



Soil Cap Management Plan

Historical Landfill and Upland Disposal Cell at Elk Ridge Estates

St. Helens, Oregon 97051

May 30, 2017

Prepared for:

Elk Ridge Estates Home
Owners Association, Inc.
P.O. Box 288
Washougal, WA 98671

Prepared by:



Mailing Address: P.O. Box 14488, Portland, Oregon 97293
Offices in Portland and Bend, Oregon / Spokane, Washington
T. 503-452-5561 / e. ENW@EVREN-NW.com

ENW Project No. 826-12001-15

Purpose

This **Soil Cap Management Plan** (Plan) has been prepared to assist Elk Ridge Estates Home Owners Association, Inc. with implementing Oregon Department of Environmental Quality (ODEQ)-required ***institutional and engineering controls*** at the Elk Ridge Estates, located in St. Helens, Oregon (the “Subject Property”). These controls are designed to minimize risk to human health and the environment from historical solid waste contamination beneath portions of the site.

Use

This document details the following:

- The understanding (post development) of the nature of and impacts associated with the historical landfill debris (including the potential methane gas hazard).
- Soil cap management requirements and protocol, including:
 - o Soil cap inspections
 - o Annual staff training
 - o Signage plan, maintenance and inspection
 - o Procedures for preventing unauthorized subsurface work
 - o Requirements for maintaining a log of subsurface work
- Management of landfill debris / impacted soil and soil cap during subsurface work.
- Protocol for managing risk associated with the accumulation of methane gas.
- Maintenance and inspection of the locked security fence around Tract E Open Space.
- Stipulation for no building construction (residences, garages, garden sheds, enclosed play structures, etc.) within the two management areas.

Identified personnel who have responsibility for exterior areas of the subject property will review this Plan on an annual basis. Records of personnel review and signature-acknowledgment of understanding will be kept on file. This includes any personnel who may be hiring contractors.

Documentation of Compliance

Please acknowledge the **completion** of required actions on annual basis, to be completed when the annual report is completed. Please create records for additional years if needed.

Year	Annual Report Submitted		Document Completion & Inclusion of Attachments in Annual Report			
	Date	By (Name & Initials)	A	B	C	D/E
2017						
2018						
2019						
2020						
2021						
2022						
2023						
2024						
2025						

This

Soil Cap Management Plan

for the

**Historical Landfill and Upland Disposal Cell
at Elk Ridge Estates**

St. Helens, Oregon 97051

Has been prepared for the sole benefit and use of our client:

Elk Ridge Estates Home Owners Association, Inc.

P.O. Box 288
Washougal, WA 98671
Columbia County, Oregon

Issued May 30, 2017

Prepared by:



Mailing Address: P.O. Box 14488, Portland, Oregon 97293
Offices in Portland and Bend, Oregon / Spokane, Washington
T. 503-452-5561 / e. ENW@EVREN-NW.com

ENW Project No. 826-12001-15

Limitations

This Soil Cap Management Plan (Plan) is reflective of site conditions discovered through environmental site assessments as documented in the March 17, 2017 *Analysis of Cleanup Alternatives* (prepared by EVREN Northwest, Inc.) and subsequent communications between EVREN Northwest, Inc. and the Oregon Department of Environmental Quality (ODEQ) regarding required actions to manage residual risk at the Subject Property. Required actions described in this Plan are consistent with State of Oregon and ODEQ rules, regulations and guidance enforce and available as of April 2017. The Client is advised that all other environmental agency requirements and regulations are still applicable to the property. The Client is further advised to check for any updates that may be applicable to a specific scope of work being conducted under this Plan.

No warranties are expressed or implied concerning potential contaminants or environmental media not addressed through sampling and analysis. EVREN Northwest, Inc. is not responsible for conditions or consequences arising from relevant information that is concealed or not fully disclosed at the time of Plan preparation. This Plan was prepared in accordance with generally accepted professional practice in the area at this time for the exclusive use of our client and their agents or authorized third parties. No other warranty, either expressed or implied, is made.

TABLE OF CONTENTS

Purpose	ii
Use	ii
Documentation of Compliance	ii
TABLE OF CONTENTS	iv
1.0 SITE SETTING AND ENVIRONMENTAL CONDITIONS	1
1.1 Regulatory Background	1
1.2 Landfill Overview	1
1.3 Site Setting	1
1.4 Management Areas.....	2
1.5 Known Extent of Methane	4
2.0 ENGINEERING AND INSTITUTIONAL CONTROLS.....	5
3.0 STAFF - REQUIRED ACTIONS	6
3.1 Soil Cap Annual Inspection	6
3.2 Annual Training.....	7
3.3 Signage Plan, Maintenance and Inspection	7
3.4 Approval Process for Authorization to Breach the Soil Cap.....	7
3.5 Maintain Log of Authorized Soil Cap Breaches	8
3.6 Submit an Annual Report.....	8
4.0 SUBSURFACE WORK – METHODS AND PROCEDURES	9
4.1 Prior to Starting Any Work.....	9
4.2 Shallow Subsurface Work.....	9
4.3 Earthwork	9
4.4 Reporting Requirements	10
4.5 Protocol to Mitigate Methane Hazards	10

Figures

Figure 1	Site Vicinity Map
Figure 2	Site Plan
Figure 3	Sample Location Diagram Tract E Open Space
Figure 4	Sample Location Diagram Upland Solid Waste Disposal Cell

Attachments

A	Soil Cap Annual Inspection Form
B	Documentation Form for Annual Staff Training
C	Annual Signage Review Form
D	Subsurface Work Log Form
E	Subsurface Work Documentation Form

Acronym List

amsl	above mean sea level
BPA	Bonneville Power Administration
CC&Rs	Covenant, Conditions and Restrictions
ENW	EVREN Northwest, Inc.
ERE	Client (Elk Ridge Estates Home Owners Association, Inc.)
LEL	lower explosive limit
ODEQ	Oregon Department of Environmental Quality
OSHA	Occupational Safety & Health Administration
PAHs	polynuclear aromatic hydrocarbons
PCBs	polychlorinated biphenyls
UEL	upper explosive limit
USGS	US Geological Survey

1.0 SITE SETTING AND ENVIRONMENTAL CONDITIONS

This Plan applies to specific portions within the Elk Ridge Estates (ERE) subdivision (Subject Property), an approximately 72-acre subdivision located in St. Helens, Oregon (see Figure 1). The property is to be developed in phases with residential lots, connecting drives and open spaces (see Figure 2). *At the time of this Plan's preparation, the subdivision is still under development.*

1.1 Regulatory Background

Environmental investigations and cleanup actions related to the historical landfill began at the Subject Property in 2007 under the direction of a former owner and developer of the property. For a concise summary of work, the reader is referred to the *Contaminated Media Management Plan*¹, Section 1.2, Summary of Environmental Work. For a more in-depth background the reader is referred to the March 2017 *Analysis of Cleanup Alternatives*².

On October 7, 2014 Oregon Department of Environmental Quality (ODEQ) issued a letter to St. Helens Assets stating two solid waste disposal area were present at the Elk Ridge Estate subject site, specifically in Tracts B and E; however, “no contamination is known or suspected to be present on any other lots or tracts in the Development.” ODEQ has approved long-term management of potential risk at the two solid waste disposal areas using engineering and institutional controls. One of the institutional controls was preparation of this *Soil Cap Management Plan*. Adherence to this Plan and the referenced *Contaminated Media Management Plan* will ensure adherence to the institutional and engineering controls selected for this site.

1.2 Landfill Overview

The former landfill at the Subject Property was located in a drainage north of Barrick Lane (current Tract E, HOA Commons Area). Reportedly, solid waste (household trash) was placed in this area over a 20-year period (1950s-1970s). In 2010, approximately 7,000 cubic yards of buried solid waste was excavated and screened. The portion that passed through the screen was placed back in the excavation (former landfill area/drainage, north of Barrick Lane). The remaining portion of the solid waste that did not pass the screen was either disposed of at Hillsboro Landfill (822 tons) or placed in an unlined cell within the Bonneville Power Administration (BPA) easement located on the northern part of the subject property (known as the Upland Solid Waste Disposal Cell).

1.3 Site Setting

The Subject Property is located within the US Geological Survey (USGS) St. Helens 7.5-minute quadrangle. The topography rises from an elevation of approximately 190 feet above mean sea level (amsl) at the site's southern reach, to an elevation of approximately 430 feet amsl at the site's northern edge (see Figure 1).

The residential Elk Ridge Estates subdivision is bounded by Barrick Lane to the southeast, Hankey Road and Milton Creek to the southwest, Perry Creek Road and Perry Creek to the west, forest land and farm land to the north, and forest land to the east. Single-family residences are

¹ EVREN Northwest, Inc. Revised August 15, 2016. *Contaminated Media Management Plan*, Elk Ridge Estates Development, NE of Hankey Rd and Barrick Ln, St. Helens, Oregon 97051. Prepared for Elk Ridge Estates Home Owners Association, Inc.

² EVREN Northwest, Inc. March 17, 2017. *Analysis of Cleanup Alternatives*, Elk Ridge Estates Development, NE of Hankey Rd and Barrick Ln, St. Helens, Oregon 97051. Prepared for St. Helens Assets, LLC.

developed south of the Subject Property along Hankey Road and Pittsburg Road. A rock quarry operated by Eagle Star Rock Products is west of Perry Creek and the site.

The Subject Property is being developed in a phased approach. The majority of the site has been re-graded and infrastructure (streets, vehicle turn-outs, medians, curbs, sidewalks, and utilities) installed for the future residential housing development. Approximately 120 building lots have been developed and 50 homes constructed on the southeast part of the site at the time of Plan preparation.

1.4 Management Areas

This Plan applies to the following two management areas with residual solid waste:

- Historical Landfill (Approximately 2-acres within Tract E of the HOA Commons Area)
- Upland Solid Waste Disposal Cell (Approximately 0.3 acres)

The location and outline of each area are shown on Figure 2. Figures 3 and 4 detail each area separately and show historical sampling locations.

Media with contaminants present at concentrations exceeding applicable State Risk-Based Concentrations were identified in both areas. Any work conducted within the boundaries of these two management areas must be conducted in a manner that is consistent with all State regulations, ODEQ requirements specific to the Subject Property, and the *Contaminated Media Management Plan*. The *Contaminated Media Management Plan* was developed to be used in combination with this Plan.

All disturbed soil in either management area must be managed as impacted soil, unless proven otherwise by an ODEQ-approved method. If a large-scale earthwork project is planned, consultation with the Environmental Consultant and development of a sampling plan is recommend to minimize expense.

The known characteristics of each management area are further described below.

1.4.1 Historical Landfill (Tract E Open Space)

This tract is in the southern part of site and was the location of the historical landfill (see Figure 3). This area includes undisturbed solid waste (placed in the 1950s and 1960s), areas of screened waste along the north-central and northeast part of the historical landfill, which may overlay undisturbed waste, and storm water drainage features (natural and manmade).

The physical characteristics of the historical landfill undisturbed solid waste area are outlined below.

- Length: approximately 600 feet northeast to southwest.
- Width: ranges from 70 feet at its southwest end, 140 feet through its middle-section, to 60 feet at its northeast end.
- Depth: up to 19.5 feet at its maximum (including soil cover) at the northeast end of the landfill.
- Area: approximately 46,000 square feet.

- Soil Cover: three feet thick and composed of silty soil mixed with angular rock. The cover is not entirely free of solid waste. A typical solid waste to soil ratio in the cover is estimated to be less than 1:20.
- Solid Waste: greater than 19.5 feet at its northeast end and composed of solid waste in a clay-silt matrix. The solid waste to soil ratio is estimated to range from 1:10 to 3:20. The soil was typically gray to brown and moist in the presence of decomposing solid waste below a depth of 4 feet (west end). An odor of decomposing waste was present in one of the test pits (TP27) and borings (B22).
- Elevation: approximately 197 feet amsl at the west end of the area to 205 feet amsl at its east end.
- Native Soil: native clayey silt underlies the historical landfill.
- Ground Water: perched ground water was encountered in the borings completed in the portion of the historical landfill centered along the axis of the ravine at depths ranging from a few inches to 12 feet below ground surface.
- Surface Water: Tract E is the natural collection point of storm water leaving the Subject Property. As such, the subdivision storm water design incorporated this natural drainage feature and the large majority of storm water captured from the developed portion of the site is conveyed to Tract E and discharged at the north side of the gully after going through a storm water treatment manhole. *Note: At the time of this Plan's preparation, the developer is in process of rerouting the residential development's storm water discharge to a point below the natural drainage/pond.*

Surface water collects on Tract E in a small detention/settling pond. Sampling has shown pond sediments to be impacted. The pond is impounded at its downstream end to prevent sediment from discharging into Milton Creek and on to the Columbia River.

- Potential Contaminants: metals, petroleum hydrocarbons, PAHs, PCBs, pesticides, herbicides, and methane (in soil gas). *Note: Due to the variable nature of materials within historic landfills it is possible that additional contamination may be present that has not yet been identified by site characterization and assessment.*

1.4.2 Upland Solid Waste Disposal Cell

As described above, a portion of the screened solid waste (the solid waste debris that was too large to pass through the screen) was placed in an unlined cell under the high-tension power lines within the BPA easement in the upper (northern) portion of the site (see Figure 4).

The physical characteristics of the upland solid waste disposal cell are outlined below.

- Length: approximately 245 feet north-northeast to south-southwest.
- Width: ranges from 70 feet at its south end, 100 feet through its middle-section, to 80 feet at its north end.
- Depth: up to 10 feet at its maximum (including soil cover) at the north end of the cell (TP30).
- Area: approximately 12,500 square feet.

- **Soil Cover:** 0.5 to 4 feet thick and composed of silty soil with occasional rounded cobbles. The cover is not entirely free of solid waste. A typical solid waste to soil ratio in the cover is estimated to be less than 1:20.
- **Solid Waste:** greater than 10 feet at its northeast end and composed of solid waste in a clay-silt matrix. The solid waste to soil ratio is estimated to range from 1:10 to 2:5. The soil was typically gray to brown and moist to wet in the presence of decomposing solid waste. Waste is typically more abundant below a depth of 4 feet. An odor of decomposing waste was present in two test pits.
- **Elevation:** approximately 340 feet amsl at the south end of the cell to 363 feet amsl at its north end.
- **Native Soil:** native clay, clayey silt, and weathered saprolitic bedrock underlies the fill in the cell.
- **Ground Water:** perched ground water was encountered at a depth of approximately 4 feet in a boring and test pit completed in the southern part of the upland disposal cell.
- **Potential Contaminants:** metals, petroleum hydrocarbons, PAHs, PCBs, pesticides, herbicides, and methane (in soil gas). *Note: Due to the variable nature of materials within historic landfills it is possible that additional contamination may be present that has not yet been identified by site characterization and assessment.*

1.5 Known Extent of Methane

Soil gas/landfill gas investigations were conducted at both management areas. Methane gas at hazardous concentrations (exceeding 1.25% by volume, which is 25% of methane's lower explosive limit [LEL]) was identified in soil gas at the Upland Solid Waste Disposal Cell. **However, any work in the management areas should be conducted in a manner that assumes the presence of methane at hazardous concentrations.**

Soil gas / landfill gas monitoring data was screened for methane concentrations exceeding 1.25% by volume.

- **Historical Landfill (Track E Open Space).** Methane detections did not exceed 1.25% by volume at probes SG01 through SG05 at the northwest portion of the historical solid waste landfill (see Figure 3 for sample locations).

Upland Solid Waste Disposal Cell. Methane exceeded 1.25% by volume at probes SG07 (34.1%), SG14 (67.6%), and SG18 (1.8%) at the south end of the solid waste disposal cell (see Figure 4 for sample locations). Soil gas was resampled on June 7 and July 7, 2016, to confirm these earlier results. Methane was detected in two (2) of the nine (9) additional monitoring probes (SG24 and SG29) at concentrations greater than 25% of its LEL (lower explosive limit or 1.25% by volume for methane). SG24 and SG29 were both sited within the estimated landfill mass, while the remaining probes were located close to the perimeter or beyond the estimated extent of the landfill mass. Methane was only 0.1% by volume at SG32, which is at or near former probe location SG07 where methane was detected at a concentration up to 34.1% in November 2012.

2.0 ENGINEERING AND INSTITUTIONAL CONTROLS

An *engineering control* is a physical method of preventing or minimizing exposure to hazardous substances remaining on the property. The soil caps over the solid waste in the managed areas at the Subject Property are an engineering control. The security fence to be installed around the historical landfill (Tract E Open Space) to restrict access is another engineering control.

An *institutional control* is a legal or administrative tool to prevent unacceptable exposure to hazardous substances remaining on the property. The following will be required:

- The soil caps are to be regularly inspected and maintained as described in this Plan.
- Procedures to ensure that all responsible persons that need to know about access and work restrictions are informed and trained in accordance with this Plan.
- Any digging/excavating will require prior permission from the Home Owners Association.
- A health and safety plan is prepared and implemented whenever the soil cap is breached.
- Protocol for managing risk associated the potential accumulation of methane gas will be established and enforced.
- All work within managed areas will be conducted according to the Subject Property's *Contaminated Media Management Plan*¹.
- A log of all work that breaches either soil cap will be maintained.
- Stipulation for no building construction (residences, garages, garden sheds, enclosed play structures, etc.) within managed areas.
- Signage to be posted and maintained.
- Preparation and submittal of an annual report documenting compliance with all of the above.
- Records of personnel review and signature-acknowledgment of understanding will be kept on file.

3.0 STAFF - REQUIRED ACTIONS

Maintaining the soil cap integrity and security is an ongoing responsibility. The **Property Manager** shall be designated as the person responsible for ensuring this Plan is implemented, that the soil cap integrity is maintained and that this Plan will be reviewed on an annual basis. If a Declaration of Covenant, Conditions and Restrictions (CC&Rs) is developed for this development, management of this Plan must be added to the Rules and Regulations of the CC&Rs. The property manager may at his or her discretion assign tasks to appropriate personnel.

Responsible Personnel

Property Manager		Maintenance Operations Manager		
Date	Name	Date	Name	Position

3.1 Soil Cap Annual Inspection

The soil cap (both management areas) is to be inspected on an annual basis. Attachment A provides an example form that may be used to conduct this inspection. The entire extent of both management areas must be inspected for erosion, wildlife disturbance and any unauthorized human activity that is breaching (penetrating) the soil cap. If any such conditions are found, measures will be immediately taken to secure the area and remedy the situation.

3.2 Annual Training

The following tasks to be conducted annually will ensure that all individuals who need to know about site restrictions are informed:

- The soil cap will be explained to all appropriate persons (e.g., home owners, anyone with responsibilities pertaining to the property, and anyone actively working on the property). The nature of the site, the importance of legal obligations of maintaining soil cap integrity, the importance of not breaching the soil cap, as well as procedures for obtaining approval to breach the cap will be discussed. These parties should be encouraged to report conditions they may observe (e.g., erosion, wildlife disturbance or unauthorized human activities such as digging) that pose a threat to the integrity of the cap and safety to humans on site to the Property Manager.
- The Manager, along with staff designated by him or her, will review this Plan and acknowledge their understanding of Plan requirements. Designated staff should include all landscape and maintenance contractors, and any staff responsible for contracting work conducted at the site.

Attachment B provides a form that may be used to collect acknowledgement signatures. These will be included with the Annual Report.

3.3 Signage Plan, Maintenance and Inspection

Signs are required to be posted regarding the soil cap. The Manager or their designee will determine the best locations for signs to be placed. Suggestions would include any access areas, or along fencing if access is restricted. A list or map of sign locations will be developed and kept on file.

Sign language may vary depending on location and anticipated audience. A suggested signage example may include:

RESTRICTED CAP MANAGEMENT AREA
DO NOT DISTURB SOIL WITHOUT AUTHORIZATION
ELK RIDGE HOME OWNERS ASSOCIATION

The signage plan will be reviewed annually for effectiveness and signs will be verified present and in good condition. Attachment C provides a form that may be used to demonstrate signage compliance.

3.4 Approval Process for Authorization to Breach the Soil Cap

The Property Manager is responsible for development of an approval process for any subsurface work, so that no unauthorized work is conducted. This includes work conducted by any contractors or utilities. The process must:

- Allow for documentation required by the work log described in the next section.
- Require personnel or entity conducting work to review, acknowledge understanding and agree to adhere to both this Plan and the *Contaminated Media Management Plan*¹.

These procedures will be reviewed on an annual basis and adjusted as necessary to improve effectiveness or allow for changing conditions.

3.5 Maintain Log of Authorized Soil Cap Breaches

Anytime work is conducted that breaches the soil in either management area a log must be maintained. Attachment D provides a form that may be used as a log of work. At a minimum, the following should be documented:

- Personnel/entity performing work.
- Reason for and description of work performed.
- Management and disposal of any impacted soils.
- Precautions taken to prevent exposure to impacted excavated soils.
- Precautions taken to prevent accumulation of explosive landfill gases in confined spaces.

Attachment E is a template form that may be provided to personnel, contractors or utilities who will be performing work that breaches the soil cap. Once work is finished, a completed form and any required supporting information should be placed in the work log file.

3.6 Submit an Annual Report

ODEQ has requested an annual report be submitted detailing the work described above. The forms in Attachments A through E have been designed to document compliance on an annual basis. These should be submitted to the Manager for permanent filing.

The Manager shall establish a due date for the Annual Report. This due date may be scheduled for convenience, but once established should be adhered to annually.

4.0 SUBSURFACE WORK – METHODS AND PROCEDURES

Work conducted on the Subject Property must be done in a manner that is protective of human health and is consistent with the ODEQ institutional controls described previously in this Plan.

Users of the plan are advised that regulations may change in the future and therefore the regulations should be reviewed prior to commencing any subsurface work. If it is believed that local and State regulations have changed, revisions to the Plan may be necessary from time to time to reflect current regulatory standards.

4.1 Prior to Starting Any Work

Any personnel or entity who will be breaching the soil cap must first:

- Obtain authorization following the approval process developed according to Section 3.4 of this Plan.
- Read and provide signature acknowledgement of the requirements of and intention to adhere to this Plan.
- Complete and/or obtain all notifications, legally-required permits or other approvals required to conduct the work to be performed prior to starting work at the site.
- Complete the Project Initiation portion of the Subsurface Work Documentation form in Attachment E, including designation of responsible parties.
- Assess work for the potential to encounter explosive conditions due to the presence of methane gas in confined and topographically low-lying area (see Section 4.5, below) prior to conducting work and develop a plan to mitigate risk if appropriate. Document assessment and risk mitigation procedures on the Subsurface Work Documentation form in Attachment E, including designation of responsible parties.

4.2 Shallow Subsurface Work

Anyone performing only small scopes of work that may disturb the soil cap, but that does not anticipate working at depths (for example landscape work):

- Must complete the requirements of Section 4.1, above.
- Must replace the soil cap material with the same or similar type of material (silt and/or clay) to a depth/height no less than the original surface of the soil cap.

Should landfill debris be encountered, **stop work immediately** and notify the Manager or their designee. Landfill debris may only be removed following the protocol established in the *Contaminated Media Management Plan*. Measure and record the depth of the soil cap over landfill debris and supply this information, along with the location of work, to the Property Manager or their designee

4.3 Earthwork

Anyone conducting earthwork within the two managed areas that that will likely encounter landfill debris **MUST** reference and adhere to the *Contaminated Media Management Plan*¹ for complete soil and water management protocol.

4.4 Reporting Requirements

Detailed notes of field work shall be kept and submitted to the Property Manager or their designee using the Subsurface Work Documentation form in Attachment E. Reason for and dates of work, personnel/contractor/utility performing work, documentation of preparation of a Health and Safety Plan, measures taken to prevent possible explosive conditions from methane, location of soil excavation, soil and water management and disposal, waste disposal receipts and maps/photos of work shall be submitted.

4.5 Protocol to Mitigate Methane Hazards

4.5.1 Methane Gas Characteristics

Methane is a colorless, odorless gas that is lighter than air and produced from the decomposition of organic matter. Methane gas identified at the site is likely to originate from decomposing solid waste from the historic landfill. Methane is nontoxic and a primary component of natural gas.

Methane presents the following hazards:

- Extremely flammable and poisonous gases will be produced by combustion
- Gas/air mixtures may be explosive
- Suffocation: methane may displace oxygen in an enclosed space and asphyxia may result
- Difficult to detect without gas monitoring equipment

4.5.2 Prior to Beginning Work

This section describes work to be conducted and requirements to be met prior to beginning site work.

Assess Potential Risk: A Competent Person (as defined by the Occupational Health and Safety Association [OSHA])³ shall assess risks associated with methane hazards (see Section 4.5.3 for information on identifying methane hazardous).

Contractor Requirements. Contractors and/or subcontractors hired to conduct work at the site will be knowledgeable and experienced. If potential methane hazards are identified for a specific scope of work, then work will be conducted by or under the supervision of a Competent Person, as defined by OSHA³.

A Competent Person will be responsible for the following in relation to methane at the subject property:

- Identify scopes of work with the potential to encounter methane hazards.
- Direct identified work to be conducted in a manner that mitigates potential hazards.
- Monitor the identified work for potential hazards, including but not limited to air monitoring for flammable conditions and oxygen levels.

³ A "competent person" is one capable of identifying existing and predictable workplace hazards who is authorized to take prompt corrective action to eliminate them.

- Take prompt action to mitigate any identified methane hazards.

All field personnel who have the potential for coming in contact with methane hazards will:

- Have appropriate technical and safety training for their scope of work.⁴
- Have a copy and be familiar with the Health and Safety Plan prepared for their scope of work.
- Have reviewed and signed the acknowledgement page of this Plan (Attachment A). The signed acknowledgement pages will be available for the property owner's or site management's inspection and permanent record-keeping, if requested.

Health and Safety Plan. If potential methane hazards are identified for a specific scope of work, a Health and Safety Plan specific to the work to be performed will be prepared according to industry standards. At a minimum, OSHA standards specific to the work to be performed will be met. The Health and Safety Plan should be prepared by a qualified specialist knowledgeable about health and safety issues, the hazards identified at the site, the previously documented site conditions, and the proposed scope of work.

4.5.3 Identification and Control of Methane Hazards

Any scope of work identified to have potential to encounter methane gas, will develop a short, basic scope-specific methane hazard mitigation plan with the following elements:

1. Description of work with the potential to encounter methane gas
2. Work area ventilation requirements (if applicable)
3. Confined space entry requirements and considerations (if applicable)
4. Methods and requirements for air monitoring
5. Description of any mitigation measures required for fire prevention

Supervision. A Competent Person will review and approve all distinct scopes of work for potential to encounter methane hazards. This person will then prepare or review the scope-specific methane hazard mitigation plans for scopes with potential to encounter methane hazards. Once a plan is approved, the Competent Person will provide oversight and ensure that all elements are implemented during work.

Identifying Work with Potential to Encounter Methane Gas. Methane gas has been shown to potentially be present in or near areas of residual solid waste (i.e., the management areas of the historical landfill and the Upland Solid Waste Disposal Cell). As long as work areas are open and well ventilated, methane gas should not present a hazard. However, any of the following scenarios are considered to have potential to encounter methane gas hazards:

- Low-lying areas
- Any subsurface work (e.g., trenches, manholes, etc.)

⁴ Any person conducting confined space entry must have passed or be certified in Confined Space Entry Training based on the OSHA 29 CFR 1910.146 permit-required confined space standards.

- Any confined space entry work
- Any spaces where gas could accumulate (e.g., basements, non-ventilated structures, etc.)
- Any hot work (e.g., welding or other work with the potential to spark)
- Hot and humid weather conditions

NOTE: The above conditions are listed as general guidelines. The Competent Person shall use professional knowledge to evaluate risk for each scope of work due to methane hazards. Similarly, the below methods of mitigating potential methane hazards are presented as general guidance. The Competent Person shall prepare, or review and approve, a scope-specific methane hazard mitigation plan.

Mitigating Potential Methane Hazards. All work in areas with potential to encounter methane gas can use the following measures to mitigate hazards related to the potential accumulation of methane gas.

- **Air Monitoring.** Methane is a colorless, odorless gas that can only be detected using air monitoring equipment. To identify potential methane hazards, air should be monitored for:
 - o **Oxygen:** Testing must be performed as often as necessary to ensure that the atmosphere at normal atmospheric pressure contains at least 19.5 percent oxygen but not more than 22 percent. For any readings outside this range, personnel should be immediately withdrawn from the area and ventilation measures put in place.
 - o **Explosive Level:** In the presence of oxygen and an ignition source, methane is combustible in the range of 5% by volume of air (its Lower Explosive Limit or “LEL”) and 15% by volume of air (its Upper Explosive Limit or “UEL”). Methane will not burn at concentrations less than its LEL or greater than its UEL. To ensure that methane is not present at concentrations above the LEL, OSHA recommends the following precautions:
 - If methane is detected at a concentration of 5% or more of its LEL (0.25% by volume), ventilation measures must be put in place to reduce the concentration of methane.
 - If methane is detected at a concentration of 10% or more of its LEL (0.5% by volume), work must be suspended until the concentration is reduced to below 5% of its LEL.
 - If methane is detected at a concentration exceeding 20% of its LEL (1.0% by volume), all personnel must be withdrawn immediately to a safe above-ground location, except those necessary to eliminate the hazard. Electrical power, except for power to pumping and ventilation equipment, must be cut off to the endangered area until the concentration of the gas is less than 5% of its LEL.

- A methane concentration at or greater than 25% of the LEL (1.25% by volume) is designated as a hazardous condition by the ODEQ. In addition to the above, all personnel should be evacuated a safe distance from the location where the reading was made, i.e., a minimum distance of 100 feet or as determined by the competent person.

Whenever possible, continuous air monitoring is preferred when personnel are present in areas with potential methane hazards. All air monitoring must be done by a competent person and should be recorded to document equipment used (including calibration methods), time and date of reading, location of reading, person conducting monitoring, ambient weather conditions, any pertaining observations, any action levels exceeded and corrective actions taken.

- *Ventilation.* OSHA has the following requirements for ventilation of underground construction activities. These may be used as a general guide for ventilating spaces or areas with the potential to accumulate methane gas. In general, fresh air must be supplied to all underground work areas in amounts sufficient to prevent any dangerous or harmful accumulation of dusts, fumes, mists, vapors, or gases. A minimum of 200 cubic feet of fresh air per minute must be supplied for each employee underground. Mechanical ventilation with reversible airflow must be provided in all of these work areas, except where natural ventilation is clearly adequate. In blasting, drilling, or other operations that may cause harmful amounts of dust, fumes, vapors, etc., the airflow velocity must be at least 30 feet per minute. For gassy or potentially gassy operations, ventilation systems must meet additional requirements. Ventilation systems used during gassy operations also must have above-ground controls for reversing airflow.
- *Fire Prevention and Control.* Particular attention should be paid to identifying and controlling activities that have the potential to spark a fire, not only in the area of a particular scope of work, but also to the site in general. For example:
 - o Open flames or fires should be prohibited (except for pre-approved and monitored hot work).
 - o During hot work, such as welding, noncombustible barriers must be installed below work being performed in or over a shaft or raise.
 - o Post signs prohibiting smoking and open flames. Identify a safe location for employees to smoke.
 - o Prohibit or closely monitor onsite fueling and/or equipment maintenance for explosive conditions.
 - o Gasoline should not be used, stored or piped underground.
 - o Leaks and spills of flammable or combustible fluids must be cleaned up immediately.

- o The Health & Safety Plan should consider the potential for methane to be present at flammable and/or explosive levels and address specific fire prevention measures.
- *Identification of Gassy Conditions and Implementation of Additional Precautions.* OSHA defines Potentially Gassy Conditions and Gassy Conditions and requires additional precautions as follows:

Potentially gassy operations occur under either of the following circumstances:

- o When air monitoring shows, for more than a 24-hour period, 10 percent or more of the LEL for methane or other flammable gases measured at 12 inches + 0.25 inch from the roof, face, floor, or walls in any underground work area
- o When the geological formation or history of the area show that 10 percent or more of the LEL for methane or other flammable gases is likely to be encountered in the underground operation.

Gassy operations occur under the following conditions:

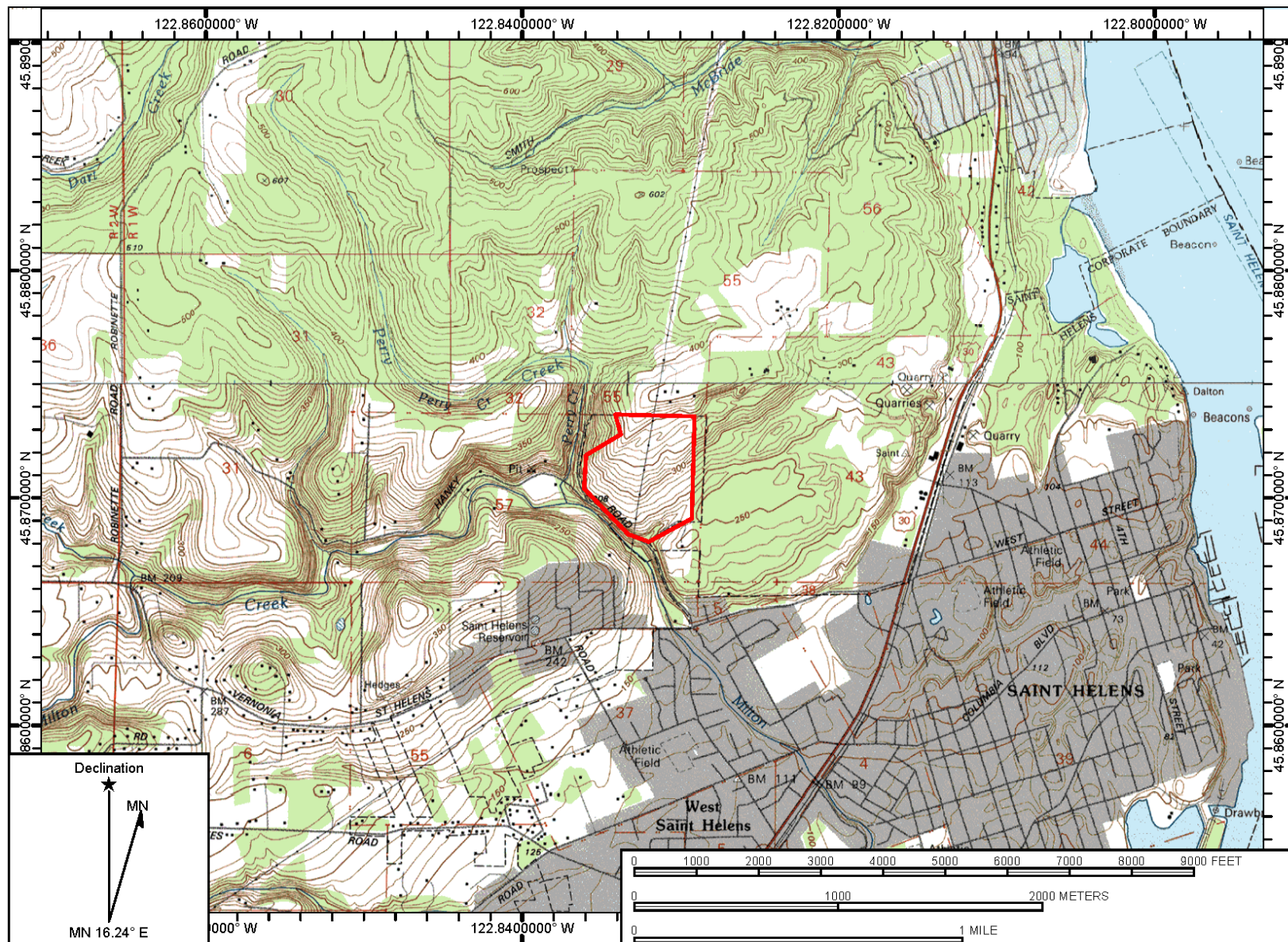
- o When air monitoring shows, for three consecutive days, 10 percent or more of the LEL for methane or other flammable gases measured at 12 inches $\pm$ 0.25 inch from the roof, face, floor, or walls in any underground work area
- o When methane or other flammable gases emitting from the strata have ignited, indicating the presence of such gases
- o When the underground operation is connected to a currently gassy underground work area and is subject to a continuous course of air containing a flammable gas concentration

Gassy operations require additional safety precautions, including the following:

- o Using more-stringent ventilation requirements
- o Using only diesel equipment approved for use in gassy operations
- o Posting each entrance with warning signs and prohibiting smoking and personal sources of ignition
- o Maintaining a fire watch when hot work is performed
- o Suspending all operations in the affected area until all special requirements are met or the operation is declassified

Additional air monitoring is also required during gassy conditions.

FIGURES



Source: USGS Topographic Map, 7.5-Minute St Helens Quadrangle, 1990

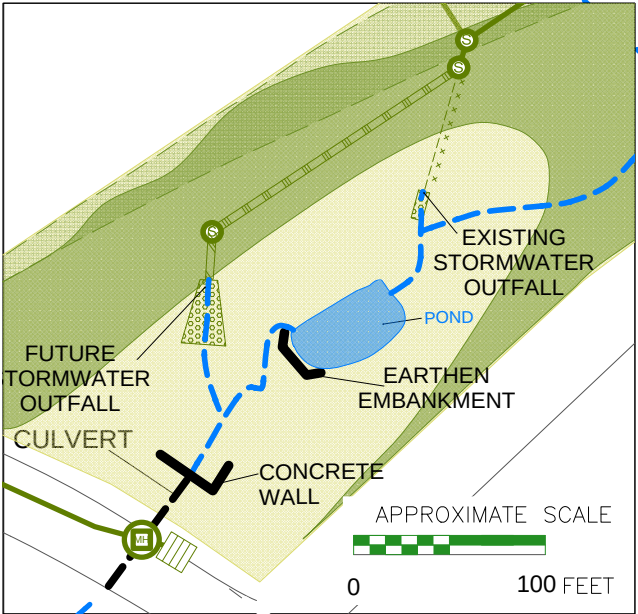
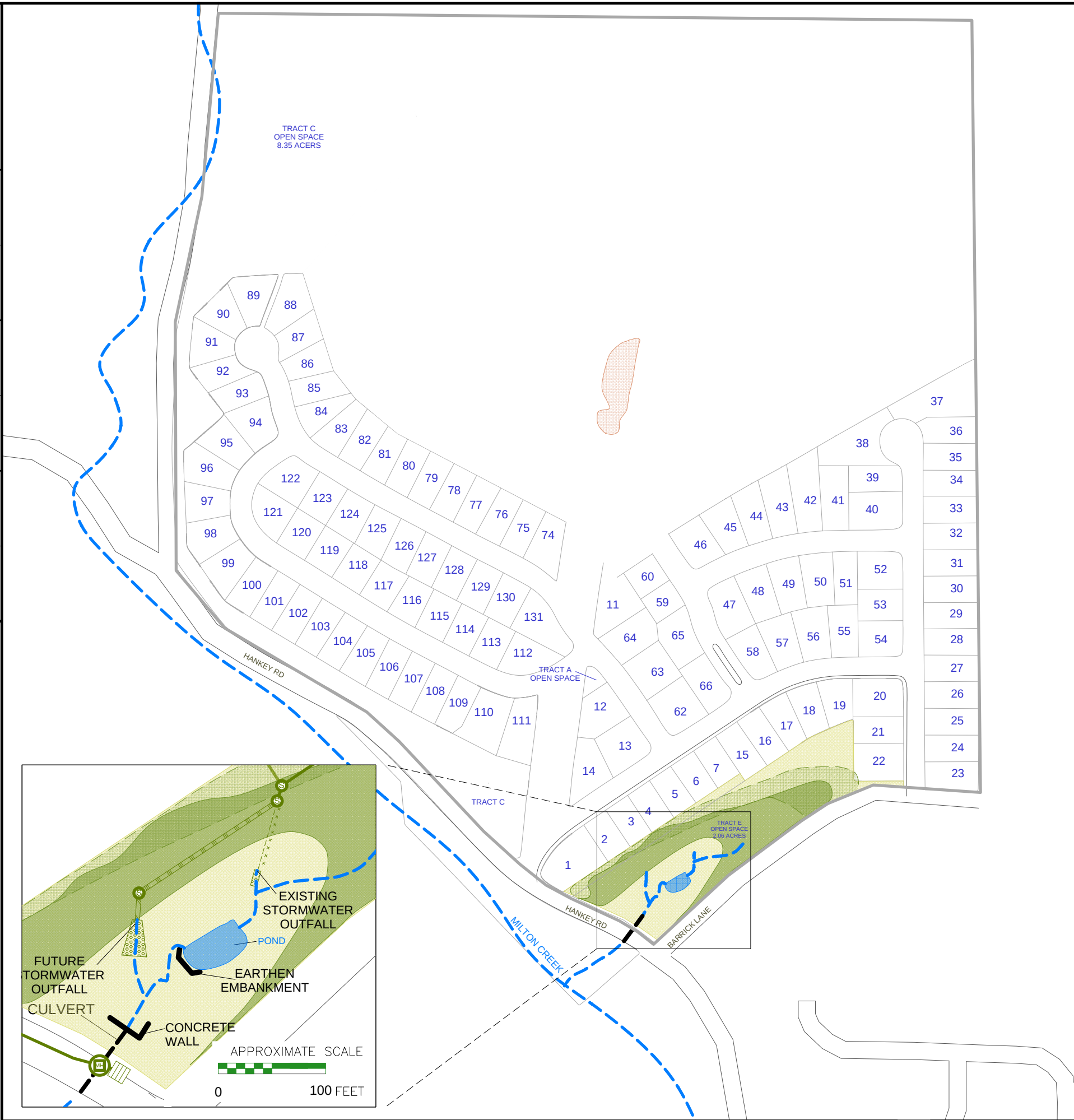


Date Drawn: 4/6/2017
 CAD File Name: 826-12001-15sv_map
 Drawn By: LDG
 Approved By: NMW

Elk Ridge Estates
 Northeast of Hankeny Road and Barrick Lane
 St. Helens, Oregon

Site Vicinity Map

Project No.
 826-12001
 Figure No.
1



- LEGEND:
- APPROXIMATE SUBJECT SITE BOUNDARY
 - APPROXIMATE PROPERTY BOUNDARIES
 - SEPARATED WASTE (INERT MATERIALS) PLACEMENT AREA
 - PLACED SOLID WASTE AREA
 - UPLAND SOLID WASTE DISPOSAL CELL
 - TRACT E (HOA COMMONS AREA)

- NOTES:
1. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH MAP DATED 2011 AND ENW FIELD NOTES.

APPROXIMATE SCALE

0250500 FEET



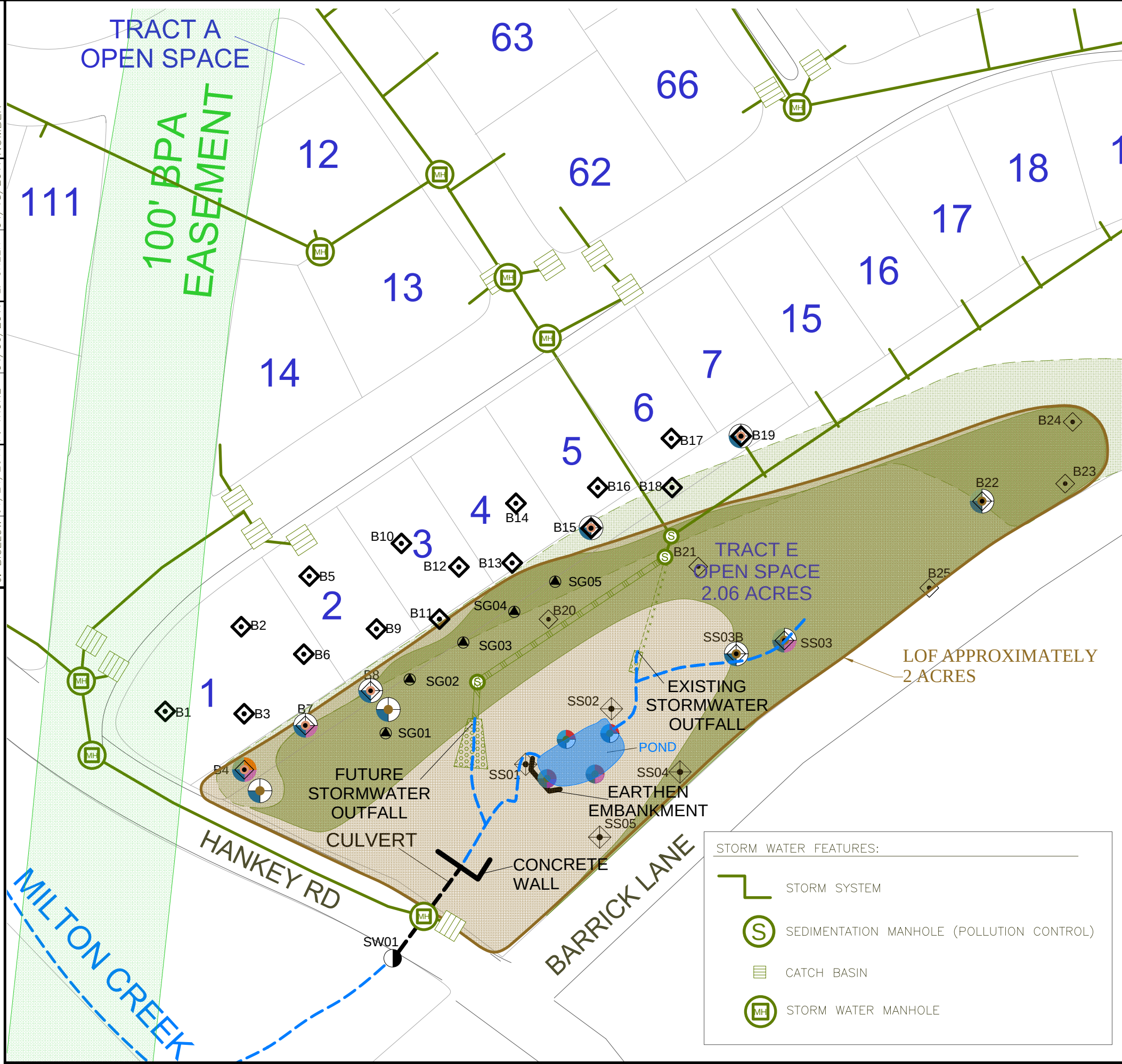
PO BOX 14488, PORTLAND, OREGON 97293
P: (503)452-5561, E: ENW@EVREN-NW.COM

FIGURE 2

SITE PLAN

NORTHEAST OF HANKEY ROAD AND BARRICK LANE
ST HELENS, OREGON 97051

DRAWN BY J. BIGELOW 01/24/2017 P. TRONE 04/06/2017 L. GREEN 04/18/2017
CHECKED BY
APPROVED BY
DRAWING 826-12001(v11) NUMBER



LEGEND:

- APPROXIMATE LOT BOUNDARIES AND LOT NUMBERS
- APPROXIMATE SUBJECT PROPERTY BOUNDARIES (COLOR INDICATING VARIOUS DEVELOPMENT AREAS)
- HISTORICAL LANDFILL – SOLID WASTE REMOVAL AND SEPARATED WASTE (INERT MATERIALS) PLACEMENT AREA
- HISTORICAL LANDFILL – UNDISTURBED SOLID WASTE AREA
- SOLID WASTE SCREENING AREA
- LOCALITY OF THE FACILITY

B21 ENW SUBSURFACE SAMPLING LOCATIONS (BOREHOLES)
SS01 ENW SURFACE SAMPLING LOCATIONS (BOREHOLES)
SD01 ENW SEDIMENT SAMPLING LOCATIONS (BOREHOLES)
SW01 ENW STORM WATER SAMPLING LOCATION
SG01 SOIL GAS / LANDFILL GAS MONITORING POINT

COPCS (EXCEEDS SLRBCS AND/OR BACKGROUND)

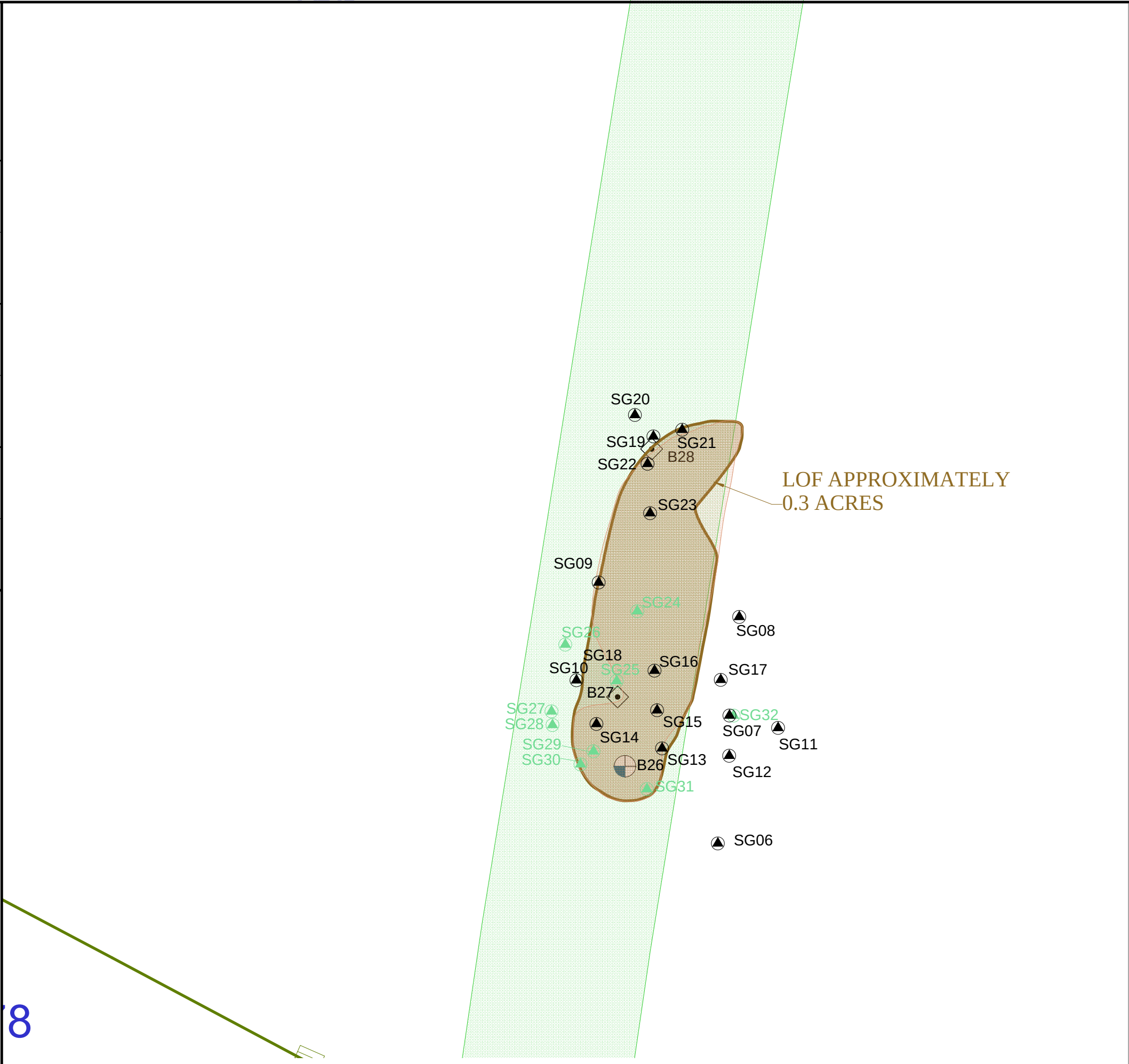
LEAD	CADMIUM	COPPER	PCBS	SILVER
ARSENIC	BENZO(A)PYRENE			

NOTES:
1. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH MAP DATED 2009 AND ENW FIELD NOTES.

APPROXIMATE SCALE
0 70 140 FEET

environmental, natural resource consultants
PO BOX 14488, PORTLAND, OREGON 97293
P: (503)452-5561, E: ENW@EVREN-NW.COM

FIGURE 3
SAMPLE LOCATION DIAGRAM
TRACT E OPEN SPACE
ELK RIDGE SUB DIVISION
ST HELENS, OREGON



- LEGEND:
- APPROXIMATE BUILDING LOCATIONS
 - APPROXIMATE PROPERTY BOUNDARIES AND LOT NUMBERS
 - BPA EASMENT
 - SOLID WASTE DISPOSAL CELL
 - LOCALITY OF THE FACILITY
 - SG01 ENW SOIL GAS / LANDFILL GAS MONITORING POINT
 - B26 ENW SUBSURFACE SAMPLING LOCATIONS (BOREHOLES)

COPCS (EXCEED SLRBCS AND/OR BACKGROUND)

SUBSURFACE SOIL

LEAD

NOTES:

1. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH MAP DATED 2009 AND ENW FIELD NOTES.

APPROXIMATE SCALE

0 60 120 FEET

PO BOX 14488, PORTLAND, OREGON 97293
P: (503)452-5561, E: ENW@EVREN-NW.COM

FIGURE 4

SAMPLE LOCATION DIAGRAM
UPLAND SOLID WASTE DISPOSAL CELL

ELK RIDGE SUB DIVISION
ST HELENS, OREGON

ATTACHMENT A

Soil Cap Annual Inspection Form

Copy and use the following form to document the ODEQ-required annual soil cap inspection.

Soil Cap Annual Inspection Form

Date of Inspection: _____
Inspected by: _____

Maintaining the soil cap integrity and security **protects individuals** from exposure to landfill debris and contaminated soil beneath the site and is an ongoing responsibility. *At a minimum, the soil cap will be inspected annually.* More frequent inspections are encouraged and should also be documented with this form.

The soil cap is present over the extent of both managed areas (Historical Landfill on Tract E Open Space and the Upland Solid Waste Disposal Cell. Persons performing the inspection must have a thorough understanding of the Soil Cap Management plan.

HISTORICAL LANDFILL SOIL CAP

Evaluate all areas for erosion, wildlife disturbance and any unauthorized human activity that is breaching (penetrating) the soil cap.

Is any unauthorized digging occurring? Y / N

If yes, immediately take steps to secure the area and manage the breach according to the Soil Cap Management Plan or Contaminated Media Management Plan, as appropriate.

Are any natural elements (e.g., wind, rain, surface water, erosion, etc.) disturbing topsoil? Y / N

Are there any signs of wildlife (e.g., moles, gophers, deer, dogs, etc.) disturbing topsoil? Y / N

Are there any potential conditions that may disturb topsoil / breach the cap? Y / N

If the answer is yes to any of these question, please document the conditions by 1) taking photographs, 2) showing location on a map, 3) describing condition and the measures taken to remedy the situation. Documentation should be kept with this form and submitted with the Annual Report.

UPLAND SOLID WASTE DISPOSAL CELL

Evaluate all areas for erosion, wildlife disturbance and any unauthorized human activity that is breaching (penetrating) the soil cap.

Is any unauthorized digging occurring? Y / N

If yes, immediately take steps to secure the area and manage the breach according to the Soil Cap Management Plan or Contaminated Media Management Plan, as appropriate.

Are any natural elements (e.g., wind, rain, surface water, erosion, etc.) disturbing topsoil? Y / N

Are there any signs of wildlife (e.g., moles, gophers, deer, dogs, etc.) disturbing topsoil? Y / N

Are there any potential conditions that may disturb topsoil / breach the cap? Y / N

If the answer is yes to any of these question, please document the conditions by 1) taking photographs, 2) showing location on a map, 3) describing condition and the measures taken to remedy the situation. Documentation should be kept with this form and submitted with the Annual Report.

ACTION OR ADDITIONAL DOCUMENTATION REQUIRED?

SIGNATURE OF PERSON PERFORMING INSPECTION:

ATTACHMENT B

Documentation Form for Annual Training

Copy and use the following form to document compliance with ODEQ's requirement for training.

For Year:

ANNUAL PERSONNEL TRAINING

Person responsible for training (name, position):

ANNUAL REVIEW OF SOIL CAP MANAGEMENT PLAN

By signing below, you acknowledge that you have reviewed, understand and will adhere to the requirements of the Soil Cap Management Plan. Attach additional pages as needed.

[illegible]

ATTACHMENT C

Annual Signage Review Form

Copy and use the following form to document compliance with ODEQ's requirement for posting and maintaining signs.

Annual Signage Review Form

For Year: _____

Maintaining the soil cap integrity and security **to protect individuals** from exposure to impacted soil beneath the site is an ongoing responsibility. To ensure continued compliance with ODEQ requirements, the signage plan will be reviewed annually for effectiveness and signs will be verified present and in good condition. This form documents signage compliance and is to be submitted with the Annual Report to ODEQ.

ODEQ requires signs be posted at both management areas (Historical Landfill and Upland Solid Waste Disposal Cell). The Property Manager or their designee will work to determine the best locations for signs to be placed. A signage plan (list or map of sign locations and wording) will be developed and kept on file.

ANNUAL SIGNAGE REVIEW AND INSPECTION

Please consider the effectiveness of the signage plan during this review and implement changes as necessary. Please explain any yes answers in the spaces provided below, or attach additional pages/supporting documentation as necessary.

Person conducting review (name, position):

Have there been any unauthorized breeches of the soil cap in the last year? Y / N

If yes, could a change in signage have prevented this breach? Y / N

If yes, describe and implement changes to the signage plan.

Are signs still present and visible at all locations? Y / N

Do any of the signs need repair? Y / N

Are there any locations that signs should be added? Y / N

Are there any other reasons to modify the signage plan? Y / N

Please modify signage plan according to need identified during this review and implement any changes in a timely manner.

ACTION OR ADDITIONAL DOCUMENTATION REQUIRED?

SIGNATURE OF PERSON PERFORMING INSPECTION:

ATTACHMENT D

Subsurface Work Log Form

This form may be used to document any work that breaches the soil cap. This will create a work log as required by ODEQ. Make copies as needed.

WORK LOG

For Any Breach of Soil Cap

For Year: _____

Maintaining the soil cap integrity and security **to protect individuals** from exposure to landfill debris and contaminated soil beneath the site is an ongoing responsibility. ODEQ requires a log of all work conducted that penetrates the soil cap. This form is to be submitted with the Annual Report to ODEQ. Make copies as necessary.

Responsible Party (Name, Position, Company):	Start Date:	End Date:
Has a subsurface work documentation form been completed?		
Please describe Scope of Work and reason for need to breach soil cap. Details and supporting documentation should be submitted with separate Subsurface Work Documentation form.		
Was any impacted soil excavated? If yes, briefly describe method of management and disposal.		
Describe precautions taken to prevent individuals from being exposed to hazardous constituents in soil.		
Responsible Party (Name, Position, Company):	Start Date:	End Date:
Has a subsurface work documentation form been completed?		
Please describe Scope of Work and reason for need to breach soil cap. Details and supporting documentation should be submitted with separate Subsurface Work Documentation form.		
Was any impacted soil excavated? If yes, briefly describe method of management and disposal.		
Describe precautions taken to prevent individuals from being exposed to excavated soils		

ATTACHMENT E

Subsurface Work Documentation Form

Copy and provide the following form to personnel, contractors or utilities who will be performing work that breaches the soil cap. ***Completing and following instructions on this form will ensure work is done according to this Soil Cap Management Plan.*** Once work is finished, a completed form and any required supporting information should be placed in the work log file.

Subsurface Work Documentation Form

Name of Project: _____

This form is to be completed by any personnel, contractor or utility performing work that will penetrate the soil cap. Work is not to be conducted unless the criteria described below are met and the Property Manager (or designee) has approved the work.

PROJECT INITIATION

Responsible Party (Name, Position, Company):	Requested Work Start Date:
CERTIFICATION: I have read the Soil Cap Management Plan and I understand its importance for mitigating risk to human health. I agree to abide by these measures and safety rules and all applicable safety regulations while working on the property. <i>FURTHER, I take responsibility for training all field personnel for this project on the requirements of this Plan.</i> I understand that any violation of these rules will result in my removal from the work area. Signature of Responsible Party Listed Above:	
Please describe proposed work, any anticipated excavation of impacted soil, proposed methods of management and disposal, proposed methods of replacing soil cap at work completion.	

PROJECT APPROVAL

Person Approving Proposed Work (Name, Position, Company):	Date of Approval:
CERTIFICATION: I have a thorough understanding of the Soil Cap Management Plan. The proposed work methods meet the requirements of the Plan. A work scope-specific methane hazard mitigation plan has been approved by a Competent Person, or a Competent Person has determined that there are no potential methane hazards associated with this scope of work. I grant approval for the work to be conducted as described. Signature of Approving Party:	
Designated personnel to contact in case of change in scope or questions regarding Plan:	Phone Number:

Subsurface Work Documentation Form

Name of Project: _____

Complete the following information upon project completion. Please attach appropriate supporting documentation including, but not limited to, field work photographs, and a map showing location and extent of work.

Responsible Party (Name, Position, Company):	Start Date:	End Date:
Detailed Description of Work:		
Was any landfill debris / contaminated soil excavated? Y / N If yes, <u>please provide supporting documentation</u> and describe in detail the methods used to manage any impacted soils onsite and method(s) of disposal. <u>Waste receipts must be provided.</u>		
Describe precautions taken to prevent individuals from being exposed to impacted soils and any identified methane hazards.		
Describe method of replacing soil cap at work completion.		
Signature of Responsible Party Listed Above:		