using hand tools.

Electric	*Gas-Oil-Steam*	*Comm-CATV*	*Water*	*Sewer*	*Temp Survey*
RED	**YELLOW**	**ORANGE**	**BLUE/PURPLE**	**GREEN**	**PINK**

FARALLON CONSULTING, L.L.C.
975 5th Avenue Northwest
Issaquah, Washington
98027

TELEPHONE CONVERSATION
Date:_____ **Time:**_____
Project Name:_____
Job No:_____
Phone No:1-800-424-5555 WA, 1-800-332-2344
OR_____
Prepared By/Initials: _____
Call: ☐ **Placed** ☐ **Received**

Contact/Title:_____

Agency/Region: One-Call Utility Notification Center

PROJECT:_____

1. Your name and the Farallon Account Number #25999_____

2. What is the type of work being conducted? (Environmental drilling, test pit excavation)

_____

3. Who is the property owner? _____

4. County and city were work is being done?_____

5. Address or street where work is taking place?_____

_____

6. Nearest cross street?_____

7. Distance and direction of the worksite from the intersection?_____

8. Marking Instructions (Generally locate on entire site including rights-of-way and easements):_____

_____

_____

9. What time and date will the locate be completed?_____

10. Utility Locate Request Number?_____

11. Utilities that will be notified?_____

_____

12. Any Overhead Concerns? No_____

_____

cc:_____ **Page**_____ **of**_____

Note: Bold indicates required information

ATTACHMENT 8
AIR MONITORING TABLE AND FORMS

HEALTH AND SAFETY PLAN
Appendix A of the Interim Action Compliance Monitoring Plan
Interim Action Area, South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002

ACTION LEVEL TABLE FOR AIR MONITORING

The Air Monitoring table (following page) presents protocol for monitoring ambient air for constituents of concern and other parameters that may affect worker safety. Please note the following with respect to use of this table:

- The Level for Respirator Use indicates the concentration at which a respirator must be donned. It does not require that the job stop. The respirator is a piece of equipment that is to be used while determining why a concentration has reached that level. Implement engineering controls such as water mist, spray foam, plastic cover, etc. to reduce the concentration.

- The Level for Work Stoppage indicates the concentration at which work on the job must stop. Determine why a concentration has reached that level, and how it can be decreased. Site evacuation is not necessary at this level. Stopping work does not imply that the concentration level will decrease. Implement engineering controls to reduce the concentration; resume work when it is safe to do so.

- These values can be modified under particular site conditions and with specific knowledge of the contaminant(s). Should such conditions arise, contact Farallon's Health and Safety Officer, Richard McManus at (425) 295-0800.

AIR MONITORING

Chemical (or Class)	Monitoring Equipment	Task	Monitoring Frequency and Location	Level for Respirator Use	Level for Work Stoppage
Carbon dioxide	LandTec GEM 2000 Draeger Tube for carbon dioxide (Model 100/a; Part Number 8101811)	Landfill gas monitoring, indoor air landfill gas monitoring	Monitoring should be continuous at 15 minute intervals during the project when disturbing potentially contaminated soil, drilling, and during start-up and optimization of the landfill gas control system. Sample at the exclusion zone boundaries every 30 minutes.	NA	5,000 ppm PEL 30,000 ppm STEL
Methane	LandTec GEM 2000 for LEL Draeger Tube for methane (Model Methane5; Part Number CH20001)	Landfill gas monitoring, indoor air landfill gas monitoring	Sampling should be continuous at 15 minute intervals during the project when disturbing potentially contaminated soil, drilling, and during start-up and optimization of the landfill gas control system. Sample at the exclusion zone boundaries every 30 minutes.	NA	5 percent by volume (LEL) 1,000 ppm TLV
Volatile Organic Vapors	Flame ionization detector (FID)/ photoionization detector (PID) as appropriate for chemicals of concern. Draeger Tube for vinyl chloride (Model 1/a; Part Number 6728031). Draeger Tube for benzene (Model 0.5/a; Part No. 8101841).	From start of mobilization to completion and demobilization.	Sampling should be continuous during the project while disturbing potentially contaminated soil, uncovering and/or removing tanks and piping, or drilling —at least every 15 minutes in the breathing zone. Sample at the exclusion zone boundaries every 30 minutes. Continuously sample during each soil and water sampling interval. If 10 parts per million (ppm) in breathing zone, collect a Draeger Tube for benzene and/or vinyl chloride (depending upon contaminants of concern).	20 ppm above background sustained in breathing zone for 2 minutes, and no benzene and/or vinyl chloride tube discoloration. If a color change appears on the tube for benzene or vinyl chloride at 10 ppm on FID/PID, don respirator.	50 ppm above background in breathing zone and no vinyl chloride or benzene tube discoloration. Stop work if tube indicates > 1 ppm for benzene or vinyl chloride. If no Draeger Tube is available, stop work at 25 ppm.

AIR MONITORING EQUIPMENT CALIBRATION/CHECK LOG

Date	Instrument/ Model No.	Serial No.	Battery Check OK?	Zero Adjust OK?	Calibration Gas (ppm)	Reading (ppm)	Leak Check	Performed By	Comments

AIR MONITORING LOG

Date	Time	Location	Source/Area/ Breathing Zone	Instrument	Concentration/Units	Sampled by

ATTACHMENT 9
TRAFFIC CONTROL PLAN

HEALTH AND SAFETY PLAN
Remedial Investigation and Feasibility Study Work Plan
South Park Landfill Site
King County
Seattle, Washington

Farallon PN: 408-002

Attachment 9
Traffic Control Plan

To be developed as necessary

ATTACHMENT B
SAMPLING AND ANALYSIS PLAN

INTERIM ACTION COMPLIANCE MONITORING PLAN
APPENDIX C OF INTERIM ACTION WORK PLAN
South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002

975 5th Avenue Northwest, Issaquah, Washington 98027
Tel: (425) 295-0800 Fax: (425) 295-0850
www.farallonconsulting.com

SAMPLING AND ANALYSIS PLAN

ATTACHMENT B OF INTERIM ACTION COMPLIANCE MONITORING PLAN

INTERIM ACTION AREA OF THE
SOUTH PARK LANDFILL SITE
SEATTLE, WASHINGTON

Submitted by:
Farallon Consulting, L.L.C.
975 5th Avenue Northwest
Issaquah, Washington 98027

Farallon PN: 408-002

For:
South Park Property Development, L.L.C.
165 Northeast Juniper Street
Issaquah, Washington 98027

February 22, 2013

TABLE OF CONTENTS

TABLES

ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

Air Toxics	Air Toxics Ltd. of Folsom, California
bgs	below ground surface
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
Farallon	Farallon Consulting, L.L.C.
GEM 2000	LandTec GEM 2000 (Plus) Gas Analyzer
Interim Action	interim action to be conducted on a portion of the South Park Landfill Site
Interim Action Area	that part of the South Park Landfill Site owned by SPPD and those areas contiguous with the SPPD property where solid waste from the South Park Landfill operation occurs (see more complete description in the Interim Action Compliance Monitoring Plan).
Plan	*Interim Action Compliance Monitoring Plan, Interim Action Area of the South Park Landfill Site, Seattle, Washington* prepared by Farallon
PLPs	potentially liable parties
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SPPD	South Park Property Development, LLC
WAC	Washington Administrative Code

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been prepared by Farallon Consulting, L.L.C. (Farallon) on behalf of South Park Property Development, LLC (SPPD) to present the specific requirements for field monitoring and sample collection and analysis in support of the compliance monitoring program that will be implemented in conjunction with the interim action (Interim Action) to be conducted on a portion of the South Park Landfill Site (Interim Action Area). The Interim Action consists of installation of a landfill cap, landfill gas controls, surface water controls, and implementation of institutional controls. Descriptions of the Interim Action, the Interim Action Area, and the South Park Landfill Site and the general vicinity are provided in the Interim Action Compliance Monitoring Plan (Farallon 2012) (Plan).

Compliance monitoring for the Interim Action will primarily be conducted via field observations and using field-operated monitoring instruments. Sample retention for laboratory analysis is not anticipated with the possible exception of discharge from the landfill gas control system if required by the permitting authority.

The overall objective of the Plan is to provide guidance for compliance monitoring while the Interim Action is being implemented. Monitoring of the landfill cap and landfill gas collection system at the Interim Action Area will continue in accordance with the Plan and this SAP while Interim Action work is ongoing and until amended, possibly with implementation of the Cleanup Action Plan and the associated Compliance Monitoring Plan for the South Park Landfill Site as a whole. At that time, the monitoring requirements specified in the Compliance Monitoring Plan for the South Park Landfill Site may necessitate amending parts of this Plan and this SAP. The purpose of any amendments will be to ensure the long-term effectiveness of the Interim Action and consistency with requirements for long-term compliance monitoring at the overall South Park Landfill Site.

The purpose of the SAP is to define the specific requirements for field monitoring and sample collection and analysis, if required, to ensure that compliance monitoring described in the Plan is conducted in accordance with technically acceptable protocols. In general, the SAP provides a description of construction observation requirements during implementation of the Plan and provides protocols pertaining to monitoring landfill gas and indoor air and sampling discharge from the landfill gas control system.

The specific objectives of the SAP are to:

- Provide the basis for conducting and documenting field activities described in the Plan;
- Describe the sample locations, sample frequency, sample quantities, analytical methods, and documentation protocols for the compliance monitoring program;
- Identify the equipment and methodology to be used for monitoring landfill gas and indoor air and for collecting samples of landfill gas control system discharge, if required;
- Address the handling and disposal of investigation-derived waste generated during installation of additional landfill gas probes; and

- Describe the procedures and documentation requirements for construction observation of the landfill cap, landfill gas control system, and soil solidification along the West Ditch, a topographically low drainage feature along the western edge of the South Park Landfill.

The SAP will apply to monitoring and sampling and analysis activities to be conducted during Interim Action construction, and during the post-construction operation, monitoring, and maintenance of the landfill cap and landfill gas control elements. Post-construction operation, monitoring, and maintenance will begin once the components of the landfill gas control system have been installed and tested and are operational, and after the landfill cap systems have been constructed. Long-term post-construction operation, monitoring, and maintenance procedures for both the landfill cap and the landfill gas control elements of the Interim Action will be documented in respective operation and maintenance plans.

2.0 OVERVIEW OF COMPLIANCE MONITORING PROGRAM

As described in the Plan, Interim Action compliance monitoring includes protection, performance, and confirmational monitoring. Protection monitoring will be performed in accordance with Washington State Model Toxics Control Act Cleanup Regulation (MTCA) as defined in Section 410(1)(a) of Chapter 173-340 of the Washington Administrative Code (WAC 173-340-410[1][a]) to confirm that human health and the environment are adequately protected during the construction and operation, monitoring, and maintenance of the landfill cap and landfill gas control systems. The primary objective of protection monitoring during the Interim Action is to protect the health and safety of workers conducting compliance monitoring tasks. Protection monitoring is addressed in detail in the Health and Safety Plan, Attachment A of the Plan. Sampling pertaining to protection monitoring is documented in the Health and Safety Plan.

Performance monitoring in accordance with WAC 173-340-410(1)(b) will confirm that the Interim Action has attained cleanup standards and, if appropriate, other performance standards such as construction quality control and monitoring necessary to demonstrate compliance with a permit or permitted construction plan. The primary objectives of performance monitoring during the Interim Action are to ensure that the components of the Interim Action are constructed per design, that landfill gas is monitored to ensure safe working conditions during construction, and that operation of the landfill gas collection system is optimized. Per the Plan, performance monitoring will commence after more than 4 acres of subgrade material has been placed within 200 feet of the boundary of the Interim Action Area. Performance monitoring landfill gas sampling will be conducted in landfill gas collectors, from the landfill gas control system discharge unit, and in selected landfill gas probes as part of system start-up and optimization. No buildings currently exist within the Interim Action Area although building construction is planned after the Interim Action capping and landfill gas control systems are installed and operational. However, indoor air monitoring may be triggered in buildings or structures outside of the Interim Action Area if performance monitoring of methane in proximate landfill gas probes exceeds the performance criterion indicated in the Plan.

Confirmational monitoring per WAC 173-340-410(1)(c) will confirm the effectiveness of the Interim Action or other performance standards. Confirmational monitoring pertaining to the landfill cap and for landfill gas controls will commence after construction and start-up testing, respectively, and will continue in accordance with their respective operation and maintenance plans, the Plan, and this SAP until possibly amended with implementation of the Compliance Monitoring Plan to be developed for the South Park Landfill Site as a whole. The primary objectives of confirmational monitoring during the Interim Action are to ensure the long-term effectiveness of the Interim Action, to monitor the effects of the Interim Action elements on landfill gas conditions enabling optimal and safe operation of the landfill gas control system, and to inspect and repair landfill cap systems as necessary over time. Landfill gas confirmation sampling will be conducted in landfill gas probes as stipulated in the Plan, from the landfill gas control system discharge unit, and in indoor air within buildings to be constructed inside the Interim Action area in the future. Indoor air monitoring may be triggered in buildings or structures outside of the Interim Action Area if methane levels in proximate landfill gas probes exceed the performance criterion indicated in the Plan.

3.0 SUMMARY OF FIELD TASKS

This section provides a summary of the field tasks for performance and confirmational monitoring. Once the Interim Action Area cap is in place and the landfill gas control system has been constructed and undergone start-up, construction phase performance monitoring for these elements of the Interim Action will transition to confirmational monitoring during the operation and maintenance phase of the Interim Action.

Performance monitoring will include:

- Construction observation of the landfill cap, landfill gas control system, and solidification of unconsolidated material in the West Ditch;
- Pre-construction baseline landfill gas monitoring event at two existing landfill gas probes located within the interior of the Interim Action Area, 16 existing landfill gas probes and four new probes located around the perimeter of the Interim Action Area, and two sanitary sewer manholes proximate to the east and west boundaries of the Interim Action Area;
- Monitoring of landfill gas at 16 existing landfill gas probes and 4 new probe installations located around the perimeter of the Interim Action Area, two sanitary sewer manholes proximate to the east and west boundaries of the Interim Action Area, and at landfill gas control system collection wells and laterals until the end of the approximately 1-month landfill gas control system start-up period; and
- Monitoring discharge from the landfill gas control system (and sampling if required) until the end of the approximately 1-month start-up period.

Confirmational monitoring will include:

- Monitoring of landfill cap systems;
- Monitoring of landfill gas at the 20 landfill gas probes around the perimeter of the Interim Action Area, two manholes, and at landfill gas control system collection wells and laterals;
- Monitoring discharge from the landfill gas control system (and sampling if required); and
- Indoor air monitoring of buildings constructed in the Interim Action Area in the future.

The Plan includes a provision for monitoring indoor air in buildings or structures outside the Interim Action Area proximate to landfill gas probes with methane measured in excess of the performance criterion. This indoor air monitoring requirement could be triggered during either performance or confirmational monitoring.

3.1 CONSTRUCTION OBSERVATION

Construction observation will include observation during construction of the landfill cap, the landfill gas control system, and the solidification of unconsolidated material in the West Ditch to

enable documentation that these Interim Action elements were constructed per design. Field tasks related to construction observation are summarized below.

3.1.1 Landfill Cap

Observation of construction of landfill cap will involve observation of surface preparations and placement of the asphaltic concrete cap and the low-permeability membrane cap. The asphaltic concrete cap will be constructed where final grades are less than 6 percent, and the low-permeability membrane cap will be constructed where final grades are equal to or greater than 6 percent.

3.1.2 Landfill Gas Control System

Observation of landfill gas control system construction will involve observation of the installation of components of the landfill gas control system, including gas collection wells and laterals, connector piping, pipe mains, controls, and the vacuum blower assembly including the discharge treatment unit.

3.1.3 West Ditch Solidification

Observation will occur during the process of solidifying unconsolidated material in the West Ditch The solidification process will be accomplished by mixing Portland cement into the recently deposited material in the West Ditch to increase geotechnical compressive strength and to reduce mobility of chemical constituents. Solidification work will include construction of underground drainage to route groundwater through the solidified mass. After the solidification work has been completed, the surface will be prepared for construction of a bioswale.

3.2 ENVIRONMENTAL DRILLING

Interim Action construction will include installing four new landfill gas probes within the Interim Action Area. These gas probes will be placed between existing gas probes along the northern SPPD property line with the adjoining Kenyon Industrial Park and the City of Seattle South Recycling and Disposal Station. Field tasks related to environmental drilling are summarized below. Interim Action construction will also entail decommissioning of three existing piezometers within the Interim Action Area that will not be needed in the future. Environmental drilling tasks will be conducted in accordance with the Minimum Standards for Construction and Maintenance of Wells (WAC 173-160-381[2]).

3.3 LANDFILL CAP OPERATION AND MAINTENANCE

Operation and maintenance of the landfill cap will include periodic inspections to identify damaged cap systems. Protocols for cap inspections and for conducting cap repairs, as needed, will be provided in the Landfill Cap Operation and Maintenance Plan.

3.4 LANDFILL GAS MONITORING

Landfill gas monitoring includes performance and confirmational compliance monitoring elements as summarized in prior Section 2.0, Overview of Compliance Monitoring Program and

described in more detail below. Landfill gas will be monitored in landfill gas probes, in sanitary sewer lines adjacent to the Interim Action Area, in the landfill gas control system collectors and discharge unit, and in indoor air as buildings are constructed in the Interim Action Area. Field tasks related to landfill gas monitoring are summarized below.

Prior to interim action construction, a baseline landfill gas monitoring event will be conducted in landfill gas probes and sanitary sewer manholes to measure landfill gas constituents, including methane, carbon dioxide, hydrogen sulfide, and oxygen. Performance monitoring of landfill gas will include monitoring of select landfill gas probes and sanitary sewer manholes indicated in the Plan, beginning after more than 4 acres of the Interim Action Area within 200 feet of the boundary have been covered with imported fill in preparation for construction of the asphaltic concrete cap or impermeable-membrane cap. As landfill gas collection wells and laterals are installed, they will be added to the performance monitoring network. Landfill gas probes, sanitary sewer manholes, and components of the landfill gas control system will be monitored for landfill gas constituents, including methane, carbon dioxide, and oxygen. Based on monitoring results, landfill gas control system valving will be adjusted to optimize the effect of each collection well/lateral and to operate the system within safety limits. Discharge from the landfill gas control system will be treated and monitored per Puget Sound Clean Air Agency discharge permit requirements which may include periodic air sample collection and laboratory testing for volatile organic constituents.

Post-construction confirmational monitoring of landfill gas will begin once all components of the landfill gas control system have been installed and are operational, and the landfill cap systems have been constructed. Confirmational monitoring procedures will include monitoring of select landfill gas probes and sanitary sewer manholes indicated in the Plan and monitoring of landfill gas in landfill gas control system collectors and discharge. Procedures for landfill gas control system operation and maintenance will be described in the Landfill Gas Control System Operation and Maintenance Plan.

As buildings are constructed in the Interim Action Area after the landfill cap and landfill gas control system are constructed, indoor air will be monitored for methane. Buildings constructed within the Interim Action Area will be constructed slab-on-grade and equipped with sub-slab depressurization systems plumbed into the landfill gas control system to mitigate the potential for methane intrusion. The purpose of the indoor air confirmational monitoring is to demonstrate that methane concentrations inside buildings and structures do not exceed the performance criteria identified in the Plan.

Significant changes in measured landfill gas parameters will be noted and monitoring data evaluated on a regular basis. Performance criteria described in the Plan will be used as the basis for assessing the need for possible mitigation measures. Mitigation measures may consist of additional landfill gas monitoring, operational adjustments of the landfill gas control system, and landfill gas extraction in identified “hot spots” using temporarily-installed extraction equipment. As noted in the Plan, additional indoor air monitoring may be conducted in buildings or structures outside the Interim Action Area if monitoring of proximate landfill gas probes indicates methane in excess of the performance criterion.

4.0 LANDFILL GAS MONITORING LOCATIONS AND FREQUENCY

The monitoring locations and frequency for Interim Action Area landfill gas probes, sanitary sewer manholes, hot spot areas possibly occurring during construction of the Interim Action, discharge from the landfill gas control system, and in indoor air within buildings located on the SPPD property in the future are described below. The field procedures for monitoring are provided in Section 5.0, Field Procedures.

4.1 PERFORMANCE MONITORING

Figure 2 of the Plan identifies 20 landfill gas probes that will be used for performance monitoring around the perimeter of the Interim Action Area, including GP-3, GP-11, GP-13, GP-15 through GP-17, GP-27 through GP-32, GP-19 through GP-22, and GP-33 through GP-36. Two sanitary sewer manholes on the east and west boundaries of the Interim Action Area will also be monitored: MH-01 and MH-02.

Compliance monitoring will begin with a baseline landfill gas monitoring event prior to construction. The baseline event will include landfill gas monitoring in the landfill gas probes situated around the perimeter of the Interim Action Area, the two sanitary sewer manholes, and at two additional existing landfill gas probes located in the interior of the Interim Action Area, gas probes GP-01 and GP-02. Baseline landfill gas monitoring will include monitoring of hydrogen sulfide in addition to parameters listed below.

Performance landfill gas monitoring will commence after more than 4 acres of the Interim Action Area within 200 feet of the Interim Action Area perimeter have been covered with imported fill in preparation for construction of the asphaltic concrete cap and/or impermeable-membrane cap. Landfill gas probes will be monitored initially on a daily basis, decreasing to twice weekly according to the judgment of the supervising engineer. Sanitary sewer manholes will be monitored on a weekly basis initially, decreasing according to the judgment of the supervising engineer, for testing of methane and carbon dioxide. The perimeter probes will be monitored for methane, carbon dioxide, oxygen, temperature, and pressure using a LandTec GEM 2000 (Plus) Gas Analyzer (GEM 2000). As landfill gas collection wells and laterals are installed, they will be added to the monitoring network and tested for vacuum pressure and gas flow. Residual nitrogen will be calculated from monitoring data collected from monitoring ports in the landfill gas control system collection wells and laterals.

Significant changes in measured landfill gas parameters attributable to construction activities will be noted. The Plan identifies two triggers for implementing mitigation measures based on results of construction-phase performance monitoring. One is based on residual nitrogen levels in landfill gas collectors and the other is based on methane levels in perimeter landfill gas probes. If necessary, construction-phase mitigation measures may consist of additional landfill gas monitoring, adjusting flow in sectors of the landfill gas control system, and possibly additional landfill gas extraction in temporarily-installed landfill gas collectors in hot spot areas to be operated until safe conditions are achieved (see below).

4.2 MONITORING AT HOT SPOTS/TEMPORARY DISCHARGE MONITORING

If performance landfill gas monitoring indicates that either of the two landfill gas performance criteria identified in the Plan are exceeded during construction, additional monitoring will be conducted, and mitigation measures, including hot-spot area landfill gas collection, may be implemented, including installation of temporary landfill gas collectors in the hot spot areas. The new landfill gas collectors will be monitored frequently for methane and/or residual nitrogen using a GEM 2000, initially at least daily. A blower assembly will be installed, if necessary, to withdraw landfill gas from hot spot areas to address the potential buildup of methane levels at specific locations until mitigation measures and/or construction activities result in safe operational conditions. If required by the Puget Sound Clean Air Agency, landfill gas discharge from the temporary landfill gas control system to the atmosphere will be monitored.

4.3 CONFIRMATIONAL MONITORING

The 20 perimeter probes identified above (refer to Figure 2 of the Plan), the two sanitary sewer manholes, and landfill gas collection system collection wells and laterals will be monitored for methane, carbon dioxide, oxygen, temperature, and pressure using a GEM 2000 as directed by the supervising engineer. Residual nitrogen will be calculated from monitoring data collected from monitoring ports in the landfill gas control system collection wells and laterals. Monitoring will occur as frequently as daily to twice weekly during the first week of full-scale operation of the landfill gas control system, decreasing after the first week to weekly through the end of the first month, twice monthly through the second month, and monthly through the remainder of the first year. It is anticipated that after several months of operation, the well flow and methane concentrations will stabilize sufficiently that monitoring and adjustments can be performed once every 2 months. If operations and monitoring data indicate stable, safe, and optimal operation, monitoring may be reduced to a quarterly schedule. Selected landfill gas collection wells and laterals will be monitored for the same parameters and at the same frequency as the perimeter probes to obtain operational data for use in system optimization. Sanitary sewer manholes will be monitored as frequently as monthly initially and decreasing according to the judgment of the supervising engineer. The landfill gas confirmational monitoring for the Interim Action will be re-evaluated, as necessary, when elements of the remedies for the South Park Landfill Site are implemented to ensure optimal operation of the Interim Action landfill gas collection system.

To the extent possible, landfill gas probe monitoring on a monthly or quarterly basis will be scheduled to occur after at least 12 hours of falling barometric pressure conditions, with a pressure drop of at least 0.25 inch of mercury.

Significant changes in measured landfill gas parameters will be noted. The Plan identifies two triggers for implementing mitigation measures based on results of confirmational monitoring. One is based on residual nitrogen levels in landfill gas collectors and the other is based on methane levels in perimeter landfill gas probes. If necessary and per the Plan, mitigation measures based on results of confirmational monitoring may consist of additional landfill gas monitoring in landfill gas probes, adjusting flow in sectors of the landfill gas control system, and possibly monitoring indoor air (see below).

4.4 MONITORING BUILDING INTERIORS

Indoor air in buildings that are constructed in the Interim Action Area as part of the SPPD property redevelopment will be monitored for methane using a GEM 2000 detector at a minimum frequency of once monthly after the buildings are occupied. Monitoring frequency may be decreased to quarterly as directed by the supervising engineer if methane levels measured during the first year remain at safe levels. If the methane performance criterion identified in the Plan is not met during any monitoring event, mitigation measures will be implemented until indoor air meets the performance criterion and may include additional monitoring and adjusting operation of the sub-slab depressurization system or the proximate sector(s) of the landfill gas collection system.

Monitoring of indoor air in buildings outside of the Interim Action Area may be triggered based on results of either performance or confirmational landfill gas monitoring in proximate landfill gas probes indicating methane levels in excess of the performance criterion identified in the Plan. Additional monitoring may include additional landfill gas probe monitoring using a GEM 2000 and/or monitoring indoor air in the proximate building or structure using a flame ionization detector.

4.5 MONITORING LANDFILL GAS CONTROL SYSTEM DISCHARGE

Discharge from the landfill gas control system will be monitored at the Landfill Gas Vacuum Blower and Carbon Treatment Compound. Discharge will be monitored once monthly at a minimum both up- and down-stream of the carbon treatment unit. Monitoring will be conducted for methane, carbon dioxide, oxygen, temperature, and pressure using a GEM 2000. The pressure drop across the carbon treatment unit and barometric pressure will be measured and recorded. Discharge downstream of the carbon treatment vessel will be sampled and analyzed for volatile organic compounds on a monthly basis or as required by permitting, using U.S. Environmental Protection Agency (EPA) Method TO-15. If the discharge is found to exceed permit limits, the spent carbon in at least one of the carbon filters will be removed and replaced with new granular carbon.

5.0 FIELD PROCEDURES

This section summarizes the field procedures and protocols that will be followed for performance and confirmational monitoring as part of the Interim Action compliance monitoring program. The Health and Safety Plan (Attachment A of the Plan) defines the protection monitoring for the Interim Action compliance monitoring program.

5.1 GAS PROBE INSTALLATION

Boring locations for four new landfill gas probes GP-33 through GP-36, indicated on Figure 2 of the Plan, will be marked and measured in the field, and the locations adjusted as necessary based on access constraints, presence of utilities, and construction plans. Farallon will use the One-Call and private utility location services to confirm the location of subsurface utilities. The proposed boring locations are within the South Park Landfill footprint and installation is anticipated to occur within solid waste. The landfill gas probe borings will be advanced using a hollow-stem auger drill rig to a total depth to be determined in the field, up to approximately 15 feet bgs, and consistent with the construction with other gas probes proximate to the proposed locations. The depth to groundwater measured in the area of drilling varies according to season and rainfall conditions, and for planning purposes is assumed to be about 10 feet below ground surface (bgs). Gas probes will be constructed with screened intervals above the groundwater. During advancement of the borings, soil/solid waste samples will be collected every 2.5 feet from the ground surface to the total depth of the boring. Sample material will be described in field logs by a Farallon Scientist and soil will be described according to the Unified Soil Classification System ASTM Standard D2488-06, *Standard Practice for Description and Identification of Soils*. Samples will not be retained for chemical analysis.

The landfill gas probes will be constructed using 2-inch-diameter Schedule 40 polyvinyl chloride (PVC) well casing. The gas probes will have 5-foot screen intervals composed of 0.040-inch slotted PVC pipe. A pea gravel filter pack will be installed from the total depth of the well to approximately 2 feet above the top of the screened interval, and a sanitary seal will be placed from the top of the sand pack to the ground surface. Surface completions will be above-grade and protected by bollards. The gas probes will be constructed in accordance with WAC 173-160-400, Minimum Standards for Construction and Maintenance of Resource Protection Wells and Geotechnical Soil Borings, and each will include a locking cap. Farallon Standard Operating Procedure (SOP) No. FAR-100 provides general procedures for well/landfill gas probe construction (Exhibit A).

5.2 LOCATION SURVEYING

The new landfill gas probes will be surveyed by a licensed surveyor for location coordinates and elevation relative to the Washington State Plane coordinates system and NAVD 1988. The survey will be made to a permanently marked point on the north rim of the top of the PVC casing, and to the north rim of the steel monument well/piezometer cover at each location.

5.3 SAMPLING PROCEDURES AND PROTOCOLS

The field sampling procedures and sample handling protocols for samples collected during the Interim Action will be in accordance with SOPs detailed in Exhibit A and summarized below. Field sampling data will be documented on Field Report forms (Exhibit B) as described in Section 9.0, Field Documentation.

The procedures for conducting landfill gas monitoring and collecting landfill gas samples from the selected locations are described in SOP No. FAR-104 and SOP No. FAR-105, and summarized below (Exhibit A).

5.3.1 Landfill Gas Control System Discharge

If testing of landfill gas control system discharge is required by a permitting authority, samples of landfill gas control system discharge will be collected in a Summa canisters according to the methodology in Farallon SOP 105 in Exhibit A and submitted for volatile organic compound testing.

Landfill gas system discharge monitoring will be conducted in accordance with SOP No. FAR-104 and SOP No. FAR-105 and the instructions summarized below:

- Check to ensure that the GEM 2000 is in "Gas Extraction Monitor" mode for sampling locations under a vacuum. Set the GEM 2000 to the "Landfill Gas Analyzer" mode for sampling locations not under a vacuum. See SOP No. FAR-202 for GEM 2000 operation.
- Connect the GEM 2000 to the landfill gas system discharge sampling port using silicone or polyethylene tubing.
- Measure the barometric and static pressure at the discharge port using the GEM 2000 prior to purging.
- Purge until methane, carbon dioxide, and oxygen percentages stabilize. Stabilization is determined when the readings change by less than 10 percent for three consecutive measurements over 10-second intervals. Record the final instrument readings.

5.3.2 Landfill Gas Probes

Landfill gas probe monitoring will be performed during a period of prolonged falling barometric pressure of at least 12 hours, if possible. The barometric conditions for the previous 48 hours also will be considered in the selection of the monitoring period. Landfill gas probe monitoring will be conducted in accordance with SOP No. FAR-104 and the instructions summarized below:

- Check to ensure that the GEM 2000 is in Landfill Gas Analyzer mode. See SOP No. FAR-202 for GEM 2000 operation details.
- Connect the GEM 2000 to the landfill gas probe using silicone or polyethylene tubing.
- Measure the barometric and static pressure at each probe using the GEM 2000 prior to purging.

- Purge the landfill gas probes until methane, carbon dioxide, and oxygen percentages stabilize. Stabilization is determined when the readings change by less than 10 percent for three consecutive measurements over 10-second intervals. Evacuate a minimum of one probe volume before recording the final instrument readings.

5.3.3 Sanitary Sewer Manholes

Sanitary sewer manhole monitoring will be performed in concert with landfill gas probe monitoring. Sanitary sewer manhole monitoring will be conducted in accordance with SOP No. FAR-104 and the instructions summarized below:

- Check to ensure that the GEM 2000 is in Landfill Gas Analyzer mode. See SOP No. FAR-202 for GEM 2000 operation details.
- Connect sufficient silicone or polyethylene sample tubing to the intake of the GEM 2000 to enable the intake of the tubing to be placed first within two feet of the bottom of the manhole cover and second within a foot of the bottom of the sewer line, or if flowing, within a foot of the fluid level in the pipe.
- Purge the intake tubing of the GEM 2000 until methane, carbon dioxide, and oxygen percentages stabilize. Stabilization is determined when the readings change by less than 10 percent for three consecutive measurements over 10-second intervals.

5.3.4 Indoor Air

Monitoring for methane in indoor air will be conducted in accordance with SOP No. FAR-104 and the instructions summarized below:

- Conduct an inspection of the building to assess construction characteristics and possible sources of contaminants that may influence monitoring results.
- A GEM 2000 will be used to monitor building interiors for buildings constructed within the Interim Action Area. See SOP No. FAR-202 for GEM 2000 operation details.
- A flame ionization detector will be used to monitor building interiors for buildings constructed outside the Interim Action Area. Monitoring procedures using a flame ionization detector will be described in a monitoring plan to be produced if this work should be required.
- With the monitoring instrument turned on, complete a walk-through of the building and monitor at cracks in the concrete slab floor or other areas that have the potential for landfill gas infiltration.
- Record the measurements where methane is detected and note the locations and methane concentrations.

5.4 SAMPLE DESIGNATION

Sample retention for laboratory analysis is not anticipated with this project with the possible exception of discharge from the landfill gas control system if required by the regulatory authority. If testing of landfill gas control system discharge is required by a permitting authority,

the sample will be collected in a Summa canister for testing of volatile organic compounds using EPA Method TO-15, and the sample will be assigned a unique sample identifier and number, which will be filled out in indelible ink and affixed to the appropriate container immediately prior to sample collection. In addition to the sample identifier and number, the sample labels will include the client name, project name and number, date and time of sample collection, sampler's initials, analytical method, and analyte preservative(s), if any. The sample identifier will be placed on the sample label, the Field Report form, and the Chain of Custody form.

Landfill gas control system discharge samples will be assigned a unique sample identifier that will include the landfill gas system discharge location designation (e.g. EP-1) and the sample date (e.g., 111512)

For example, the landfill gas control system discharge sample collected from the EP-1 system on November 15, 2012 would be numbered EP-1-111512.

6.0 SAMPLE HANDLING

Sample retention for laboratory analysis is not anticipated, with the possible exception of discharge from the landfill gas control system if required by the regulatory authority. If testing of landfill gas control system discharge is required by a permitting authority, the sample will be collected in a Summa canister for testing of volatile organic compounds using EPA Method TO-15. This section discusses the sample handling methods to be used for the Interim Action compliance monitoring program if samples of landfill gas control system discharge should be required.

Upon transfer of the samples to laboratory personnel or arrival of the samples at the laboratory, the laboratory will assume responsibility for custody of the samples. Laboratory personnel will document the status of the shipping and handling containers and will adhere to standard chain-of-custody protocols to track each sample through the stages of laboratory processing.

6.1 SAMPLE PACKAGING AND SHIPMENT

If testing of landfill gas control system discharge is required by a permitting authority, the sample will be collected in a Summa canister for testing of volatile organic compounds using EPA Method TO-15. Summa canister samples shipped for laboratory analysis will be packaged according to applicable regulations and the recommendations of the laboratory performing the analysis. After being sealed in shipping containers, the samples will be expeditiously transported to the analytical laboratory.

The following procedures (representing the minimum shipping and handling requirements) will be used for sample packaging:

- A sample label will be affixed to the corresponding sample container at the time of sample collection.
- Bubble-wrap bags, or an equivalent, will be used to protect sample containers.
- Sample containers will be placed into a cooler (if required for sample preservation) and checked against the Chain of Custody form to ensure that all samples within the cooler are listed.
- One copy of the Chain of Custody form will be detached and retained by the Farallon Field Scientist.
- Remaining paperwork will be sealed in a re-sealable plastic bag and taped to the inside of the shipment container.
- If required for sample preservation, one to three re-sealable bags will be filled with ice and/or chemical equivalent and included in the cooler. Ice will be double-bagged in heavy-duty bags.
- The cooler or shipping container will be sealed with a Chain of Custody seal.
- The cooler or shipping container will be taped shut using strapping tape.

- The laboratory address will be affixed to the cooler or shipping container.
- Extraneous stickers will be removed from the cooler or shipping container.
- The cooler or shipping container will be examined to ensure that Farallon's return address is affixed.

6.2 SAMPLE DOCUMENTATION AND CHAIN OF CUSTODY

Sample containers will be identified with a durable label, and the sample identifier will be recorded on the Field Report forms (Exhibit B). Other sample documentation to be maintained by field personnel includes Chain of Custody forms and seals, sample labels, and shipment bills. Examples of these forms and labels are provided in Exhibit B.

At the time of sampling, the appropriate sample containers will be selected, and the sample number for each sample will be recorded on the Field Report form. A Chain of Custody seal will be used to seal the cooler or shipping container shut before shipping. The Chain of Custody seal is used to show that no tampering occurred between the time the cooler or shipping container was relinquished by field personnel and the time it arrived at the laboratory. The Chain of Custody seal will be attached so that it must be broken to open the cooler or shipping container. Information recorded on the seals will be checked against sample summary log entries, and the samples will be recounted before they are removed from the site to verify that no samples were misplaced. Entries for all samples will be made on the Chain of Custody form prior to the transfer of the samples from the site.

Each Chain of Custody form will contain the medium, date, time sampled, sample identification and number, project name and number, sampler's initials, and analyte preservative(s) if any.

7.0 LABORATORY ANALYSIS

Sample retention for laboratory analysis is not anticipated with this project with the possible exception of discharge from the landfill gas control system if required by the regulatory authority. This section discusses the laboratory analysis procedures to be used for the Interim Action compliance monitoring program if samples of landfill gas control system discharge should be required.

If testing of landfill gas control system discharge is required by a permitting authority, the sample will be collected in a Summa canister according to the methodology in Farallon SOP 105 in Exhibit A and submitted to an analytical laboratory for testing of volatile organic compounds using EPA Method TO-15. The analytes, analytical methods, sample container requirements, preservation procedures, and holding times for landfill gas samples are presented in Table B-1.

Air Toxics Ltd. of Folsom, California (Air Toxics) will conduct the required air analyses, for the Interim Action compliance monitoring program. Air Toxics is Ecology-accredited and meets Ecology and EPA QA/QC requirements.

8.0 MANAGEMENT OF INVESTIGATION-DERIVED WASTE

Investigation-derived waste, including soil, water, and other materials generated during the Interim Action, may be contaminated and will be containerized and stored in a secure area on the South Park Landfill Site pending receipt of analytical results for associated samples. The specific criteria for tracking the sampling and analysis of the waste to identify appropriate disposal options for each of the expected waste streams are discussed below.

8.1 WASTE SOIL

The proposed landfill cap at the Interim Action Area will prevent human contact with soil or solid waste within the South Park Landfill. Therefore, it is assumed that solid waste and associated soil generated from locations within the boundaries of the South Park Landfill during implementation of the Interim Action compliance monitoring program would be re-interred on the SPPD property upon approval by Ecology. The solid waste and soil may be temporarily stored in 55-gallon drums on the South Park Landfill Site until the material can be re-interred in the Interim Action Area.

8.2 WASTEWATER

Wastewater may be generated during equipment decontamination. To the extent practicable, wastewater will be segregated during field activities based on the anticipated concentrations of contaminants present in the area where the water was generated. The drums used for waste storage will be labeled according to content, date, origin, and level of personal protective equipment used during waste generation (i.e., Level C or Level D). No wastewater will remain on the Interim Action Area longer than 90 days. The status of wastewater generated during the Interim Action will be tracked using a Waste Inventory form.

Profiles of contained wastewater will be generated to identify appropriate disposal options. Waste profiles will be provided to the transport, storage, and disposal facility. The waste generator (SPPD) will select the disposal location, and waste profiles and manifests will be forwarded to the generator for approval before the materials are transported off the Interim Action Area. Wastewater will be transported off the Interim Action Area in labeled U.S. Department of Transportation-approved containers. Waste-related documentation will be maintained in the project file.

8.3 DISPOSABLES

Disposable personal protective clothing (e.g., Tyvek suits, rubber gloves, boot covers) and disposable sampling devices (e.g., plastic scoops, bailers) will be cleaned, placed into plastic garbage bags, and disposed of as nonhazardous waste.

9.0 FIELD DOCUMENTATION

Documentation of field activities will be provided on a variety of forms as summarized below and provided in Exhibit B. Other forms of field documentation may be retained in electronic formats such as digital photography and data files from field instrumentation such as global positioning systems and data loggers. Documentation generated during the field program will be retained in the project file and included in the reports generated, as appropriate.

9.1 FIELD REPORT FORM

Field personnel will be required to keep a daily field log on a Field Report form. Field notes will be as descriptive and inclusive as possible, enabling independent parties to reconstruct the sampling situation from the recorded information. Language will be objective, factual, and free of inappropriate terminology. A summary of each day's events will be provided on the Field Report form. At a minimum, field documentation will include the date, job number, project identification and location, weather conditions, sample collection data, personnel present and responsibilities, field equipment used, and any activities performed in a manner other than as specified in the SAP. In addition, if other forms or documents such as well-head surveys or maps are completed or used, they will be cited in and attached to the Field Report form. Field personnel will sign the completed Field Report form. A copy of the Field Report form is included in Exhibit B.

9.2 LOG OF BORING FORM

A Log of Boring form will be prepared by a Farallon Scientist for each boring drilled during the Interim Action. The log includes hydrologic conditions, lithologic descriptions using the Unified Soil Classification System, and the contact between solid waste and native soil. A copy of the Log of Boring form is included in Exhibit B.

9.3 LANDFILL GAS MONITORING FORM

A Landfill Gas Monitoring Form will be used to record the monitoring location, landfill gas probe monitoring port pressure, atmospheric pressure, barometric pressure for the prior 24 hours, and other pertinent measurements and supplementary information collected during sampling at each landfill gas probe and sanitary sewer manhole monitoring location. The form will be completed by the Field Scientist at the time of sample collection. These forms will be maintained in the project files. A copy of the Landfill Gas Sampling Data form is included in Exhibit B.

9.4 SAMPLE LABEL

If samples are to be retained for laboratory testing, a sample label is filled out and affixed to the appropriate sample container immediately prior to sample collection. The label is filled out in indelible ink and includes the medium, date, time sampled, sample identification and number, project name and number, sampler's initials, and analyte preservative(s) if any.

9.5 WASTE MATERIAL LABEL

A waste material label is filled out and affixed to the appropriate waste container immediately upon filling. The label is filled out in indelible ink and includes the job number and name, the address where the waste was generated, container contents, date, consultant's name and telephone number, and sampler's initials.

9.6 WASTE INVENTORY TRACKING SHEET

A Waste Inventory Tracking Sheet will be used to document and track the wastes generated during the Interim Action. The form will include information on the origin and type of waste, waste container, date generated, date removed from the Interim Action Area, the transporter, and the disposal location. A copy of the Waste Inventory form is included in Exhibit B.

9.7 CHAIN OF CUSTODY FORM

The written procedures that are followed when a sample is collected for laboratory testing, transferred, stored, analyzed, and/or destroyed are designed to create an accurate written record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis and reporting of analytical values. This written record, the Chain of Custody form, will be filled out by field sampling personnel at the time a sample is obtained.

All samples submitted to the laboratory are accompanied by a Chain of Custody form. This form is checked for accuracy and completeness, signed, and dated by the laboratory sample custodian accepting the sample. At the laboratory, each sample is assigned a unique sequential laboratory identification number that is stamped or written on the Chain of Custody form.

All samples are held under internal chain of custody in the Sample Control room under appropriate storage conditions (e.g., ambient, refrigerated, frozen). The laboratory Project Manager assigned to the client is responsible for tracking the status of the samples throughout the laboratory. Samples are signed out of the Sample Control room in a sample control logbook by the analyst who will prepare the samples for analysis.

The Chain of Custody form includes the client name, project name and number, date and time sampled, sample identifier, sampler's initials, analysis, and analyte preservative(s), if any. A copy of the Chain of Custody form is included in Exhibit B.

10.0 REFERENCES

Farallon Consulting, L.L.C. 2012. *Interim Action Compliance Monitoring Plan, Interim Action Area of the South Park Landfill Site, Seattle, Washington.* Prepared for South Park Property Development, L.L.C. Pending.

Washington State Department of Ecology (Ecology). 1995. *Guidance on Sampling and Data Analysis Methods.* Publication Number 94-49. January.

TABLE

ATTACHMENT B—SAMPLING AND ANALYSIS PLAN
INTERIM ACTION COMPLIANCE MONITORING PLAN
Interim Action Area of the
South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002

Table B-1
Analytical Methods, PQLs, Sample Containers, Preservations, and Holding Times for Landfill Gas Samples
Interim Action Area, South Park Landfill Site
Seattle, Washington
Farallon PN: 408-002

Analyte	PQL ($\mu g/m^3$)	Analytical Method	Sample Container(s)	Sample Preservation	Sample Holding Time
Volatile Organic Compounds					
Dichlorodifluoromethane	0.132	EPA TO-15	Summa Canister (6-liter)	Ambient Temperature	14 days
Chloromethane	0.055				
Freon 114	0.186				
Vinyl Chloride	0.068				
Bromomethane	0.103				
Chloroethane	0.070				
Trichlorofluoromethane	0.149				
1,1-Dichloroethene	0.105				
Freon 113	0.203				
Dichloromethane	0.092				
(trans) 1,2-Dichloroethene	0.105				
1,1-Dichloroethane	0.108				
(cis) 1,2-Dichloroethene	0.105				
Chloroform	0.129				
1,1,1-Trichloroethane	0.145				
1,2-Dichloroethane	0.108				
Benzene	0.085				
Carbon Tetrachloride	0.167				
1,2-Dichloropropane	0.123				
Trichloroethene	0.142				
Bromodichloromethane	0.178				
(cis) 1,3-Dichloropropene	0.121				
Toluene	0.100				
(trans) 1,3-Dichloropropene	0.121				
1,1,2-Trichloroethane	0.145				
1,2-Dibromoethane	0.204				

Table B-1
Analytical Methods, PQLs, Sample Containers, Preservations, and Holding Times for Landfill Gas Samples
Interim Action Area, South Park Landfill Site
Seattle, Washington
Farallon PN: 408-002

Analyte	PQL ($\mu g/m^3$)	Analytical Method	Sample Container(s)	Sample Preservation	Sample Holding Time
Volatile Organic Compounds (continued)					
Tetrachloroethene	0.181	EPA TO-15	Summa Canister (6-liter)	Ambient Temperature	14 days
Chlorobenzene	0.123				
1,1,1,2-Tetrachloroethane	0.183				
Ethylbenzene	0.115				
m,p-Xylene	0.115				
Styrene	0.113				
o-Xylene	0.115				
1,1,2,2-Tetrachloroethane	0.183				
4-Ethyltoluene	0.130				
1,3,5-Trimethylbenzene	0.130				
1,2,4-Trimethylbenzene	0.130				
1,3-Dichlorobenzene	0.160				
Benzyl Chloride	0.138				
1,4-Dichlorobenzene	0.160				
1,2-Dichlorobenzene	0.160				

NOTES:
$\mu g/m^3$ = micrograms per cubic meter
PQL = practical quantitation limit

EXHIBIT A
STANDARD OPERATING PROCEDURES

ATTACHMENT B—SAMPLING AND ANALYSIS PLAN
INTERIM ACTION COMPLIANCE MONITORING PLAN
Interim Action Area of the
South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002

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STANDARD OPERATING PROCEDURES

EXHIBIT A OF THE SAMPLING AND ANALYSIS PLAN, ATTACHMENT B TO THE INTERIM ACTION WORK PLAN

INTERIM ACTION AREA OF THE SOUTH PARK LANDFILL SITE SEATTLE, WASHINGTON

Submitted by:
Farallon Consulting, L.L.C.
975 5th Avenue Northwest
Issaquah, Washington 98027

Farallon PN: 408-002

For:
South Park Property Development, L.L.C.
165 Northeast Juniper Street
Issaquah, Washington 98027

February 22, 2013

TABLE OF CONTENTS

1.0 SOP NO. FAR-100
LANDFILL GAS PROBE CONSTRUCTION

The standard operating procedure for landfill gas probe construction contains the following sections:

- Purpose
- Equipment and Supplies
- Decontamination
- Procedures
- Documentation

1.1 PURPOSE

The purpose of this SOP is to provide field personnel with the specific information needed to construct and install landfill gas probes. This SOP is to be followed by all personnel who construct and/or install landfill gas probes at the Site.

The landfill gas probes to be installed will be constructed using 2-inch diameter, schedule 40 PVC well casing with 0.040-inch slotted screens.

1.2 EQUIPMENT AND SUPPLIES

The following equipment is necessary to construct and install landfill gas probes:

- Landfill gas probe construction equipment (e.g., water level meter, photoionization detector [PID], tape measure, digital camera, plastic sheeting), as needed.
- Landfill gas probe construction materials (e.g., well casing both screened and blank, filter pack gravel, bentonite and/or Volclay Grout seal material, concrete, locking casing cap, wellhead stove-pipe monument complete with locking top, bollards for placement around wellhead monument), as provided by driller.
- Required documentation, including Log of Well Construction Data and Field Report forms.
- Personal protective equipment (PPE) as described in the Health and Safety Plan.
- Decontamination equipment as specified in SOP No. FAR-300.

1.3 DECONTAMINATION

Equipment that will come in contact with potentially contaminated soil will be decontaminated prior to arrival on site, relocation on site, and site exit. Procedures for decontamination of equipment are outlined in SOP No. FAR-300.

1.4 PROCEDURES

This section presents the procedures to be implemented for well construction and installation.

- Don appropriate PPE as described in the Health and Safety Plan.
- Measure depth to bottom of borehole to calculate appropriate placement and length of screened interval, filter pack, and seal. Calculate approximate volumes of filter pack and seal material required for specific well bore annulus and casing diameter.
- Measure and check lengths of screen and blank casing prior to installation, confirm slot size and gravel filter pack size, confirm of type bentonite seal and/or Volclay Grout seal and wellhead monument. Record type and brand of all well construction materials used.
- Record start and completion times for various stages of landfill gas probe construction such as installation of casing into borehole, filter pack and seal emplacement, and wellhead monument.
- Record volumes of filter pack, bentonite seal, and concrete used to construct the landfill gas probe and check against calculated volumes to confirm proper placement and amount. Record irregularities during construction process that could indicate construction problems such as bridging of filter pack or seal material.
- Upon completion of landfill gas probe installation, measure total depth and depth to groundwater (however, should be completed above groundwater), and record on well construction summary form.

1.5 DOCUMENTATION

Document well construction activities on the Log of Well Construction Data form and in the Field Report form.

2.0 SOP NO. FAR-104
LANDFILL GAS MONITORING USING LANDTEC GEM 2000 GAS ANALYZER

The standard operating procedure for landfill gas monitoring using LandTec GEM 2000 (Plus) gas analyzer (GEM 2000) contains the following sections:

- Purpose
- Application
- References
- Equipment and Supplies
- Decontamination
- Procedures
  - Calibration
  - Measurement—Landfill Gas Probes
  - Measurement—Landfill Gas Wells and Laterals
  - Measurement—Landfill Gas System Discharge Emissions
- Documentation

2.1 PURPOSE

The purpose of this SOP is to provide field personnel with the specific information needed to collect consistent and representative landfill gas monitoring data, and accurately document the data collection process landfill gas monitoring using the GEM 2000 or LandTec GEM 5000 (GEM 5000) gas analyzer. This SOP is to be followed by all personnel who monitor and collect landfill gas samples at the Site.

2.2 APPLICATION

This SOP provides step-by-step guidelines to be followed by the field sampling crew to assure consistent and representative sampling and monitoring of landfill gas using the GEM 2000 or GEM 5000.

2.3 REFERENCES

Herrera Environmental Consultants, Inc. 2012. Draft Memorandum Regarding Gas Probe and Indoor Air Quarterly Monitoring Results at South Park Landfill, Seattle, Washington. To Stephen Bentsen, FloydSnider. From Bruce Carpenter and Michael Spillance, Herrera Environmental Consultants. January 17.

Aspect Consulting, L.L.C. 2011. *South Park Custodial Landfill Monitoring Procedures.*

2.4 EQUIPMENT

The following equipment is necessary to monitor landfill gas:

- GEM 2000 Gas Analyzer and calibration gases;
- Silicone and polyethylene tubing;
- SKC, Inc.-branded universal pump (SKC pump) or equivalent; and
- Extraction Flow Rate Monitor with flow range to match the SKC pump.

2.5 DECONTAMINATION

The equipment used for landfill gas monitoring does not require decontamination other than the evacuation of gas from wells and sampling equipment as described below.

2.6 PROCEDURES

This section describes the procedures to be used during landfill gas monitoring.

2.6.1 Calibration

Prior to the monitoring events, calibrate the GEM 2000 using a 4 percent oxygen span gas and a 50 percent methane/35 percent carbon dioxide calibration gas following the procedures in SOP No. FAR 202.

2.6.2 Measurement—Landfill Gas Probes

To collect measurements in landfill gas probes:

- Check that the GEM 2000 is in the Landfill Gas Analyzer mode. See SOP No. FAR-202 for GEM 2000 operation.
- Connect the GEM 2000 to the landfill gas probe using silicone and polyethylene tubing.
- Check the barometer chart at the University of Washington website to determine that there has been a falling barometer for at least the last 24 hours prior to sampling http://www.atmos.washington.edu/~neallog/temp_real_pressure.html
- Measure the barometric and static pressure at each probe using the GEM 2000 prior to purging.
- For 2-inch-diameter poly-vinyl chloride (PVC) monitoring probes, connect the SKC pump or equivalent to the 2-inch diameter PVC monitoring probes and evacuate at a flow rate of 3 liters per minute (l/min) evacuating a minimum of one probe volume.

- For 0.75-inch-diameter PVC monitoring probes, evacuate using the GEM 2000 and Extraction Monitor at a flow rate of 300 milliliters per minute (ml/min).
- Purge the landfill gas probes until methane, carbon dioxide, and oxygen percentages stabilize. Stabilization is determined when the readings change by less than 10 percent for three consecutive measurements over 10 second intervals.
- Evacuate a minimum of one probe volume before recording the final instrument readings. For a 2 inch diameter schedule 40 well casing, this is 659.78 ml per foot (0.0233 cubic feet per foot) of well casing. For 0.75 inch diameter Schedule 40 PVC well casing, this is 99.817 ml per foot (0.003525 cubic feet per foot) of well casing.

2.6.3 Measurement—Landfill Gas Control System

To collect measurements in landfill gas control system collector wells and laterals and discharge:

- Check that the GEM 2000 is in the Gas Extraction Monitor mode. See SOP No. FAR-202 for GEM 2000 operation.
- Connect the GEM 2000 to the landfill well or lateral using silicone and polyethylene tubing.
- Measure the barometric and static pressure at each well using the GEM 2000 prior to purging.
- Purge the wells until methane, carbon dioxide, and oxygen percentages stabilize. Stabilization is determined when the readings change by less than 10 percent for three consecutive measurements over 10 second intervals.
- Record the final instrument readings.

2.6.4 Measurement—Indoor Air

To collect measurements from indoor air using the GEM 2000:

- Prior to measuring indoor air in the building, inspect the building to identify potential sources of contamination. The purpose of the building inspection is to assess building construction characteristics; heating, ventilating, and air conditioning (HVAC) systems; and sources of possible chemical contaminants that may influence the results of indoor air monitoring. Note the presence of chemical products and evaluate whether these products contain the target compounds for the indoor air monitoring
- The building owner/operator will be notified in advance of the sampling, and necessary access agreements and tenant notifications will be executed.
- Check that the GEM 2000 is in the Landfill Gas Analyzer mode. See SOP No. FAR-202 for GEM 2000 operation.
- With the GEM 2000 on, complete a walk-through of the building.

- Hold the inlet port of the GEM 2000 over any cracks in the concrete slab floor or other areas that would have the potential for landfill gas infiltration.
- Record the measurements where methane is found, noting the location in the building where the measurements were taken.

2.6.5 Documentation

Document landfill gas monitoring activities on the Landfill Gas Monitoring Form and in the Field Report form.

3.0 SOP NO. FAR-105
LANDFILL GAS SYSTEM EMISSION SAMPLING USING EPA ANALYTICAL METHODS TO-14 OR TO-15

The standard operating procedure for landfill gas system emission sampling contains the following sections:

- Purpose
- Application
- References
- Equipment and Supplies
- Decontamination
- Procedures
  - Sample Collection
  - Post-Sample Collection
  - Analysis
- Documentation

3.1 PURPOSE

The purpose of this SOP is to provide field personnel with the specific information needed to collect consistent and representative landfill gas system emission samples and accurately document the data collection process using U.S. Environmental Protection Agency (EPA) Analytical Methods TO-14 or TO-15. This SOP is to be followed by personnel who collect landfill gas system emission samples at the Site.

3.2 APPLICATION

This SOP provides step-by-step guidelines to be followed by the field sampling crew to assure consistent and representative sampling.

3.3 REFERENCES

Air Toxics LTD. *Guide to Air Sampling and Analysis, Canisters and Tedlar Bags.* Fourth Edition. Folsom, California. www.airtoxics.com.

U.S. Environmental Protection Agency (EPA). January 1999. Method TO-14A. EPA/625/R-96/010b. Cincinnati, Ohio.

———. January 1999. Method TO-15. EPA/625/R-96/010b. Cincinnati, Ohio.

3.4 EQUIPMENT AND SUPPLIES

The following equipment and supplies are necessary to perform landfill gas system discharge emission sampling:

- A sufficient number of 6-liter Summa canisters, appropriate filters, and flow controllers to collect the samples;
- Appropriate wrenches, pressure gauges, and a field tool kit; and
- The shipping packages for the Summa canisters.

3.5 DECONTAMINATION

The equipment used for air sampling does not require decontamination in the field. Each Summa canister will arrive clean from the contract laboratory, Air Toxics Ltd. of Folsom, California, and certified to 0.02 part per billion by volume for the project-specific analyte list.

3.6 PROCEDURES

This section presents the instructions for landfill gas system discharge emission sampling.

3.6.1 Sample Collection

Collect landfill gas system emission samples using 6-liter Summa canisters prepared under negative pressure and laboratory-certified to be clean for the compounds of interest for the Site. The Summa canisters will be equipped with dedicated flow regulators for collection of a sample over the sampling period. To collect the samples:

- Several days in advance of sampling, check the Summa canisters for leaks to ensure that each canister is under sufficient vacuum pressure to obtain representative samples. Ensure that documentation of the laboratory certification for the canisters is included on a tag attached to the canister and in the paperwork that accompanies the canister shipment from the laboratory.
- Confirm that the sampling canister valves are closed (knob tightened clockwise).
- Attach the manifold to the canister, including the filter, flow controller, and pressure gauge.
- Confirm that a brass cap is secured at the inlet of the manifold/flow controller, creating an air-tight sampling train.
- Quickly open and close the sample canister valve and observe the gauge reading. If the initial gauge reading is less than the laboratory-recommended value, discontinue leak testing and obtain additional canisters. Repeat the testing for each canister.

- If the initial vacuum pressure is within acceptable limits, continue to monitor the gauge to check for leaks in the manifold and at the connections to the Summa canister. Observe the gauge for 5 minutes. If the needle on the gauge drops, indicating a loss of pressure, the sampling train is not air-tight. In this situation, refit and/or tighten the connections until the needle holds steady. If leakage is still indicated, use an alternate manifold/flow controller to confirm that the initial manifold/flow controller requires replacement. Obtain replacement equipment and repeat the testing.
- Verify that the number engraved on each Summa canister matches the number listed on the certified-clean tag attached to the canister to ensure that the canister was properly decontaminated.
- Set up the Summa canisters in the desired sampling location approximately.
- Verify that the Summa canister valve is closed tightly, and remove the threaded cap at the top of the canister.
- Attach the flow regulator/pressure gauge to the top of the canister and use a wrench to gently tighten it.
- Open the valve and record the pressure on the gauge as the "initial pressure" in the field notes and on the sample tag attached to the canister.
- Completely fill out the sample tag attached to the canister and record the following sample information:
  - Sample identification
  - Sample start date
  - Sample start time
  - Location of sample
  - Initial pressure of canister
  - Canister number
- Verify that the sample container is filling.
- Check periodically during the sampling period to confirm that the canisters are operating properly. Periodically check the pressure during the sampling. The final pressure at the end of sampling should be approximately 5 to 6 inches of mercury.
- If the pressure is above 6 inches of mercury, leave the canister to fill for the full sampling period. If the pressure is below 5 inches of mercury, close the canister and contact the Project Manager immediately. The Project Manager will confer with the laboratory to evaluate whether sampling must be repeated using a new canister or whether sufficient vacuum is present to obtain valid laboratory data.

- At the end of sampling, record the time and the exact pressure of the canister on the sample tag for that canister, on the Chain of Custody form, and in the field notes. Record any other condition that could affect sampling results (e.g., site activities, weather).
- Close the sample canister valve, disconnect it from the manifold, and replace and tighten the brass cap on the canister inlet.

3.6.2 Post-Sample Collection

Ensure that each of the sample containers is labeled with the following information:

- Sample identification.
- Date and time of sample collection.
- Starting and ending canister pressure.
- Site name and company name.
- Record this information and the ending time of sample collection in the field notes.
- Transfer pertinent information to the Chain of Custody form.
- Pack each of the Summa canisters in its original shipping container, seal with a custody seal, and send to the laboratory for analysis as soon as possible. The holding time for the analysis to be performed described herein is 30 days.

3.6.3 Analysis

The samples should be analyzed using EPA Method TO-15, with low-level analysis using Selective Ion Mode (SIM) to obtain method detection and reporting limits that are sufficiently low to meet or exceed the target cleanup levels for tetrachloroethene (PCE) and trichloroethene (TCE) based on commercial exposure, which are 2.17 and 0.51 micrograms per cubic meter, respectively, if needed. The air samples collected in the Summa canisters have a 30-day holding time.

3.7 DOCUMENTATION

Provide documentation regarding field activities and other sampling documentation such as photos or video recordings. The documentation will be included on standard Farallon forms, field notes, and if electronically recorded, transferred to the proper project folder and labeled.

4.0 SOP NO. FAR-200
PHOTOIONIZATION DETECTOR CALIBRATION AND OPERATION

The standard operating procedure for use of the photoionization detector contains the following sections:

- Purpose
- Application
- References
- Equipment and Supplies
- Procedures
  - PID Calibration Check
  - PID Calibration
  - PID Drift or Other Change
  - PID Operation
- Documentation

4.1 PURPOSE

The purpose of this SOP is to provide field personnel with step-by-step instructions on the proper use, operation, and handling of the MiniRae Photoionization Detector (PID), Models 2000 and 3000. Reference the operation and maintenance manual specific to this piece of equipment, as necessary.

4.2 APPLICATION

The PID is used as a field screening instrument for measurement of total volatile organic (TVO) concentrations in air. Typical uses include air monitoring of the breathing zone for health and safety purposes, soil screening for TVO emissions, and landfill gas probe headspace.

The PID is a highly sensitive instrument with an operating range of 0.1 to 10,000 or 15,000 parts per million (ppm) isobutylene equivalents. Its detection limit is 0.1 ppm hexane or isobutylene and its response time is less than 3 seconds.

4.3 REFERENCE

PE Photovac Air Monitor/Portable Photoionization Detector (PID), Model 2000 or 3000 manuals.

4.4 EQUIPMENT AND SUPPLIES

The following equipment is necessary to calibrate and use the PID:

- Photoionization Detector (PID).
- A calibration gas regulator and silicon tubing.
- Calibration gas containing approximately 100 ppm isobutylene.
- (A 110-volt battery charger.)

4.5 PROCEDURES

4.5.1 PID Calibration Check

The PID calibration should be checked at the beginning of the day, or as needed if drift occurs (see below). To check PID calibration:

- Connect the regulator to the gas cylinder. Connect tubing to the regulator.
- Turn the PID on by pressing ON/OFF. Wait for the PID to proceed to the default display. Allow it to warm up according to manufacturer's instruction (10 minutes).
- The initial reading should be 0 or 0.1 ppmv.
- Start the gas flow by pushing in the regulator knob and turning it one-half turn. Some gas will begin to escape.
- Connect the tubing from the regulator to the PID sensor tip.

The PID reading should climb to 99-101 ppmv. When it reaches a maximum, turn off the regulator and disconnect sensor tip. The reading should return to zero. If any of the above predicted-readings do not occur then repair or re-calibration will be necessary.

4.5.2 PID Calibration

To calibrate the PID:

- Connect the regulator to the gas cylinder. Connect tubing to the regulator.
- Turn the PID on by pressing ON/OFF. Wait for the PID to proceed to the default display. Allow it to warm up according to manufacturer's instruction (10 minutes).
- Enter the calibration menu: For both models this requires simultaneous pressing of the right and center buttons. Enter "span calibration" and follow on-screen instructions- be ready to turn on the gas at the regulator and to connect PID sensor probe to regulator tubing- if prompted for password hit enter.
- When the display reverts to the default display, the PID is calibrated and ready for use.

- Values read by the PID when calibrating with isobutylene should be recorded in a calibration book or the log field book in use at that time.

4.5.3 PID Drift or Other Change

Check the drift from the initial daily calibration by exposing the PID to the calibration gas (see above). Drift is commonly a failure of the instrument to return to zero after soil vapors should be dissipated, failure to "zero" usually accompanies inaccuracy in the upper end of the instrument's detection range. Several situations cause drift, including soil or water in the tip of the probe, soil or water in the sensor filter, or other change such as the tightening or loosening of probe tip assembly since the instrument was calibrated. Re-calibration would serve little purpose until the cause of the drift is determined.

4.5.4 PID Operation

To monitor the breathing zone for Health and Safety purposes, soil screening for TVO emissions, and landfill gas probe headspace:

- Connect the PID sample probe to the PID hand-held Air Monitor.
- Turn the PID on by pressing ON/OFF. Wait for the PID to proceed to the default display. Allow it to warm up according to manufacturer's instructions (10 minutes).
- For soil screening, seal the soil in a ziplock bag for no more than 5 minutes to avoid false readings due to moisture build-up; there is also a filter for use on the end of the sensor tip for wet situations. Pierce the ziplock with a clean tool and insert the sensor tip, quickly establishing a tight seal. The meter should rapidly react; report the maximum value in a timeframe not to exceed 1 minute.
- When monitoring the breathing zone for Health and Safety purposes, allow the PID to monitor the air quality at the breathing zone, chest or face level, and read the meter display that shows the detected concentrations.
- When monitoring soil for TVO emissions, place the probe inlet near the surface of the soil and read the meter display that shows the detected concentrations. Be cautious not to allow soil to be sucked into the instrument.
- When monitoring for the headspace of a landfill gas probe, monitor the headspace directly after opening the probe. Place the probe inlet directly above the PVC casing. Read the meter display that shows the detected concentrations.
- If an increasing meter reading is indicated, monitor until the maximum meter reading is obtained and leave the probe inlet in that position for approximately six seconds.
- Humidity or moisture from rain can cause large fluctuations in PID readings. It is essential that the PID remains dry at all times while in use. Moisture can cause inaccurate readings and damage the PID.

- If the PID is showing erratic readings, then it is possible that either there is moisture or dirt in the probe or dirt has collected in the filter. If this occurs, clean and dry the sample probe perhaps placing it near a running car/truck heater, and replace the filter if necessary (with attention to placing the filter shiny-side down towards the monitor).

4.6 DOCUMENTATION

Document PID measurements for all monitoring events on field forms and in a detailed field notebook. Also record observations of varying weather conditions such as temperature and humidity fluctuations.

5.0 SOP NO. FAR-202
LANDTEC GEM 2000 GAS ANALYZER CALIBRATION AND OPERATION

The standard operating procedure for calibrating and operating the LandTec GEM 2000 gas analyzer contains the following sections:

- Purpose
- Application
- References
- Equipment and Supplies
- Procedures
  - GEM 2000 Field Calibration
  - GEM 2000 Drift or Other Change
  - GEM 2000 Operation—Non-Vacuum
  - GEM 2000 Operation—Vacuum
- Documentation

5.1 PURPOSE

The purpose of this SOP is to provide field personnel with step-by-step instructions on the proper use, operation, and handling of the LandTec GEM 2000 Gas Analyzer (GEM 2000). Reference the operation and maintenance manual specific to this piece of equipment, as necessary.

5.2 APPLICATION

The GEM 2000 is a field screening instrument for measurement of methane, carbon dioxide, and oxygen percent concentrations in air along with pressure and temperature. Typical uses include air monitoring of the breathing zone for health and safety purposes and landfill gas monitoring wells and system emissions. The GEM 2000 has an operating range of 0 to 70 percent for methane, 0 to 40 percent for carbon dioxide, and 0 to 25 percent for oxygen.

The GEM 2000 is sensitive to extreme temperatures and shock damage. Always transport the GEM 2000 in a vehicle interior and not in the trunk or truck bed and do not place the analyzer against anything hot or leave it in an unattended car during the summer. At the site, protect the instrument from direct sunlight, heavy rain, or wind chill.

The GEM 2000 displays probe temperature via an optional temperature probe (TP-100) and when connected, temperature measurements will be displayed in the screen and recorded with other data.

Always use the water trap. If the water trap becomes flooded, change the filter immediately and ensure all tubes are clear before re-use.

5.3 REFERENCE

LandTec GEM 2000 Gas Analyzer & Extraction Monitor Operation Manual.

5.4 EQUIPMENT AND SUPPLIES

The following equipment is necessary to calibrate and use the GEM 2000:

- LandTec GEM 2000 Gas Analyzer (GEM 2000)
- A calibration gas regulator and silicon tubing.
- Calibration gas containing 4 percent oxygen, balance nitrogen.
- Calibration gas containing 50 percent methane (CH_4), 35 percent carbon dioxide (CO_2), balance nitrogen.
- A 100-240-volt battery charger.
- Water trap and supply of dry filters.

5.5 PROCEDURES

5.5.1 GEM 2000 Field Calibration

The GEM 2000 should be calibrated at the beginning of the day, or as needed if drift occurs (see below). To calibrate the GEM 2000 in the field:

- Connect the regulator to the gas cylinder. Connect tubing to the regulator.
- Turn the GEM 2000 on by pressing the red button. Wait for the GEM 2000 to proceed to the default main screen. Warm-up will take approximately 20 seconds.
- Press 1 Menu, use your Up(2) or Down(8) keys to scroll to "Field Calibration" and then press Enter.
- Press 3 Edit Target Concentrations and enter manually the target concentration for the CH_4 calibration gas (50 percent).
- Press Enter to move to CO_2 and enter the target concentration for the carbon dioxide calibration gas (35 percent).

- Press Enter to move to oxygen and enter the target oxygen concentration for the oxygen calibration gas (4 percent).
- Press Enter to complete.
- Connect span gas calibration bottle containing 4 percent oxygen and allow the gas to flow for approximately 30 seconds to ensure a complete purge of any gas in the GEM 2000.
- Press Enter to bring up the Calibration Menu.
- Choose Zero Channels and press Enter.
- Choose Zero CH_4, press Enter when done.
- If calibration was successful you should see the message "User Zero Complete".
- Connect the calibration gas bottle containing 50 percent methane and 35 percent carbon dioxide and allow the gas to flow for approximately 30 seconds to ensure a complete purge of any gas in the GEM 2000.
- Press Enter to bring up the Calibration Menu.
- Choose Zero Channels and press Enter.
- Choose Zero O_2, press Enter when done.
- If calibration was successful you should see the message "User Zero Complete".
- Press Enter to go to the Calibration Menu.
- Choose Span Channels and press Enter.
- Choose Span CH_4.
- Verify that the methane and carbon dioxide calibration gas is still connected to the GEM 2000, wait 30 seconds for the gas to flow thru the GEM 2000.
- Press Enter to set methane (CH_4) span.
- The message "Calibration Complete" should appear.
- Press Enter to go to the Calibration Menu.
- Choose Span Channels and press Enter.
- Choose Span CO_2.
- Verify that methane and carbon dioxide calibration gas is still connected to the GEM 2000, wait 30 seconds for gas to flow through the GEM 2000.
- Press Enter to set CO_2 Span, the message "Calibration Complete" should appear.
- Connect the oxygen calibration bottle, allow the gas to flow for approximately 30 seconds to ensure a complete purge of any gas from the GEM 2000.

- Press Enter to go to the Calibration Menu.
- Choose Span Channels and press Enter.
- Choose Span O_2 and press Enter to set O_2 span.
- The message "Field Calibration Complete" should appear.
- Verify that the calibration has been done correctly by taking a reading from the calibration gas bottles in the normal gas readings screen.
- If the calibration is not successful, go to the Calibration Menu and select Factory Settings.
- Wait for the GEM 2000 to reset, you will see the message "resetting please wait"
- Complete the field calibration again.

5.5.2 GEM 2000 Drift or Other Change

Check the drift from the initial daily calibration by exposing the GEM 2000 to the calibration gas.

5.5.3 GEM 2000 Operation—Non-Vacuum

Landfill gas probes are commonly placed on the perimeter of the landfill to test for gas migration or may be placed next to a building or road. To monitor landfill gas probes or sanitary sewer manholes not connected to an active vacuum extraction system or for indoor air/breathing zone for health and safety purposes:

- Press 1 Menu and scroll to Mode of Operation.
- Press Enter and go to Landfill Gas Analyzer, press Enter again.
- When the gas read screen is displayed select 3 Next ID and use the cursor to select the appropriate location.
- A reminder is displayed to disconnect sample tubes as a clean air purge will automatically remove the previous sample from the instrument (default is 30 seconds). When Enter is pressed, the purge will begin and read Gas Levels screen will be displayed.
- At this point, connect the sample tube with water trap from the sample point to the inlet port of the instrument, ensuring the connector clicks into place.
- For monitoring landfill gas probes, connect the sample tube to the gas probe sample port. **Do not connect the sample tube to the probe port before connecting to the instrument as this will cause any pressure in the probe to dissipate and a proper pressure reading will not be taken.**

- **For monitoring sanitary sewer manholes, provide access via a port in the manhole cover or by moving the manhole cover sufficiently to enable dropping sample tubing into the air space of the sewer pipe as indicated in the sampling and analysis plan. Do not submerge the sample tube intake.**
- Start or stop the pump at anytime by pressing the Pump key.
- Record measurement when the reading stabilizes.
- Press Enter to stop the pump before storing a reading.
- Disconnect the sample tubing from the probe and repeat the above steps for the next sample location.

5.5.4 GEM 2000 Operation—Vacuum

The GEM 2000 may be configured as a gas extraction monitor for the purpose of monitoring extraction wells and laterals under vacuum pressure and for obtaining flow measurements. To monitor landfill gas penetrations connected to an active vacuum extraction system such as Accu-flo well heads, orifice plates, or pitot tubes:

- Press 1 Menu and scroll to Mode of Operation.
- Press Enter and go to Gas Extraction Monitor, press Enter again.
- When the gas read screen is displayed, select 3 Next ID and use the cursor to select the appropriate location.
- A reminder is displayed to disconnect sample tubes as a clean air purge will automatically remove the previous sample from the instrument (default is 30 seconds). When Enter is pressed, the purge will begin and read Gas Levels screen will be displayed.
- Connect the sample tubes with water trap filter to the wellhead ensuring the gas sample tube and impact pressure tubes are property oriented. Insert the temperature probe if used.
- Press the Pump key to start the sample pump, a countdown timer will be displayed in the upper left area of the display. The pump may be stopped and restarted at any time by pressing the Pump key. The pump run time is set in Data Field 3.0 software.
- Allow the gas readings to stabilize and press 5 Measure Flow, this will store the gas level readings and display the PRESSURE READINGS screen.
- The PRESSURE READINGS screen will prompt the user to disconnect the sample tubes and allow the pressure to stabilize.
- Once the pressure has stabilized press Enter Zero Transducers and press 1 to continue.
- The gas flow and energy screen is now displayed so modifications may be made to the well if required.

- Press 3 NEXT ID and proceed to the next sampling location. An automatic purge will be performed at this time to ensure the sample has been exhausted from the GEM 2000.

5.6 DOCUMENTATION

Document GEM 2000 measurements for all monitoring events on field forms and in a detailed field notebook. Also record observations of varying weather conditions such as temperature and humidity fluctuations.

6.0 SOP NO. FAR-300
FIELD MONITORING EQUIPMENT DECONTAMINATION

The standard operating procedure for decontaminating field monitoring equipment contains the following sections:

- Purpose
- Application
- References
- Equipment and Supplies
- Procedures
  - General Decontamination
  - Specific Decontamination
- Documentation

6.1 PURPOSE

The purpose of this SOP is to provide field personnel with an outline of the procedure and frequency of decontaminating field monitoring equipment that has come into contact with soil, solid waste, or water.

6.2 APPLICATION

This SOP provides a step-by-step guideline to be followed by the field sampling crew to prevent cross-contamination between measurement locations.

6.3 REFERENCES

RCRA Groundwater Draft Technical Guidance (EPA 1992).

YSI 566 MPS Operations Manual

6.4 EQUIPMENT AND SUPPLIES

The following equipment is necessary to decontaminate equipment used during performance or compliance monitoring.

- Alconox (or equivalent).
- A clean hose and tap water source, if available. Otherwise use two spray bottles, one for deionized water and one for deionized water and Alconox.

- Deionized water.
- A labeled 55-gallon drum for wastewater and a bucket to use for smaller volume prior to containing in drum.
- Personal protective equipment as described in the Health and Safety Plan.

6.5 PROCEDURES

6.5.1 General Decontamination

All reusable equipment that will come in contact with soil, solid waste, or water and/or be used to acquire samples will be decontaminated prior to arrival on site, relocation on site, and site exit. For all decontamination procedures:

- Don appropriate PPE as described in the Health and Safety Plan.
- Wash the equipment with a solution of nonphosphate detergent (Alconox or equivalent) and deionized water.
- Rinse the equipment with tap water (if using Alconox).
- Rinse the equipment with deionized water.
- After decontamination, dispose of all supplies (nitrile gloves, paper towels) in a designated trash bag prior to relocation on site or getting in and out of truck.

6.5.2 Specific Decontamination

Specific decontamination procedures are described below for each type of equipment that is anticipated for use.

6.5.2.1 Soil Sampling Equipment

After collecting a soil sample using the hand auger, split-spoon or tube sampler, or stainless-steel hand sampling equipment, decontaminate the equipment as follows:

- Don appropriate PPE as described in the project specific HASP.
- Brush off any soil clinging to the equipment;
- Rinse the equipment with Alconox solution.
- Rinse the equipment with deionized water.
- Segregate cleaned equipment to avoid possible cross-contamination

6.6 DOCUMENTATION

Document decontamination procedures associated with monitoring well activities in the field notebook.

7.0 BIBLIOGRAPHY

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EXHIBIT B
FIELD FORMS

ATTACHMENT B—SAMPLING AND ANALYSIS PLAN
INTERIM ACTION COMPLIANCE MONITORING PLAN
Interim Action Area of the
South Park Landfill Site
Seattle, Washington

Farallon PN: 408-002

FARALLON consulting

FIELD REPORT

Page ___ of ___

Date: _____ **Project #:** _____ **Task #:**_____

Project: _____ **Site Address:** _____

Client: _____ **Contractor:** _____

Weather: _____ **Temp:** _____

Equipment Used: _____

Hours: _____ _____ **Mileage:** _____ **Project Manager:** _____

Contractor *Staff*

Prepared By: _____ **Reviewed By:** _____

Comments:

FARALLON consulting

FIELD REPORT (continued)

Page ___ of ___

Project: _____ **Date:** _____ **Project #:** _____ **Task #:**_____

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027

Log of Boring:

Depth (feet bgs.)	Sample Interval	Lithologic Description	USCS	USGS Graphic	% Recovery	Blow Counts 8/8/8	PID (ppm)	Sample ID	Sample Analyzed	Well Construction Details
60										
65										
70										

Well Construction Information

Monument Type:
Casing Diameter (inches):
Screen Slot Size (inches):
Screened Interval (ft bgs):

Filter Pack:
Surface Seal:
Annular Seal:

Ground Surface Elevation (ft):
Top of Casing Elevation (ft):
Boring Abandonment:
Surveyed Location: X: Y:

LANDFILL GAS MONITORING FORM

		PAGE: OF
DATE:	PROJECT NAME:	PROJECT NO:
WEATHER CONDITIONS:		
BEGINNING BAROMETRIC PRESSURE:		TIME
MID DAY BAROMETRIC PRESSURE:		TIME
END BAROMETRIC PRESSURE:		TIME
LANDFILL GAS INSTRUMENT -		
MANUFACTURER:	MODEL NUMBER:	SERIAL NUMBER:
CALIBRATION GAS CONCENTRATIONS -		
CH4 - % VOLUME:	CO2 - % VOLUME:	O2 - % VOLUME:
LANDFILL GAS INSTRUMENT CALIBRATION PRIOR TO MEASUREMENT IN WELLS -		
DATE CALIBRATED:	TIME CALIBRATED:	CALIBRATED BY:
CALIBRATION NOTES:		
LANDFILL GAS INSTRUMENT CALIBRATION CHECK AFTER MEASUREMENTS IN WELLS -		
DATE CALIBRATED:	TIME CALIBRATED:	CALIBRATED BY:
CALIBRATION NOTES:		

WELL ID '	TIME	CH4 - % VOLUME	CO2 - % VOLUME	O2 - % VOLUME	NOTES

PREPARED BY:

WASTE INVENTORY TRACKING SHEET

Project Number: _____
Project Name: _____
Project Address: _____
Field Work: _____
Project Manager: _____

Page of
Date: _____
Prepared By: _____
Date Removed: _____
Transporter: _____
Disposal Location: _____

Container ID	Fullness	**Contents** (soil-gw-decon water) / Origin (boring or well number)	Date(s) Accumulated	Labled (Y/N)	Sampled (Y/N)	Comments

NOTES: Contents should be specified and include identification of well/boring, media, souce, depth of soil (if applicable), and any other applicable information.

Location of Drums (sketch or describe):

FARALLON consulting

Chain of Custody

OnSite Environmental Inc.
14648 NE 95th Street • Redmond, WA 98052
Phone: (425) 883-3881 • Fax: (425) 885-4603

Page _____ of _____

Company:

Project Number:

Project Name:

Project Manager:

Sampled by:

Turnaround Request (in working days)

(Check One)

☐ Same Day ☐ 1 Day

☐ 2 Day ☐ 3 Day

☐ Standard (7 working days)

☐ _____ (other)

Laboratory Number:

Requested Analysis

Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix	# of Cont.	NWTPH-HCID	NWTPH-Gx/BTEX	NWTPH-Dx	Volatiles by 8260B	Halogenated Volatiles by 8260B	Semivolatiles by 8270C	PAHs by 8270C / SIM	PCBs by 8082	Pesticides by 8081A	Herbicides by 8151A	Total RCRA Metals (8)	TCLP Metals	HEM by 1664	VPH	EPH					% Moisture

	Signature	Company	Date	Time	Comments/Special Instructions
Relinquished by					
Received by					
Relinquished by					
Received by					
Relinquished by					
Received by					

Reviewed by/Date

Reviewed by/Date

Chromatograms with final report ☐

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