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# PUBLIC REVIEW DRAFT
# FEASIBILITY STUDY

## SIMPLOT SOILBUILDERS SUNNYSIDE
## 300 SOUTH 1ST STREET
## SUNNYSIDE, WASHINGTON

Ecology Cleanup Site ID: 2558
Facility/Site ID: 76742139

*Prepared for*

**J.R. Simplot Company**
1130 Hwy 30 W
Pocatello, Idaho 83204

*Prepared by*

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Seattle, Washington 98101

Project Number: PNB0100

February 17, 2026

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| µg/L | micrograms per liter |
| Agreed Order | Agreed Order No. DE 16446 |
| ARAR | Applicable, or Relevant and Appropriate Requirements |
| ASTs | aboveground storage tanks |
| bgs | below ground surface |
| CAP | Corrective Action Plan |
| CLARC | Cleanup Levels and Risk Calculation |
| COPCs | constituents of potential concern |
| CRBG | Columbia River Basalt Group |
| CSM | Conceptual Site Model |
| DPT | direct-push technology |
| DRO | diesel range organics |
| Ecology | Washington State Department of Ecology |
| ECs | Engineering Controls |
| EDB | ethylene dibromide |
| FS | feasibility study |
| ft/day | feet per day |
| ft/ft | feet per foot |
| Geosyntec | Geosyntec Consultants, Inc. |
| GRO | gasoline range organics |
| HDR | HDR Engineering, Inc. |
| HIS | indicator hazardous substance |
| ICs | Institutional Controls |
| ISCO | in situ chemical oxidation |
| mg/kg | milligrams per kilogram |
| MNA | monitored natural attenuation |
| MPE | multiphase extraction |
| MTCA | Model Toxics Control Cleanup Act |
| PAHs | polycyclic aromatic hydrocarbons |
| PID | photoionization detector |
| PLP | Potentially Liable Person |

| | |
|---|---|
| ppm | parts per million |
| PRB | permeable reactive barrier |
| QI | eolian silt and fine sand |
| RAOs | remedial action objectives |
| RCRA | Resource Conservation and Recovery Act |
| RCW | Revised Code of Washington |
| RI | remedial investigation |
| SGS | Simplot Grower Solutions |
| Simplot | J.R. Simplot Company |
| Stantec | Stantec Consulting Corporation |
| SVOCs | semivolatile organic compounds |
| the Site | the Simplot Grower Solutions facility located at 300 1st Street, Sunnyside, Washington |
| TPH | total petroleum hydrocarbons |
| USEPA | United States Environmental Protection Agency |
| USGS | United States Geological Survey |
| USTs | underground storage tanks |
| VCP | Voluntary Cleanup Program |
| VOCs | volatile organic compounds |
| WAC | Washington Administrative Code |
| WRIA | Water Resource Inventory Area |

# EXECUTIVE SUMMARY

This feasibility study (FS) report, prepared by Geosyntec Consultants, Inc. (Geosyntec) on behalf of J.R. Simplot Company (Simplot), presents an evaluation of potential remedial alternatives to address subsurface impacts at the Simplot Grower Solutions (SGS) facility located at 300 1st Street in Sunnyside, Washington (the Site). The Site is located in a mixed industrial and residential area with residential properties east and south of the property. This FS has been prepared under the requirements of Agreed Order No. DE 16446 between the State of Washington Department of Ecology (Ecology) and Simplot.

Preceding this FS, Simplot conducted a multi-phase remedial investigation (RI) to evaluate the nature and extent of subsurface contamination at the Site. The results of the RI activities and prior investigations have been incorporated into the development of this FS.

The previous investigations have identified nitrate and ammonia, volatile organic compounds (VOCs), heavy metals, herbicides, and petroleum-related constituents in the soil and groundwater at the Site. Soil and groundwater constituent concentrations currently exceed Model Toxics Control Act (MTCA) cleanup levels for multiple constituents. The MTCA Cleanup Levels and Risk Calculation (CLARC) values were compared to Site constituent concentrations and used as the basis for developing target cleanup goals for the Site. Site soil and groundwater samples analyzed for metals indicate that elevated metals concentrations are present, but do not appear to be attributed to historical releases at the Site. As part of the development of the draft corrective action plan, and prior to the implementation of the preferred cleanup alternative, a focused study of background metals will be conducted to develop Site-specific metal background and target cleanup levels.

The objective of this FS is to provide an assessment of potential remedial alternatives and identify the preferred remedy. The objective is met by presenting regulatory requirements and remedial action objectives (RAOs), identifying and screening potential remedial technologies, developing and evaluating remedial alternatives, and selecting the preferred cleanup action alternative.

The RAOs developed for the Site include the following:

- Protect or reduce risks from direct contact with impacted Site soils
- Protect off-site groundwater for beneficial use including use as a drinking water source for both public and private users

The RI included developing a Conceptual Site Model (CSM) to be used to identify primary sources of constituents, release mechanisms, and potential exposure pathways for receptors. Based on the Site characteristics and location, no aquatic or terrestrial ecological receptors were identified, with human receptors being the only receptors considered for the Site. The CSM identified that exposure pathways for direct contact with soils and groundwater (non-drinking water), and contact by vapor intrusion were partially complete for current on-site scenarios and mostly complete for future on-site and off-site scenarios.

Based on the CSM, the following treatment technologies were screened to address subsurface impacts at the Site:

- No Action
- Monitored Natural Attenuation (MNA)
- Institutional Controls (ICs)—Land Use Restrictions, Groundwater Use Restrictions
- Engineering Controls (ECs)—Capping, Permeable Reactive Barrier (PRB), Soil Stabilization/Solidification
- In Situ Treatment—Soil Mixing, Phytoremediation, In Situ Chemical Oxidation (ISCO)
- Ex Situ Treatment—Soil Vapor Extraction System, Groundwater Extraction System
- Excavation and Disposal

Cleanup action alternatives were presented to Ecology in a technical memorandum dated September 22, 2023. Ecology provided a response to the document on September 29, 2023, indicating that the proposed alternatives comply with the requirements detailed in WAC 173-340-350. The cleanup action alternatives for the Site are evaluated in this FS and are shown below.

- Alternative 1: Soil Mixing, ISCO, and PRB
  - This alternative includes soil mixing of the vadose zone soils from 0 to 4 feet below ground surface (bgs), ISCO of saturated soils and groundwater via mixing and injection of amendment, and placement of a PRB along the eastern Site property line to contain any residual constituents on-site.
- Alternative 2: Excavation and Disposal, ISCO, and PRB
  - This alternative includes excavation and disposal of the vadose zone soils from 0 to 4 feet bgs, ISCO of saturated soils and groundwater via injection of amendment, and placement of a PRB along the eastern Site property line to contain any residual constituents on-site.
- Alternative 3: Excavation and Disposal, ISCO of Impacted Off-site Groundwater, PRB, and MNA
  - This alternative includes excavation and disposal of on-site soils from 0 to 4 feet bgs, ISCO of off-site saturated soils and groundwater via injection of amendment, placement of a PRB along the eastern Site property line to contain any residual constituents on-site, and MNA of source zone constituents on-site.
- Alternative 4: Multi-Phase Extraction and Treatment, PRB
  - This alternative includes extraction of soil vapor and groundwater via multiple extraction wells and treatment with granular activated carbon. Treated groundwater would be discharged to a sanitary sewer connection and treated vapors would be discharged to atmosphere. The final step includes placement of a PRB along the eastern Site property line to contain any residual constituents on-site.

- Alternative 5: Pavement Cap, ISCO of Impacted Off-site Groundwater, PRB, and MNA
  - This alternative includes placement of an asphalt cap, ISCO of off-site saturated soils and groundwater via injection of amendment, placement of a PRB along the eastern Site property line to contain any residual constituents on-site, and MNA of source zone constituents on-site.
- Alternative 6: No Action
  - This alternative is presented only for consideration as a baseline for comparison against the action alternatives. This alternative would not meet cleanup thresholds and would not be protective of human health and the environment.

Remedial alternatives were evaluated based on requirements in the Model Toxics Control Act and Agreed Order No. 16446: their protectiveness of human health and the environment, degree of permanence, implementation cost, expected effectiveness over the long-term, management of short-term risks to human health and the environment, technical and administrative implementability, consideration of public concerns, costs to implement and monitor treatment and compliance, degree to which recycling, reuse, and waste minimization are employed, and net environmental benefit.

The recommended remedial alternative for implementation at the Site is *Alternative 1: Soil Mixing, In Situ Chemical Oxidation, and Permeable Reactive Barrier.* Alternative 1 includes mixing an oxidant into the identified areas of vadose zone soils from ground surface to approximately four feet below ground surface, ISCO of saturated soils and groundwater via injection, and installation of a PRB to contain remaining constituents on-site.

# 1. INTRODUCTION

This feasibility study (FS) report, prepared by Geosyntec Consultants, Inc. (Geosyntec) on behalf of J.R. Simplot Company (Simplot), presents an evaluation of potential remedial alternatives to address subsurface impacts remaining at the Simplot Grower Solutions (SGS) property located at 300 1st Street in Sunnyside, Washington (the Site). The Site encompasses approximately 2.7 acres and is currently owned by Simplot.

In 2007, nitrate and ammonia were found in groundwater east of the Site during an investigation conducted as part of ongoing remediation of the neighboring Bee-Jay Scales property located at 116 North 1st Street in Sunnyside, Washington (Stantec Consulting Corporation [Stantec] 2007). On October 1, 2008, Simplot received a notice from the Washington Department of Ecology (Ecology) regarding potential downgradient releases emanating from the Site to off-site properties.

On March 19, 2009, Simplot entered the Washington Voluntary Cleanup Program (VCP) and conducted a preliminary investigation in September 2009. The preliminary investigation identified nitrate and ammonia, volatile organic compounds (VOCs), heavy metals, herbicides, and petroleum-related constituents at the Site (HDR Engineering, Inc. [HDR] 2009). Concentrations of these compounds were found in exceedance of Model Toxics Control Act (MTCA) screening levels for soil and groundwater.

On June 26, 2019, Simplot entered Agreed Order No. DE 16446 (Agreed Order) with Ecology that outlined a pathway for remediation of the Site. The Agreed Order named Simplot as the Potentially Liable Person (PLP) under MTCA regulations, requiring Simplot to execute the requirements for Site remediation.

Under the requirements of the Agreed Order, Simplot conducted additional sampling activities through 2022 to complete a multi-phase remedial investigation (RI) to assess the nature and extent of subsurface contamination at the Site (HDR 2020, 2021, 2022, 2023).

Simplot submitted a technical memorandum outlining proposed remedial cleanup action alternative technologies to Ecology on September 24th, 2023. Ecology responded via email on September 29th, 2023, stating that the proposed technologies comply with the requirements of WAC 173-340-350. The proposed cleanup action alternatives and the results of the RI and prior investigations have been incorporated into the development of this FS.

## 1.1 Purpose and Objectives

The purpose of this FS is to present the information and evaluations relevant to assessing remedial technologies and alternatives to address subsurface constituents at the Site. The overall objective of this FS is to evaluate the remedial alternatives and identify the preferred remedial cleanup action alternative.

To meet the objective, this FS includes a summary of relevant Site background information and a summary of regulatory requirements, outlines remedial action objectives (RAOs), identifies and screens remedial technologies, develops and evaluates remedial alternatives, and identifies the preferred remedy.

## 1.2 Regulatory Framework

This FS is required by the Agreed Order. This FS was developed based on the requirements of the Agreed Order, as well as Chapter 173-340 of the Washington Administrative Code (WAC), MTCA Cleanup Regulations.

Compliance with the Agreed Order and MTCA regulations is enforced under Revised Code of Washington (RCW) Section 70.105D.050(1).

## 1.3 Report Organization

This remainder of this document is organized as follows:

- Section 2, Background Information, provides a description of Site location, use, and geology and hydrogeology.
- Section 3, Site Investigation and Interim Action History, provides a summary of previous remedial investigations and findings.
- Section 4, Conceptual Site Model and Nature and Extent of Impacts, describes the development and criteria for the conceptual site model and the nature and extent of impacts to Site media.
- Section 5, Proposed Site-Specific Target Remediation Levels, details the applicable cleanup requirements and proposed cleanup levels to meet Site-specific goals.
- Section 6, Remedial Action Objectives and Documentation of Cleanup Goals, details the constituents of concern and compliance points for Site media.
- Section 7, Identification and Screening of Remedy Alternatives, identifies potential cleanup technologies and screens applicability for meeting Site RAOs and cleanup goals.
- Section 8, Explanation of Cleanup Action Alternatives, provides a detailed explanation of each proposed cleanup action alternative.
- Section 9, Evaluation of Cleanup Alternatives, provides complete evaluation of each cleanup alternative and ability to meet MTCA criteria.
- Section 10, Preferred Cleanup Action Alternative, details the preferred cleanup alternative and the basis for selection.
- Section 11, References, lists sources cited in this document.

Tables, figures, and appendices referenced in this document are embedded or follow the text.

# 2. BACKGROUND INFORMATION

General background information on the Site location and surroundings, Site use and history, geology, and hydrogeology have been excerpted from the HDR RI reports and are summarized below. Maps of the Site location, vicinity, and layout are provided in Figures 1 through 3.

## 2.1 Site Location and Surroundings

The Site consists of three parcels within Yakima County (Parcel Nos. 22102523444, 22102523445, and 22102523446), encompassing approximately 2.7 acres, and is currently owned by Simplot (Figure 1). The Site is located in Yakima County, Washington, within the City of Sunnyside limits, and is zoned for light industrial use (City of Sunnyside zoning code M-1).[1] The Site is irregularly shaped and includes two buildings, a modular office and a warehouse, and a concrete containment structure used for storing chemical totes and tanks (Figure 2). The Site consists of mostly unpaved ground surface, except for a small, asphalt paved parking lot near the modular office structure.

According to the City of Sunnyside geographic information system (GIS) database, the Site is located within an area containing mixed light industrial and residential land use. Land use directly east and south of the Site is high-density residential (City of Sunnyside zoning code R-3). According to the HDR RI reports, immediately southwest of the Site is the Yakima County Public Works building and maintenance yard (Figure 3). The maintenance yard includes a fueling station with two underground storage tanks (USTs) for storage of diesel and gasoline. To the north of the Site is a railroad owned by Union Pacific, running north to northeast. Directly north of the railroad is the Milne Fruit Products processing facility.

In the early 1960s to 1986s, an agricultural distribution facility was operated by the former owners of the Bee-Jay Scales facility (Facility Site ID 504; Cleanup Site ID 3642) located at 116 North 1st Street, one block north of the Site (SECOR 2007). The Bee-Jay Scales facility is currently undergoing remediation, primarily for nitrate and ammonia.

## 2.2 Site Use and History

Simplot has used the Site as an agricultural distribution facility since the early- to mid-1960s (HDR 2009). A historical review conducted by HDR identified general area land use as agricultural warehouses, lumber yards, coal storage, and railroad transportation dating back to the early 1900s.

## 2.3 Site Geology and Hydrogeology

The Site is located within the Yakima Fold Belt of the Columbia Basin Province in Washington (Washington State Department of Natural Resources 2023). Site-specific geologic maps reviewed by HDR indicated that the Site is underlain by late Pleistocene to Holocene eolian deposits or Pleistocene to Holocene aged loess (QI; HDR 2023). QI is described as eolian silt and fine sand. Eolian deposits are described as pale orange to brown silt and fine sand with locally containing multiple caliche layers and tephra beds.

[1] Yakima County hosts GIS maps at this website: https://yakimacounty.maps.arcgis.com/

According to the United States Department of Agriculture (USDA) National Resource Conservation Service (NRCS) database, soil underlying the Site consists of Outlook fine sandy loam and Cleman very fine sandy loam.[2] The database notes that Outlook fine sandy loam occurs throughout the majority of the Site; with Cleman very fine sandy loam along the eastern and southeastern Site boundaries. These soils possess moderately high to high hydraulic conductivity and moderate to high water capacity. The depth to the water table for these soils is greater than 80 inches. The Cleman soils are well drained, while the Outlook soils are somewhat poorly drained.

Boring investigations conducted by HDR identified a layer of fill at the ground surface up to 2 feet deep throughout the Site (HDR 2009). Subsurface soils were generally comprised of clayey silt to approximately 12 feet below ground surface (bgs). The clayey silt was dark brown to brown, with a color change usually to gray at approximately 9 to 12 feet bgs. HDR noted that observed underlying material was reportedly consistent with published geologic and soil maps (HDR 2023).

The Site is situated in the Yakima Watershed Basin within the Lower Yakima Water Resource Inventory Area (WRIA No. 37; Ecology 2022). WRIA No. 37 drains to the Yakima River below its confluence with the Naches River, but also includes tributaries to the Columbia River from the Hanford Reservation (Ecology 2023).

According to the United States Geological Survey (USGS), the Site is in the Yakima River Basin Aquifer system. Groundwater within this system is found within unconsolidated basin-fill deposits, the Columbia River Basalt Group (CRBG), and generally older bedrock (USGS 2009). Hydraulic characteristics of the aquifers in the area are diverse due to the high diversity of the basin fill and CRBG deposits. Groundwater in the area is either confined or unconfined and water levels in the area have some seasonal fluctuation due to irrigation activities and variations in precipitation.

Field investigations conducted by HDR have observed seasonal fluctuations in depth to groundwater ranging between approximately 8 to 10 feet bgs throughout the Site. Site-specific groundwater measurements indicate general groundwater flows to the east and southeast, with gradients ranging from 0.007 feet per foot (ft/ft) to 0.026 ft/ft, dependent on seasonality (HDR 2023). HDR estimated groundwater velocity within the shallow on-site aquifer as 0.03 feet per day (ft/day), based on a hydraulic conductivity of 1 ft/day and a gradient of 0.009 ft/ft (HDR 2013).

Five permanent groundwater wells currently exist at the Site: MW-1 (screen depth: 7.5–17.5 feet bgs), MW-2 (screened 5–15 feet bgs), MW-3 (screened 5–20 feet bgs), MW-4 (screened 5–20 feet bgs), and MW-5R (screened 10–20 feet bgs; HDR 2012).[3] Simplot has additionally installed four off-site wells along South 3rd Street, located hydraulically downgradient and east of the Site: MW-6 (screened 6–22 feet bgs), MW-6D (screened 26–36 feet bgs), MW-7 (screened 9–24 feet bgs), and MW-7D (screened 27–37 feet bgs; HDR 2022).

[2] The USDA hosts an interactive map at: https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx
[3] Ecology hosts a well construction map at: https://appswr.ecology.wa.gov/wellconstruction/map

There are no known potable wells at the Site. A City of Sunnyside emergency drinking water well, MW-10, is located approximately 0.5 miles cross-gradient from the Site and is screened in a deep aquifer zone (surface seal extends to 245 feet bgs; City of Sunnyside 2016).[4]

[4] Ecology hosts a well construction map at: https://appswr.ecology.wa.gov/wellconstruction/map

# 3. SITE INVESTIGATION AND ACTION HISTORY

The following sections provide a summary of the environmental investigations and remedial actions conducted in association with the Site between 2007 and 2022. Locations of monitoring wells, temporary borings, and interim remedial activities conducted during this timeframe are included in Appendix A. Results from these investigations are summarized in Appendices B and C.

## 3.1 Off-site Investigation: Bee-Jay Scales Facility

In 2007, a groundwater investigation was conducted at the neighboring Bee-Jay Scales facility (Facility Site ID 504; Cleanup Site ID 3642) located at 116 North 1st Street, one block north of the Site (SECOR 2007). The Bee-Jay Scales facility has been undergoing environmental assessment and cleanup on soil and groundwater since February 1992.

As part of the ongoing investigation at the Bee-Jay Scales facility, Stantec advanced a boring along the eastern property boundary of the Simplot Sunnyside Site to assess the extent of groundwater impacts associated with the Bee Jay Scales facility. Samples collected from this boring identified elevated concentrations of nitrate, sulfate, chloride, 1,2-dichloroethane, 1,2-dichloropropane, arsenic, benzene, Dinoseb herbicide, and ammonia in groundwater (HDR 2009). As a result of these detections, on October 1, 2008, Simplot received an "Early Notice Letter" from Ecology to investigate the presence of potentially hazardous chemicals within the subsurface at the Site.

## 3.2 Preliminary On-site Investigation

On September 23 and 24, 2009, Simplot advanced 13 temporary borings (B01 through B13) using direct-push technology (DPT) for the collection of soil and groundwater samples at the Site from up to 12 feet bgs (HDR 2009). Samples were analyzed for VOCs, chlorinated herbicides, Resource Conservation and Recovery Act (RCRA) metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver), chloride, sulfate, nitrate, and ammonia. The samples identified the following groundwater constituents with screening level exceedances: benzene, bromodichloromethane, 1,2-dichloroethane, 1,2-dichloropropane, ethylbenzene, naphthalene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, total xylenes, arsenic, barium, lead, 2,4-D, nitrate, sulfate, and chloride. Groundwater exceedances were present in all boring holes (HDR 2009).

## 3.3 On-site Monitoring Well Installation and Monitoring

In March 2011, Simplot installed five monitoring wells (MW-1 through MW-5) with screens from 5 and 20 feet bgs to intercept first encountered groundwater at the Site.[5]

Between March 2011 and January 2020, multiple rounds of groundwater monitoring have been conducted on the Site wells:

- 2011: March (included collection of soil samples during well installation), June, September

[5] MW-5 was removed in late 2012 and replaced with well MW-5R, located slightly south of the original well (Section 3.4).

- 2012: December
- 2013: April, July, October
- 2014: October
- 2015: April, October
- 2016: April, October
- 2017: May, December
- 2018: April, September
- 2020: January
- 2021: September

Samples were analyzed for VOCs, chlorinated herbicides, RCRA metals, polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), nitrate, and ammonia. Results of the monitoring well sampling are included in the HDR RI report (2023).

## 3.4 Source Removal Excavation

In December 2012, Simplot excavated approximately 155 cubic yards (20 feet by 22 feet and 9.5 feet deep) of soil from a former rinse area near the northeastern corner of the Site (Figure 3). Depth to groundwater at the time of excavation was approximately 9.5 feet bgs. Sampling results from this area of the Site indicated elevated concentrations of nitrate and ammonia. Excavated soil was stockpiled and removed from the Site. Confirmation samples were collected from the excavation pit sides and bottoms (eight wall samples, two bottom samples). Samples were analyzed for VOCs, chlorinated herbicides, nitrate, and ammonia, and concentrations were below screening levels. Monitoring well MW-5 was within the excavation footprint, was abandoned during excavation activities, and was later replaced as MW-5R (screened 10–20 feet bgs).[6]

## 3.5 Off-site Downgradient Well Installations

In November 2012, two downgradient off-site monitoring wells (MW-6 and MW-7) were installed east of the Site along South 3rd Street with screens at first groundwater (screened 6–22 feet bgs and 9–24 feet bgs, respectively). In July 2021, two additional downgradient off-site monitoring wells were installed along South 3rd Street (MW-6D and MW-7D; screened 26–36 feet bgs and 27–37 feet bgs, respectively) to obtain groundwater data from a deeper zone as part of the Phase 2.5 Remedial Investigation (Section 3.7).

## 3.6 Subsurface Drain Evaluation

In April 2013 HDR completed a subsurface drain study to assess whether shallow Site groundwater had the potential to enter four identified existing subsurface drainage systems (old under-drain system, irrigation district drain system, city stormwater drain system, and industrial wastewater drain system; HDR 2013). Groundwater samples were collected from drainpipes and manholes

[6] Ecology hosts a well construction map at: https://appswr.ecology.wa.gov/wellconstruction/map

downgradient from the Site. Samples were analyzed for chloride, sulfate, total phosphorus, nitrate, and ammonia. Total phosphorus was the only exceedance present in the cross-gradient (north of Site) and downgradient (east of Site) storm drains.

## 3.7 Phase 1 and 2 Remedial Investigations: Additional Borings

In January 2020, 15 temporary borings (BH-01 through BH-15) were drilled on-site using DPT for groundwater sample collection (HDR 2020). Samples were collected from up to 16 feet bgs and analyzed for VOCs, gasoline range organics (GRO), ethylene dibromide (EDB), chlorinated herbicides, diesel range organics (DRO), RCRA metals, dissolved mercury, chloride, sulfate, nitrate, and ammonia. Exceedances were generally observed in samples from the eastern portion of the Site, except for arsenic, which exceeded the screening level at all boring locations.

In December 2020, 15 additional borings (BH2-1 through BH2-15) were drilled on-site (BH2-1 through BH2-8) and off-site (BH2-9 through BH2-15) using DPT (HDR 2021). Groundwater samples were collected from 8–12 feet bgs and analyzed for VOCs, GRO, EDB, chlorinated herbicides, DRO, RCRA metals, dissolved mercury, chloride, sulfate, nitrate, and ammonia. Exceedances included VOCs, EDB, GRO, DRO, 2-methyl-4-chlorophenoxyacetic acid (MCPA) herbicide, arsenic, and nitrate. At least one exceedance was reported for each boring; arsenic exceeded the screening level in each boring.

## 3.8 Phase 2.5 Remedial Investigation: MW-6D and MW-7D Installation, On-site Soil Vapor Headspace Screening, On-site Soil Suitability Testing, and Off-site Tier 1 Soil Vapor Intrusion Assessment

In July 2021, monitoring wells MW-6D and MW-7D were installed to along South 3rd Street (Section 3.5).

In November 2021, 38 borings were installed (SVH2.5-01 through SVH2.5-38) throughout the Site and soil vapor headspace samples were screened for VOCs using a photoionization detector (PID). PID measurements ranged from no detection (<0.1 parts per million [ppm]) to 444 ppm. The highest PID reading was observed in a boring located in the northeastern corner of the Site. The majority of positive headspace PID detections were observed in vapor from borings advanced in the center and northeastern corner of the Site.

Fifteen soil samples (sample names starting with SST2.5) were also collected from three borings as part of a soil suitability test. The samples were analyzed for nitrate, ammonia, phosphorus, potassium, sulfate, sodium, sodium absorption ratio (SAR), cation exchange capacity, and bicarbonate. Results from the sampling indicated that use of phytoremediation as a treatment technology would be of limited efficacy due to high salt levels, low organic matter, and small area availability.

In November 2021, Simplot drilled five borings at downgradient residences east of the Site, along South 2nd Street and South 3rd Street, to conduct a Tier 1 vapor intrusion investigation. Soil vapor samples were collected from approximately 4 feet bgs in Summa™ canisters and analyzed for VOCs. One constituent (1,3-butadiene) exceeded the Cleanup Levels and Risk Calculation (CLARC) Deep Soil Gas Method B Cancer screening level. HDR noted that detection of

1,3-butadiene may have been the results of drilling activities (from heating up synthetic rubbers used in o-rings or other components). No other constituents exceeded screening levels.

## 3.9 Phase 3 Remedial Investigation: On-site Tier 2 Vapor Intrusion Investigation, Geophysical Survey and Soil Investigation

In May 2022, a Tier 2 vapor investigation was conducted at the Site based on PID readings observed in the northeastern corner during the Phase 2.5 RI activities and their proximity to buildings (HDR 2023). Sub-slab/crawl space soil vapor sampling (three samples), indoor air sampling (two samples), and outdoor ambient air sampling (one sample) was completed at the two on-site buildings (warehouse-type structure and modular office building). Samples were collected using Summa™ canisters and were analyzed for 15 VOCs on the United States Environmental Protection Agency (USEPA) Toxic Organics-15 (TO-15) list of analytes. Indoor air sampling results were compared against the most restrictive CLARC Air Method screening levels. Two indoor air samples collected inside the warehouse building exceeded screening levels for benzene. Based on the results of the sub-slab samples, it is assumed that the indoor air sample exceedances are from benzene-containing products used within the warehouse, and not from vapor intrusion emanating from below the structure. The warehouse building is primarily used for storage of agricultural implements and is not occupied for extended periods. As of Summer of 2023, the Site is inactive and unstaffed.

In August 2022, a geophysical survey was conducted using combinations of metal detection/magnetics and ground penetrating radar (GPR) techniques to identify subsurface anomalies. Two direct current (DC) resistivity tests were performed to characterize soil electrical properties to a depth of 40 feet bgs.

Subsequently, 36 temporary soil borings (BH3-1 through BH3-36) were advanced using DPT to 15 feet bgs to investigate subsurface anomalies and buried utilities found during the geophysical survey and where high PID measurements were previously observed. Soil samples were collected from the borings and analyzed for VOCs, GRO, DRO, herbicides, arsenic, cadmium, and nitrate-nitrite-nitrogen. Results exceeded CLARC Soil Method screening levels for VOCs, metals, and GRO.

No USTs were identified during the geophysical survey. Notable findings included a small, isolated object to the southeast of the office structure and two areas of buried debris near the previously excavated former container rinsing area (Section 3.4).

# 4. CONCEPTUAL SITE MODEL AND NATURE AND EXTENT OF IMPACTS

HDR developed a Conceptual Site Model (CSM) based on the results of the samples (groundwater, soil, and air) collected as a part of site investigations between 2007 and 2022(HDR 2023). Indicator hazardous substances (IHSs) were identified in the HDR CSM, along with two primary release source areas and mechanisms of constituent release into the environment.

The CSM additionally summarizes the environmental pathways for exposed individuals and routes of entry to the body for each medium of exposure (soil, groundwater, and air). The CSM developed by HDR did not address potential attenuation of Site constituents through processes such as advection, dispersion, or degradation; a theoretical discussion on methods of constituent mass transport was included in this section to elaborate on the development of the proposed remedies discussed in Section 5.

Additional Site-specific considerations included aquatic and terrestrial receptors. During the development of the CSM, no aquatic or terrestrial ecological receptors were identified and no environmentally sensitive natural resources including wetlands, surface water bodies, forested natural areas, or habitat for threatened and endangered species are present on the Site or in the vicinity.

## 4.1 Indicator Hazardous Substances

Per WAC 173-340-703, HDR developed the following list of IHSs for Site media by comparing investigation data collected between 2007 and 2022 to July 2022 CLARC screening levels:

- Soil—VOCs, metals, TPH, and herbicides
- Groundwater—VOCs, PAHs, metals, GRO, DRO, and herbicides
- Indoor air—benzene[7]

IHS tables were developed by HDR for petroleum and non-petroleum constituent exceedances in soil and constituents in groundwater. The following tables (Tables 1 through 3) are adapted from the 2023 RI report and the complete list of results are included in Appendices B and C. Additionally, the 2023 RI report developed isocontour figures for the respective tables, which are attached in Appendix A.

[7] Indoor air samples collected inside the warehouse building in May 2022 contained concentrations of benzene above CLARC screening levels. However, the exposure pathway for current vapor intrusion impacts was determined to be incomplete based on limited occupancy of the warehouse and the results of the sub-slab sample analyses (Section 4.4).

## Table 1: Petroleum Constituent Exceedances in Soil (HDR 2023)

| Indicator Hazardous Substances | Analyte | CLARC Screening Level | Number of Exceedances[1] | Minimum Exceedance | Maximum Exceedance |
|---|---|---|---|---|---|
| | | (mg/kg) | | | |
| VOCs | 1,2-Dichloroethane | 0.0016 | 7 (10%) | 0.00239 | 0.107 |
| | 1,2,3-Trimethylbenzene | 0.073 | 21 (35%) | 0.0913 | 111 |
| | 1,2,4-Trimethylbenzene | 0.072 | 22 (32%) | 0.296 | 495 |
| | 1,3,5-Trimethylbenzene | 0.071 | 22 (32%) | 0.0945 | 142 |
| | Xylenes, Total | 0.83 | 13 (22%) | 0.977 | 1,070 |
| | Toluene | 0.27 | 1 (1%) | 249 | 249 |
| | Benzene | 0.0017 | 34 (50%) | 0.00198 | 15.7 |
| | Cumene | 0.79 | 11 (16%) | 0.827 | 13.2 |
| | Ethylbenzene | 0.34 | 5 (7%) | 0.434 | 118 |
| | Methyl tert-butyl ether (MTBE) | 0.0072 | 1 (1%) | 0.0098 | 0.0098 |
| PAH | GRO | 30 | 24 (47%) | 33.1 | 9,090 |
| | Naphthalene | 0.24 | 33 (49%) | 0.244 | 44.65 |
| | 1-Methyl naphthalene | 0.0042 | 27 (57%) | 0.00736 | 1.03 |
| | 2-Methyl naphthalene | 0.088 | 17 (36%) | 0.116 | 2.08 |

**Notes:**

[1] Number in parentheses represents the percent of exceedances for the dataset, which is presented in Table 8 in Appendix B (HDR 2023).

mg/kg = milligrams per kilogram

## Table 2: Non-Petroleum Constituent Exceedances in Soil (HDR 2023)

| Indicator Hazardous Substances | Analyte | CLARC Screening Level | Number of Exceedances[1] | Minimum Exceedance | Maximum Exceedance |
|---|---|---|---|---|---|
| | | (mg/kg) | | | |
| VOCs | 1,1,2-Trichloroethane | 0.0011 | 2 (3%) | 0.00315 | 0.12 |
| | 1,2,3-Trichlorobenzene | 0.011 | 2 (3%) | 0.0365 | 0.26 |
| | 1,2,3-Trichloropropane | 1.5E-07 | 1 (1%) | 0.00607 | 0.00607 |
| | 1,2,4-Trichlorobenzene | 0.029 | 2 (3%) | 0.209 | 0.236 |
| | 1,2-Dichloropropane | 0.0017 | 2 (3%) | 0.0028 | 0.003 |
| | Tetrachloroethylene (PCE) | 0.0028 | 6 (9%) | 0.00343 | 0.0262 |
| | Acetone | 2.1 | 2 (3%) | 18.7 | 26.9 |
| | n-Butylbenzene | 0.71 | 15 (22%) | 1.07 | 19.3 |
| | tert-Butylbenzene | 1 | 1 (1%) | 1.52 | 1.52 |
| | n-Propylbenzene | 0.88 | 14 (21%) | 0.898 | 48.7 |
| | sec-Butylbenzene | 1.3 | 2 (3%) | 1.9 | 12.9 |
| | Methyl ethyl ketone | 1.4 | 1 (2%) | 5.22 | 5.22 |
| | Methyl isobutyl ketone | 0.19 | 3 (5%) | 0.496 | 0.932 |
| Metals | Cadmium (potable groundwater and surface water) | 0.035 | 54 (92%) | 0.0758 | 3.6 |
| | Arsenic | 0.15 | 53 (90%) | 2.86 | 15 |
| | Barium | 83 | 4 (44%) | 170 | 250 |
| | Selenium | 0.26 | 4 (44%) | 3.3 | 5.7 |
| | Iron | 7.6 | 3 (100%) | 9,750 | 37,600 |
| | Manganese (diet—e.g., fish consumption) | 3.3 | 3 (100%) | 291 | 871 |
| Herbicides | Dinoseb | 0.032 | 2 (3%) | 0.083 | 0.171 |
| | 2,4-Dichlorophenoxyacetic acid | 0.022 | 6 (9%) | 0.0254 | 0.221 |

**Notes:**

[1] Number in parentheses represents the percent of exceedances for the dataset, which is presented in Table 8 in Appendix B (HDR 2023).

## Table 3: Groundwater Constituents (HDR 2023)

| Indicator Hazardous Substances | Analyte | CLARC Screening Level | Number of Exceedances[1] | Minimum Exceedance | Maximum Exceedance |
|---|---|---|---|---|---|
| | | (µg/L) | | | |
| Comingled Constituents[2] | | | | | |
| VOCs | 1,1,2-Trichloroethane | 0.77 | 2 (1%) | 7.5 | 8.7 |
| | 1,2-Dichloroethane | 0.48 | 51 (24%) | 0.68 | 490 |
| | 1,2,3-Trichloropropane | 0.00038 | 8 (4%) | 0.069 | 12 |
| | 1,2-Dichloropropane | 1.2 | 49 (23%) | 1.4 | 340 |
| | Benzene | 0.8 | 28 (13%) | 1.1 | 11,000 |
| | Bromodichloromethane | 0.71 | 2 (1%) | 1.5 | 5 |
| | Ethylbenzene | 700 | 1 (0.5%) | 1,800 | 1,800 |
| | Total xylenes | 1,000 | 4 (3%) | 2,000 | 3,700 |
| Metals | Arsenic | 7 | 183 (88%) | 7 | 450 |
| | Cadmium (potable groundwater and surface water) | 5 | 11 (5%) | 5.3 | 20 |
| PAHs | 1-Methyl naphthalene | 1.5 | 6 (9%) | 2.5 | 4.3 |
| | Naphthalene | 160 | 9 (4%) | 170 | 790 |
| | GRO | 1,000 | 14 (11%) | 1,300 | 30,000 |
| Unique Constituents[3] | | | | | |
| VOCs | EDB | 0.01 | 5 (2%) | 0.022 | 250 |
| | 1,1,2,2-Tetrachloroethane | 0.22 | 1 (0.5%) | 0.77 | 0.77 |
| Herbicides | 2-methyl-4-chlorophenoxy-2- propionic acid (MCPP) | 16 | 6 (4%) | 33 | 44,000 |
| PAHs | Residual Range Organics (RRO) | 500 | 4 (3%) | 820 | 3,500 |
| | DRO | 500 | 22 (17%) | 590 | 22,000 |
| Metals | Chromium | 50 | 6 (3%) | 52 | 260 |
| | Lead | 15 | 24 (12%) | 15.6 | 210 |

**Notes:**

[1] Number in parentheses represents the percent of exceedances for the dataset, which is presented in Table 8 in Appendix B (HDR 2023).

[2] Comingled constituents are those that also resulted in exceedances in soil.

[3] Unique constituents did not result in exceedances in soil, only groundwater.

µg/L = micrograms per liter

## 4.2 Source Areas and Constituent Release Mechanisms

HDR identified two source areas at the Site: an area with petroleum impacts in the north-northeastern portion of the Site, and an agricultural chemical release area primarily focused within the northeastern portion of the Site.

Details on the two source areas and mechanisms of constituent release identified by HDR are discussed in the sections below.

### 4.2.1 Source Area 1: Petroleum Impacts North-Northeast of Warehouse Building

Isoconcentration maps of petroleum constituents were developed by HDR and indicated that a petroleum release or releases to the subsurface may have previously occurred in the area to the north-northeast of the warehouse building. HDR identified Site activities associated with this area as former petroleum storage and/or dispensing, however no details on historical infrastructure (e.g., tanks) or operational years were available.

Associated IHSs were listed as VOCs, semivolatile organic compounds (SVOCs), GRO, DRO, and metals. Previous investigations conducted by HDR identified constituents between 0 and 15 feet bgs within the subsurface. Environmental media determined to be impacted included soil and groundwater. First groundwater was reportedly encountered between 8.5 and 10 feet bgs. The highest soil vapor PID readings were observed below the water table but above 15 feet bgs (bottom of boring depths). HDR inferred that a smear zone is additionally present within subsurface soils, caused by seasonal groundwater fluctuations. As noted in Section 3.8, only one constituent exceeded its soil vapor screening levels and the constituent's presence in vapor could have been the result of the drilling activities.

### 4.2.2 Source Area 2: Container Rinsing in Northeastern Corner of Property and Similar Areas on the Site

The Site was historically used as an agricultural product distribution facility. Agricultural chemical containers were reportedly stored and rinsed over unpaved surfaces at the Site. HDR identified a designated container rinsing area in the northeastern portion of the Site and stated that similar container rinsing activities likely occurred within other undesignated areas on the Site. Discharge of rinse water from chemical containers to the ground surface resulted in impacts to soil and groundwater. Associated IHSs were listed as herbicides, nitrate, ammonia, metals, VOCs, and SVOCs.

As an interim remedial measure, soil in the known former rinse area was excavated in 2012 (Section 3.2).

## 4.3 Mass Transport Mechanisms

Although not explicitly discussed in the 2023 RI report, physical processes of constituent mass transport within the saturated zone are likely diffusion (constituent mass moving from an area of greater concentration to an area of lower concentration), advection (movement of dissolved constituents with flowing groundwater), and dispersion (constituent spreading longitudinally and transversely) toward deeper and downgradient groundwater due to groundwater flow toward the east and southeast.

Within the smear zone, constituents are likely to adsorb to soil material (decrease of constituent concentration in the aqueous phase) and/or re-dissolve into groundwater (increase of constituent concentration in the aqueous phase) during seasonal water table fluctuations.

Within the unsaturated (vadose) zone, volatilization of organic constituents from soil/groundwater into soil vapor is likely occurring (constituent mass transfer to air).

Additional potential mass transport mechanisms may include constituent degradation or metals complexation (e.g., due to unstudied microbial and/or oxidation-reduction processes).

## 4.4 Exposure Receptors and Exposure Pathways

Exposure pathways are mechanisms by which humans and aquatic or terrestrial ecological receptors can become exposed to Site constituents. The exposure pathway CSM table developed by HDR in the 2023 RI report is included at the end of the section for reference.

### 4.4.1 Potential Receptors

Access to the Site is via locked gates with no public access. Previously, on-site personnel included primarily Simplot employees. Current and potential future human receptors could include the following:

- Simplot employees (current [not on Site full-time] and future)
- Other authorized (i.e., construction workers, contractors) and unauthorized (i.e., trespassers) Site visitors (current and future)
- Off-site receptors (future only)

### 4.4.2 Potential Exposure Pathways

Potential exposure routes through which potential receptors may be exposed to constituents through include:

- Direct (dermal) contact with constituent mass
- Ingestion of constituent mass
- Inhalation of constituent mass

Current Site employees/visitors may become exposed to constituent mass through direct contact with surface soils. There are currently no potable wells present on-site; therefore, direct contact with groundwater is not a current exposure pathway. The Tier 2 on-site vapor intrusion investigation completed in 2022 indicated that inhalation of constituent mass is not a current exposure pathway. Although benzene concentrations in indoor air samples collected from the warehouse building exceeded CLARC screening levels, the warehouse is not occupied for long periods of time and is often ventilated to ambient air during building occupancy (Section 3.9).

Future Site employee/visitors may become exposed to constituents through direct contact with soil and groundwater during future excavation or Site construction activities. No potable wells are planned to be installed at the Site in the future; therefore, ingestion of constituent mass is not a future exposure pathway.

Current off-site residential exposure through direct contact with constituent mass is not a current pathway. Ingestion of constituent mass is additionally not a current pathway, as there are no known potable off-site wells within the groundwater plume. The Tier 1 off-site vapor intrusion investigation completed in 2021 determined that off-site inhalation of constituent mass is additionally not a current complete pathway (Section 3.8).

Future off-site residential exposure may occur if impacted Site soils become airborne and migrate off-site, such as during future construction activities (potential for direct contact, ingestion and/or inhalation of constituent mass). Additionally, future off-site residential exposure through ingestion may be a future pathway if undocumented off-site potable water wells exist, or if new wells are installed within the shallow aquifer plume for extraction of drinking water. However, installation of new wells within the city limits is highly unlikely, as city code requires new buildings to connect to the municipal water supply.

Surface water dermal contact, ingestion, and inhalation were determined by HDR not to be potential exposure pathways based on current and anticipated future use conditions. The 2023 RI report also showed that ecological risk characterization and assessment were not necessary because of a lack of habitat at the site.

## 4.5 Volume of Impacted Media Considered for Remedial Action

Site media including unsaturated (vadose zone) soil, saturated soil, and groundwater have been confirmed to be impacted. The following assumptions of volumes and quantities are used to develop the cleanup action alternatives in the following sections.

### 4.5.1 Soil

The impacted soils observed during the investigations appear to be contained on-site, as shown in the Site figures included in Appendix A. The soil impacts include shallow unsaturated soils considered to be in the vadose zone which extends from ground surface to approximately 8 feet bgs. These soils extend across the Site with an estimated surface area of 35,000 square feet and a total volume of 10,370 cubic yards. An assumed weight ratio of 1.5 tons per cubic yard yields a total of 15,556 tons of material.

Impacted saturated soils are more difficult to quantify, as fluctuations in seasonal groundwater levels increase the potential for smear-zone material. Treatment of the saturated soils may be accounted for as part of the groundwater remedies. Additionally, remedy alternatives should include provisions to account for completing cleanup actions during lower or higher seasonal groundwater levels. The preference for excavation alternatives would be to complete during lower groundwater levels, while the preference for completing in situ injections during higher groundwater levels would provide natural saturation/hydration of the saturated soils.

### 4.5.2 Groundwater

Groundwater with observed constituent levels exceeding CLARC cleanup values extends from the on-site northwestern release areas to the southeast and partially off-site, as confirmed by boring samples collected across the observed groundwater flow path. Contour figures provided in Appendix A provide a total estimated surface area for impacted groundwater of approximately 75,000 square feet. The vertical extent of impacts is considered to be 15 feet bgs. For the purposes

of developing the remedial alternatives, it is assumed that groundwater constituents exceeding CLARC cleanup and Site-specific background levels will require treatment.

**Table 4: Conceptual Site Model (HDR 2023)**

| Primary Source | Indicator Hazardous Substances | Primary Source Release Mechanism | Secondary Source | Secondary Source Release Mechanism | Pathway | Potential Exposure Routes | On-site Exposure Pathway Complete? | | Off-site Exposure Pathway Complete? | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Current | Future | Current | Future |
| Former petroleum storage and/or dispensing | VOCs, SVOCs, petroleum constituents (GRO, DRO), metals | Unknown (potential spill(s) and/or unknown AST or UST) | Subsurface soil | Infiltration/ leaching | Groundwater | Ingestion | No | Yes | Yes[1] | Yes |
| | | | | | | Inhalation | No | Yes | Yes | Yes |
| | | | | | | Dermal contact | No | Yes | Yes | Yes |
| | | | | Soil disturbance (unpaved areas/construction) | Subsurface soil | Ingestion | No | Yes | No | Yes |
| | | | | | | Inhalation | No | Yes | No | Yes |
| | | | | | | Dermal contact | No | Yes | No | Yes |
| | | | | Volatile emission | Volatilization/ vapor intrusion | Inhalation | No[3] | No[3] | No | Yes |
| Former rinse area (northeast corner of property), other similar areas | Herbicides, nitrate-N, ammonia, metals, VOCs, SVOCs | Discharge of rinse water from chemical containers to ground surface | Surface soil | Infiltration/ leaching | Groundwater | Ingestion | No | Yes | Yes[1] | Yes |
| | | | | | | Inhalation | No | Yes | Yes | Yes |
| | | | | | | Dermal contact | No | Yes | Yes | Yes |
| | | | | Soil disturbance (unpaved areas/construction) | Surface soil | Ingestion | Yes | Yes | No | Yes |
| | | | | | | Inhalation | Yes | Yes | No | Yes |
| | | | | | | Dermal contact | Yes | Yes | No | Yes |
| | | | | Volatile emission | Volatilization/ vapor intrusion | Inhalation | No | Yes | No | Yes |
| Contaminated groundwater | VOCs, SVOCs, metals, petroleum constituents (GRO, DRO) | Dissolved constituents migrating deeper and downgradient | Adsorbed constituents to soil in saturated zone | Further dissolution/ desorption | Groundwater | Ingestion | No | Yes | Yes[1] | Yes |
| | | | | | | Inhalation | No | Yes | Yes | Yes |
| | | | | | | Dermal contact | No | Yes | Yes | Yes |
| | | | | Discharge to surface water | Irrigation and drainage system[2] | Ingestion | No | No | No | No |
| | | | | | | Inhalation | No | No | No | No |
| | | | | | | Dermal contact | No | No | No | No |
| | | | | Volatile emission | Volatilization/ vapor intrusion | Inhalation | Yes | Yes | No | Yes |

**Notes:**

[1] The current pathway is complete only if undocumented, private potable wells exist. The City of Sunnyside's only source of drinking water is groundwater, but it is extracted from deep wells 0.5 miles from the site and from a deeper aquifer.

[2] See HDR April 2013 drainage study (HDR 2013).

[3] Revised based on review of sub-slab sample results that indicated sub-slab vapors were below screening levels. Indoor air samples indicated elevated levels of benzene that are assumed to be from benzene-containing products used within the warehouse, and not from an external release resulting in vapor intrusion.

AST = aboveground storage tank

# 5. PROPOSED SITE-SPECIFIC TARGET REMEDIATION LEVELS

The Site is located in an industrial area with residential homes to the east and south. During the remedial investigations, it was determined that no aquatic or terrestrial ecological receptors were present at the Site. The target receptors for developing the Site-specific remediation levels include human receptors as current and future on-site workers that may encounter direct contact with soils and groundwater and human receptors of future off-site migration into soils and groundwater.

Under WAC 173-340-710, MTCA requires that cleanup actions comply with all legally applicable local, state, and federal laws, and requirements that are legally applicable and identified by Ecology to be relevant and appropriate (ARARs). Based on the location and proposed remedial approach (Section 10), the cleanup action must comply with the requirements of the following laws in accordance with WAC 173-340-710(9):

- Washington Solid Waste Management Act, Chapter 70.95 RCW
- Washington Hazardous Waste Management Act, Chapter 70.105 RCW
- Washington Water Pollution Control Act, Chapter 90.48 RCW
- Any laws requiring or authorizing local government permits or approvals for the remedial action

"Relevant and appropriate" requirements include those cleanup standards, standards of control, and other human health and environmental requirements, criteria, or limitations established under state or federal law that, while not legally applicable to the hazardous substance, cleanup action, location, or other circumstance at a site, address problems or situations sufficiently similar to those encountered that their use is well suited to the particular site.

In addition to the above cleanup requirements, USEPA maximum contamination levels (MCLs) were also used during the groundwater evaluation process. Applicable cleanup and actions levels are categorized as follows:

1. Chemical-specific: Pertain to handling or control of specific chemicals based on health concerns or risks.
2. Location-specific: Cleanup levels/actions based on the location of the Site, including wetlands, historic sites, or sensitive ecosystems.
3. Action-specific: Dictated by specific actions that may occur at the Site, or adjacent impacted properties, and generally include method and type of select remedial technologies and remedial actions or use of certain types of equipment during remedial actions.

For the evaluation of the cleanup levels and cleanup action alternatives proposed in this FS, chemical-specific, location-specific, and action-specific actions and target cleanup levels were considered.

## 5.1 Draft Cleanup Levels

Based the exposures evaluated in the CSM, CLARC screening and cleanup levels were assessed and referenced for the respective current and future completed exposure pathways. A comprehensive list of draft cleanup levels is provided in Table 5 (attached).

### 5.1.1 Soil Exposure

#### *5.1.1.1 Direct Contact Pathway*

Due to the Site industrial land use designation, future exposure to impacted soils is possible, as construction or improvements may occur. CLARC cleanup levels for Method A Industrial Properties and Method B Direct Contact–Cancer were used, when applicable, to screen for cleanup scenarios. Based on MTCA cleanup level methodology, the more conservative cleanup value for the "Direct Contact" and "Industrial Properties" constituents will be used as the proposed target cleanup levels.

#### *5.1.1.2 Soil to Groundwater Pathway*

Groundwater elevations were observed to fluctuate seasonally and were recorded at 4 to 10 feet bgs. Based on groundwater concentrations of constituents of potential concern (COPCs), leaching into the groundwater has occurred, may continue during seasonal groundwater elevation changes, and appears to have resulted in a submerged smear-zone of product below the water surface. To provide protection from COPCs in soil migrating into groundwater, the CLARC values for "Protectiveness of Groundwater–Saturated" were utilized as the proposed target cleanup levels.

#### *5.1.1.3 Soil to Vapor Pathway*

A soil vapor intrusion investigation was completed and determined that benzene was present in the on-site warehouse, however it is assumed that the source of benzene in the warehouse indoor air samples is a result of using benzene-containing products in the warehouse, and not from an external release resulting in vapor-intrusion This is further confirmed with the results of the sub-slab samples indicating that the respective constituents were below screening levels. No other constituents or locations on-site or off-site were confirmed for vapor intrusion; however, the CSM indicated that future on-site and off-site exposure could be possible, and as such, cleanup levels are based on the requirements of WAC 173-340-708.

## 5.2 Groundwater Exposure

### 5.2.1 Direct Contact Pathway

The direct contact pathway for groundwater was determined to be complete for on-site activities if construction activities exposed workers to groundwater during excavation work. Although unlikely, the off-site direct contact pathway for groundwater was determined to be complete for exposure as groundwater may be extracted via undocumented shallow private wells. Based on these potentially complete pathways, Method A, Method B–Cancer, and Washington State and Federal groundwater cleanup levels were used.

### 5.2.2 Groundwater to Vapor Pathway

The Tier 1 vapor intrusion investigation determined that contaminated soil vapor in air are not present off-site. It is assumed that fine-grained Site soils have inhibited contaminated groundwater

migration off-site, and reduced the potential for a completed pathway. However, future migration of impacted groundwater may be possible, so considerations for mitigation were developed.

## 5.3 Site Exceedances for Metals

Select groundwater and soil samples collected during all the multiple phases of the remedial investigations indicate arsenic, barium, cadmium, and selenium levels are above target cleanup goals. Based on the distribution of the metal samples throughout the Site and in the downgradient monitoring wells, it is probable that these metal constituents are present throughout the region, and not a result of the releases that have occurred at the Site.

### 5.3.1 Metals Background Study

A background metals investigation will be completed to assess the occurrence and distribution of naturally occurring metals, with results to be summarized in a background memorandum. The data generated from this effort will support the development of Site-specific cleanup levels for metals exceeding CLARC screening thresholds for inclusion in a draft Corrective Action Plan (CAP), to be provided to Ecology for comment and approval.

# 6. REMEDIAL ACTION OBJECTIVES AND DOCUMENTATION OF CLEANUP GOALS

Draft site-specific RAOs have been identified based on MTCA and WAC regulations. The RAOs have been developed based on the review and analysis of the sources of contamination and the nature and extent of contamination at the Site. RAOs work to control the contamination sources and to reduce the potential for exposure of receptors to Site contamination. RAOs link the Site characterization, CSM, and risk evaluation to the cleanup action alternatives. Further, RAOs serve as a basis for selecting technologies and developing cleanup action alternatives and are developed for each medium causing exposure. The RAOs are intended to be protective of human health and the environment and include the following:

- Protect or reduce risks from direct contact with impacted Site soils
- Protect off-site groundwater for beneficial use, including use as a drinking water source for both public and private users

## 6.1 Constituents of Potential Concern

COPCs have been identified in both soil and groundwater. The COPCs are generally categorized as VOCs, SVOCs, PAHs, TPH, metals, and herbicides.

Cleanup levels for direct contact with soil, protection of groundwater via soil interface, and groundwater were developed from the CLARC levels detailed in the 2023 RI report.

To demonstrate the ability to meet the RAOs and achieve compliance with the cleanup levels, compliance points for the respective media and exposure pathways will be developed to include the following:

- Soil:
  - Protection from direct contact up to 15 feet bgs
  - Protection of groundwater from impacted soil
- Groundwater:
  - Protection as a drinking water source from the uppermost level of the saturated zone to the lowest depth potentially affected

The estimated timeframe to meet RAOs and compliance with cleanup levels will be detailed for each alternative as part of the evaluation, and a consideration of the reasonableness of the respective timeframes will be detailed for each of the alternatives and used in the evaluation.

# 7. IDENTIFATION AND SCREENING OF REMEDY ALTERNATIVES

This section identifies and evaluates individual technologies to achieve RAOs. In general, a single technology may not achieve all RAOs; therefore, a combination of technologies may be compiled to provide alternatives for a more comprehensive evaluation based on effectiveness, implementability, and cost.

## 7.1 Identification of Cleanup Technologies

- No Action: This action leaves contaminated materials in place and in their current condition and assumes no further activity. The "No Action" alternative is included only as a baseline to provide a comparison for all other technologies.
- Institutional Controls: Institutional controls (ICs) restrict access to, or control the use of, a site. They include construction of physical barriers including fences and gates, berms, warning signs, hostile vegetation, and designation of the lands in public records with use restrictions. Deed restriction may also be used to limit access.
- Monitored Natural Attenuation: Monitored Natural Attenuation (MNA) is used as a method to determine the natural degradation and reduction of COPCs in the contaminated media by developing a sampling protocol and conducting scheduled sampling events to track increases or decrease in COPCs, migration pathways, and general physiological behavior of the COPCs in soil and groundwater.
- Engineering Controls: Engineering controls (ECs) include any number of technologies used to reduce exposure and/or limit mobility of constituents. Examples of ECs include capping soil binders, and permeable reactive barriers.
- In Situ Treatment: In situ treatment leaves the impacted media in-place and includes soil mixing or injection of oxidizing and/or stabilizing amendments, and phytoremediation using vegetative material to degrade or contain COPCs in soil and groundwater.
- Ex Situ Treatment: Ex situ treatment includes extraction of soil vapor and groundwater via pump and treat systems or treatment of extracted groundwater at off-site receiving facilities. Additionally, ex situ treatment may also include excavation of impacted soils with on-site treatment and/or disposal at an off-site receiving facility.

## 7.2 Screening of Remedial Cleanup Technologies

A review and evaluation of each of the cleanup technologies was performed to determine if RAOs and cleanup levels could be met. The following table provides a summary of selected cleanup technologies and shows selection factors identified during the screening process.

## Table 6: Remedial Action Technologies

| Treatment Technology | Site Specific Screening Evaluation |
|---|---|
| No Action | The No Action alternative will not meet RAOs or ARARs, but is used for consideration as a baseline against other technologies being evaluated. |
| ICs | ICs use physical barriers or statutory designations to restrict access or control the use of a site. ICs do not reduce the volume or toxicity of the impacted material and typically do not protect all receptors. ICs can augment other technologies to ensure that future construction projects do not disrupt or disturb them. Therefore, ICs would likely need to accompany another technology to adequately meet RAOs and ARARs. |
| ECs | An asphalt cover/barrier that would inhibit migration/infiltration of precipitation and potential mobilization of constituents through the Site soils could be implemented. This technology would meet RAOs and ARARs when paired with other technologies to address existing documented groundwater impacts. Considerations for capture and diversion of precipitation would need to be included in the design. |
| | PRBs are ECs that are implemented with the placement of an adsorptive and/or reactive media at the groundwater-soil interface via injection or trenching in a line perpendicular to groundwater flow to create a boundary to capture COPCs in groundwater. A PRB would be used in conjunction with other treatment technologies to limit off-site migration of remaining COPCs after other remedies have been completed. A PRB alone would not achieve all RAOs, as it is limited to reducing COPCs in groundwater only, but is capable of meeting groundwater cleanup levels as it captures and immobilizes COPCs in the groundwater. Challenges to PRBs include selecting appropriate media to capture targeted COPCs. Additionally, barrier sizing and longevity is directly related to the volume and concentration of COPCs in the groundwater and once the media has reached capacity for adsorption, any remaining COPCs may continue to migrate through the exhausted media barrier. |
| MNA | MNA would be used as a means to track the COPC concentrations in soil and groundwater before and after additional cleanup technologies were deployed. MNA alone would not meet RAOs or ARARs, but could be used to determine efficacy of other treatment technologies and provide a threshold for additional treatment activities such as follow up ISCO injections or if further treatment system operations are warranted. |
| In Situ Treatment | ISCO would include bench-scale or pilot-study testing to determine the most appropriate oxidant(s) to be used to destroy the COPCs in soil and groundwater. The selected oxidant would be delivered into the soil and groundwater via direct-push or through permanent injection wells. This technology would meet RAOs and ARARs by destroying COPCs and/or reducing COPC concentrations below or to target cleanup levels, but may require multiple injection events. |
| | Soil mixing would include bench-scale or pilot-study testing to determine the most appropriate oxidant(s) to be used to destroy the COPCs in soil. The selected oxidant would be mixed into the soil with an excavator or large auger after fully hydrating the soil. This technology would meet RAOs and ARARs by destroying COPCs and/or reducing COPC concentrations below or to target cleanup levels, but may require multiple mixing events. |
| | Phytoremediation works by harnessing the treatment capacity of plants and their associated microbial communities. This in situ technology can effectively degrade or contain a wide array of COPCs in soil and groundwater. RAOs and compliance with ARARs may be achieved; however, the time required to meet targets may be excessive and not all COPCs will be remediated. The main challenges to the effective use of phytoremediation on-site are depth to groundwater, limited real estate for planting, and the presence of herbicides designed to target plant life. Based on the Site-specific COPCs, this technology is not considered for use. |

| Treatment Technology | Site Specific Screening Evaluation |
|---|---|
| Ex Situ Treatment | Ex situ treatment via multi-phase extraction system would require the installation of extraction wells throughout the impacted area. Soil vapor and groundwater would be extracted and processed through an on-site treatment system. Treated soil vapor would be discharged to the atmosphere and treatment groundwater would be re-injected into the subsurface or into a sanitary sewer connection. This technology would meet RAOs and ARARs, but would require extensive operations and maintenance and administrative oversight to ensure continued regulatory compliance of discharged media. Additional challenge to this technology is the unknown operational time required to extract the COPCs, as longer-chain constituents such as diesel range organics are less mobile and require extensive extraction energy and time to fully capture. |
| | Excavation and disposal of the contaminated Site soil would meet RAOs and ARARs for soil only by physically removing COPCs impacted material. This technology would require an additional technology to treat the impacted groundwater. |

Based on the screening factors, five cleanup action alternatives, in addition to the No Action alternative, will be evaluated to address the COPCs. The five proposed treatment alternatives include the following:

- Alternative 1: Soil Mixing, In Situ Chemical Oxidation, and Permeable Reactive Barrier.
- Alternative 2: Excavation and Disposal, In Situ Chemical Oxidation, and Permeable Reactive Barrier.
- Alternative 3: Excavation and Disposal, In Situ Chemical Oxidation of Impacted Off-site Groundwater, Permeable Reactive Barrier, and Monitored Natural Attenuation.
- Alternative 4: Multi-Phase Extraction and Treatment.
- Alternative 5: Pavement Cap, In Situ Chemical Oxidation of Impacted Off-site Groundwater, Permeable Reactive Barrier, and Monitored Natural Attenuation.
- Alternative 6: No Action.

# 8. EXPLANATION OF CLEANUP ACTION ALTERNATIVES

The following sections provide further detail of each of the respective remedial alternatives. Alternative details are included in each section. General assumptions used for the development and evaluation of each cleanup action alternative include the following:

**Table 7: Cleanup Alternative Evaluation Assumptions**

| | | |
|---|---|---|
| Impacted (on- and off-site) groundwater area at ground surface | 75,000 | square feet |
| Impacted (on- and off-site) soil area at ground surface | 35,000 | square feet |
| Impacted (off-site only) groundwater area at ground surface | 16,000 | square feet |
| Depth of excavations | 4 | feet |
| Volume of impacted/excavated soils | 5,185 | cubic yards |
| Weight of excavated soils (1.5 tons per cubic yard) | 7,778 | tons |
| Radius of influence for ISCO injection | 12 | feet |
| Number of injection points | 130 | points |
| Number of ISCO injection events | 1 | event |
| Radius of influence for placement of extraction wells | 15 | feet |
| Number of extraction wells | 25 | wells |
| Pavement area | 73,000 | square feet |
| Soil profile/waste characterization | Nonhazardous | |

As previously stated, Site samples indicate that naturally occurring background metals may be present throughout the Site. Additional investigation into the distribution, frequency, and concentrations of metals is required to fully characterize the Site and establish Site-specific background values and cleanup goals. The results of the investigation may require revision(s) to the implementation of the selected alternative.

Compliance monitoring for each alternative would be achieved with the installation and monitoring of new monitoring wells located within the contaminated sources areas, downgradient of source areas, and downgradient of the property, ideally located to the east of the property in 2nd Street. Field parameters such as oxidation-reduction potential, dissolved oxygen, and conductivity would be measured, and analytical samples would be collected to monitor COPC concentrations before and after implementation of any alternative to determine the short and long-term effectiveness in achieving cleanup levels.

Implementation of each alternative may be segmented into reduced, targeted phases to account for annual budgeting and level of disruption to the Site and surrounding areas.

## 8.1 Alternative 1: Soil Mixing, ISCO, and PRB

The first phase of Alternative 1 includes soil mixing from ground surface to approximately 4 feet bgs. A preselected oxidant such as potassium permanganate or sodium persulfate dosed at a

calculated concentration would be applied to the soil via mechanical mixing and allowed to react with COPCs. Pre- and post-soil samples would be collected to determine efficacy and reaction rate.

The second phase includes injection of a dissolved oxidant into the subsurface soil (4–8 feet bgs) and groundwater to a total depth of approximately 16 feet bgs where the oxidant(s) reacts and destroys the COPCs in-place. The injections would be completed via direct-push injection or through permanent injection wells installed throughout the impacted area. A bench-scale or pilot-test may be completed using soils from the impacted soil and groundwater zones to determine which oxidants and injection concentrations would be most effective for treating COPCs in both soil and groundwater. Soil samples would be collected during installation of proposed Site monitoring wells and sent to a testing laboratory to conduct the tests.

Based on existing analytical soil sample results, soil characteristics, and observed extent of impacted soil and groundwater, 130–200 injection points would be required to deliver the oxidant(s). The oxidant would be injected at predetermined depths at specific intervals to target soil and groundwater media. Overall oxidant loading is dependent upon which product is ultimately used, but estimated volume of hydrated and mixed product is approximately 700,000–940,000 gallons. Actual product volumes to be injected into the subsurface will vary greatly depending on soil porosity and existing saturation.

The final phase of the alternative would be the installation of a PRB. The barrier would be placed along the eastern property line perpendicular to the groundwater flow direction to capture any remaining COPCs in groundwater migrating from the Site. The PRB media would be injected using direct push probes into the subsurface from approximately 4 to 16 feet bgs.

Challenges for this alternative include achieving homogenous distribution and complete COPC destruction in the shallow soils due to shallow injection depths and concerns for “daylighting” or surfacing of the oxidant. The alternative may also require multiple injection events to fully oxidize COPCs due to unknown volumes of COPCs and naturally occurring organic material that will oxidize along with the COPCs during the initial injection. Additionally, handling of the oxidants must be completed by certified personnel due to the highly reactive nature of the products.

## 8.2 Alternative 2: Excavation and Disposal, ISCO, and PRB

Alternative 2 includes delineation of the horizontal and vertical extent of the assumed COPC plume(s) using soil boring data and inferred boundary areas. Excavation would be completed to 4 feet bgs for evaluation purposes. If deeper excavation is considered, seasonally adjusting the excavation event to coincide with lower groundwater levels would help to capture additional soil and reach seasonally submerged smear-zone soils.

The impacted soils would be mechanically removed from the Site using construction equipment and then transported to a certified receiving facility/landfill for disposal. For the purposes of the evaluation, it is assumed that on-site treatment of excavated soils is not required, soil will be considered nonhazardous, and soil will be transported once excavated. Clean fill material would be placed into the excavated area and regraded to match existing terrain.

To treat the impacted groundwater and submerged smear-zone soils, ISCO injections would be completed throughout the impacted area as described above. By including ISCO as part of the alternative, saturated/submerged soils and groundwater would be treated. Finally, a PRB would be installed as detailed in Alternative 1.

Challenges to this alternative include constructability of the excavation and the potential need for sheet-piles and/or construction shoring to reach the full excavation depths, as well as the potential need for stormwater management and/or dewatering and treatment while completing the excavations. Multiple mobilizations would be required to complete the excavation, ISCO injections, and PRB installation.

## 8.3 Alternative 3: Excavation and Disposal, ISCO of Impacted Off-site Groundwater, PRB, and MNA

Alternative 3 includes the same excavation and disposal activities of the shallow soils as detailed in Alternative 2 and also includes ISCO injection to target impacted off-site groundwater. A PRB would then be installed as detailed in the previous alternatives. MNA would be the primary means for the degradation and reduction of remaining COPCs on-site in the groundwater and submerged soils. This alternative intends to remove the main source of contamination in soil and impacted groundwater off-site. Clean soil would be placed back into the excavation and may include a semipermeable layer of soil or low strength slurry to impede the upward migration of constituents into the clean fill. Depending on future use of the Site, administrative restrictions could be implemented to reduce the potential for direct contact with the remaining impacted deeper soils and groundwater.

Challenges for this alternative include potential complexities if groundwater is encountered during excavation, as historically high groundwater was recorded between 4 and 10 feet bgs, potential re-contamination of clean fill soils, and leaving impacted groundwater and submerged soils in-place. The timeframe for remediating the Site would also be longer than other alternatives.

## 8.4 Alternative 4: Multi-Phase Extraction and Treatment

Alternative 4 would include installation of multiphase extraction (MPE) wells at locations throughout the impacted area. Dedicated groundwater extraction pumps would be installed in select wells and the extracted groundwater would be conveyed to a centrally located treatment system. Soil vapor would also be conveyed from the extraction wells to the treatment system via a vacuum blower located at the treatment system. Treated groundwater would be either discharged to a sanitary sewer connection or reinjected back into the ground, depending on approval from the respective regulatory agencies. The main benefit to MPE is that COPCs will be removed without bias as the treatment system will extract and treat each of the constituents and the system will create an inward groundwater gradient, limiting the migration of COPCs.

Challenges to this alternative include extended operational time needed to achieve cleanup goals. Operational variables include soil porosity, seasonal groundwater elevations, and surface infiltration. Approval of the groundwater discharge method may also limit the use of MPE. Additionally, operation of the system will require a qualified field technician to conduct regular Site visits to collect operational and treatment data including analytical vapor and water samples to ensure compliance with discharge permit limits for vapor and groundwater treatment. Spent

treatment media including granular carbon will also need to be periodically disposed of and replaced with fresh media.

## 8.5 Alternative 5: Pavement Cap, ISCO of Impacted Off-site Groundwater, PRB, and MNA

Alternative 5 includes asphalt paving of unpaved surfaces within the existing Site security fencing. The asphalt pavement cap would inhibit precipitation from infiltrating into the Site soils, which could inhibit additional constituent mobilization. Inhibiting infiltration may also help to slow the subsurface groundwater flow and may help to retain the impacted groundwater within the Site boundary. ISCO of impacted off-site groundwater would also be completed, as well installation of a PRB, as detailed in the previous alternatives, to capture constituents in groundwater before leaving the Site. MNA would be a means for the degradation and reduction of remaining COPCs on-site in the groundwater and submerged soils. This alternative intends to inhibit the migration of constituents through the subsurface soils and groundwater. Depending on future use of the Site, administrative restrictions could be implemented to reduce the potential for direct contact with the soil and groundwater.

Challenges for this alternative include potential complexities for collecting and discharging of precipitation runoff from the new impervious surface into an off-site stormwater collection system and leaving impacted groundwater and soils in-place. The timeframe for remediating the Site would also be longer than other alternatives.

## 8.6 Alternative 6: No Action

Alternative 6 is presented as a baseline for comparison against the five action alternatives. This alternative would not meet any cleanup standards and would not provide protection to human health and the environment.

# 9. EVALUATION OF CLEANUP ALTERNATIVES

The above six remedial alternatives were screened against Ecology's seven evaluation and selection criteria, as presented in WAC 173-340-360, to select the most advantageous approach. Each remedial alternative was evaluated against the criteria presented below:

- Ability to protect human health and the environment
- Permanence
- Effectiveness over the long-term
- Management of short-term risks
- Implementability (technical and administrative)
- Public acceptance
- Cost

The following MTCA requirements (WAC 173-340-360) must be met by the selected treatment alternative(s):

- Threshold requirements:
  - Protect human health and the environment
  - Comply with cleanup standards
  - Comply with applicable state and federal laws
  - Provide for compliance monitoring
- Other requirements
  - Use permanent solutions to the maximum extent practicable
  - Provide for a reasonable restoration time frame
  - Consider public concerns
  - Employ recycling, reuse, and waste minimization (Agreed Order requirement)
  - Net environmental benefit (Agreed Order requirement)

To evaluate the treatment alternatives, the following (WAC 173-340-360, 3-C) criteria will be used for each alternative:

- Protectiveness of human health and the environment
- Permanence of the reduction of toxicity, mobility, or volume of COPCs
- Cost to implement including construction, oversight, administrative, and operational
- Effectiveness over the long-term, including COPCs that remain on-site at any degree in excess of the cleanup goals and for any duration of time

- Management of short-term risks to human health and the environment
- Technical and administrative implementability including technical feasibility, availability of off-site facilities, materials, labor, scheduling, monitoring, and constructability
- Consideration of public concerns of the selected alternative and how the concerns are accounted for

The following sections detail the evaluation of each respective alternative when compared to the MTCA evaluation criteria presented above. A comprehensive comparative analysis of all cleanup action alternatives is presented in Table 8 (attached).

Costs for each alternative were developed using professional judgement and based on direct consultant experience, RS Means cost estimating databases, and vendor/contractor quotes, and are estimated to be within the minus 30% and plus 50% range. A comparison of costs is provided in Table 9 and detailed cost tables for each alternative are provided in Appendix D.

## 9.1 Alternative 1: Soil Mixing, ISCO, and PRB

Alternative 1 includes in situ oxidation of impacted on-site shallow and submerged soils and on-site and off-site impacted groundwater. The PRB provides an additional level of protection to capture any remaining constituents not fully oxidized. The alternative meets all threshold compliance criteria. The alternative is capable of meeting the cleanup criteria for the Site.

Key elements of Alternative 1 are presented in Figure 4. The alternative is ranked highest based primarily on permanence of the solution, protectiveness, effectiveness, and implementability, and is the second most expensive alternative to implement at $3,970,000.

## 9.2 Alternative 2: Excavation and Disposal, ISCO, and PRB

Alternative 2 uses in situ oxidation similar to Alternative 1, however, excavation and disposal is used to remedy impacted shallow/vadose zone soils. After excavation is complete, clean fill material would be placed in the excavation area. A PRB would be installed after the completion of the excavation and ISCO injections. This alternative meets all threshold compliance criteria. The alternative is capable of meeting the cleanup criteria for the Site.

Key elements of Alternative 2 are presented in Figure 5. The alternative is ranked third (ties with Alternative 4) based primarily on permanence of the solution and long-term effectiveness, and is the most expensive alternative to implement at $4,660,000.

## 9.3 Alternative 3: Excavation and Disposal, ISCO of Impacted Off-site Groundwater, PRB, and MNA

Alternative 3 used excavation and disposal of the shallow soils and includes ISCO of the off-site groundwater impacts. A PRB would be installed to prevent constituents from migrating off-site. This alternative proposes MNA as a mechanism for degrading the Site constituents in soil and groundwater media.

This alternative meets most threshold compliance criteria, but does not reduce the source zone constituents in on-Site groundwater. Short-term management of risks is achieved by

destroying/reducing off-site constituents and removing the pathway for direct contact in the shallow Site soils. However, direct contact of deeper soils and groundwater will remain as a potentially complete pathway depending on future Site activities. Long-term effectiveness is ranked low as remaining constituents may require more than 30 years to naturally degrade below cleanup levels.

Key elements of Alternative 3 are presented in Figure 6**.** The alternative ties for fifth in permanence and is the third most expensive to implement at $3,170,000.

## 9.4 Alternative 4: Multi-Phase Extraction and Treatment

Alternative 4 includes the installation of vapor and groundwater wells that will convey impacted media to an on-site treatment system. Treated groundwater would be discharged to a sanitary sewer connection or reinjected and treated vapors would be discharged to the atmosphere. The alternative is easily implemented, however extensive permitting and ongoing compliance monitoring would be required to operate the treatment system. Additionally, the location of the Site requires extensive routine travel by qualified field technicians to maintain and operate the system. Many unknown variables including soil geotechnical characteristics such as porosity may limit the extraction rates of groundwater and vapors, resulting in extended operational time to remediate the Site. Additionally, the remaining Site constituents are assumed to be less volatile compounds that may be more difficult to mobilize and extract from the subsurface via this type of treatment. For evaluation purposes, an operational timeframe of 5 years was used to score the alternative and estimate costs.

The alternative meets the threshold compliance criteria and most of the permanence factors. However, the unknowns for extraction rates rank the short-term risks management factor lowest among the action alternatives.

Key elements of Alternative 4 are presented in Figure 7. The alternative is tied at third overall and is the fourth most expensive to implement at $2,860,000.

## 9.5 Alternative 5: Pavement Cap, ISCO of Impacted Off-site Groundwater, PRB, and MNA

Alternative 5 uses pavement capping of the Site and includes ISCO of the off-site groundwater impacts. A PRB would be installed to prevent constituents from migrating off-site. This alternative proposes MNA as a mechanism for degrading the on-site constituents in soil and groundwater media.

This alternative meets most threshold compliance criteria. Short-term management of risks is achieved by destroying/reducing off-site constituents and removing the pathway for direct contact in the on-site soils. Direct contact of soils and groundwater will remain as a potentially complete pathway depending on future Site activities, however, exposure can me limited through administrative restrictions for allowable on-site activities. Long-term effectiveness is ranked moderate as remaining constituents may require more than 30 years to naturally degrade below cleanup levels.

Key elements of Alternative 5 are presented in Figure 8. The alternative ranks second overall and is the second least expensive alternative to implement at $2,700,000.

## 9.6 Alternative 6: No Action

Alternative 6 provides no level of protection or removal of constituents and does not meet the minimum cleanup goals or RAOs. This alternative is presented only as a consideration for not completing any remedial work at the Site.

The alternative ranks lowest amongst the alternatives and is the least expensive to implement at $100,000, with only administrative costs considered for implementation.

## Table 9: Cost Comparison of Remedial Cleanup Action Alternatives

| Design Alternatives Cost Comparison Summary | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Alternative 1** | | **Alternative 2** | | **Alternative 3** | | **Alternative 4** | | **Alternative 5** | | **Alternative 6** | |
| Table D-1 | | Table D-2 | | Table D-3 | | Table D-4 | | Table D-5 | | N/A | |
| Cost | | Cost | | Cost | | Cost | | Cost | | Cost | |
| -30% | $2,780,000 | -30% | $3,260,000 | -30% | $2,220,000 | -30% | $2,000,000 | -30% | $1,890,000 | -30% | $70,000 |
| | **$3,970,000** | | **$4,660,000** | | **$3,170,000** | | **$2,860,000** | | **$2,700,000** | | **$100,000** |
| +50% | $5,950,000 | +50% | $6,990,000 | +50% | $4,750,000 | +50% | $4,290,000 | +50% | $4,050,000 | +50% | $150,000 |

Alternative 1: Soil Mixing, ISCO, and PRB
Alternative 2: Excavation and Disposal, ISCO, and PRB
Alternative 3: Excavation and Disposal, ISCO of Impacted Off-site Groundwater, PRB, and MNA
Alternative 4: Multiphase Extraction and Treatment
Alternative 5: Pavement Cap, ISCO of Impacted Off-site Groundwater, PRB, and MNA
Alternative 6: No Action

**Notes:**

Rough cost estimate and minus 30% and plus 50% range.
Estimated costs include capital costs and annual recurring costs.

# 10. PREFERED CLEANUP ACTION ALTERNATIVE

## 10.1 Preferred or Permanent Clean up Action Alternative

The recommended cleanup action alternative for implementation at the Site is *Alternative 1:Soil Mixing, In Situ Chemical Oxidation, and Permeable Reactive Barrier (Figure 4).* Alternative 1 provides the highest level of protectiveness compared to the other alternatives evaluated for on-site and off-site receptors by reducing constituents to target cleanup levels in groundwater and on-site soils. Reduction of constituents will be accomplished by sub-surface injection of an oxidant selected specifically for the Site. Soil mixing of the oxidant will also be used where constituents are found to be above the target cleanup levels in the shallowest four feet of soil. Once the ISCO injections component of the alternative has been completed, a permeable reactive barrier will be installed along the eastern property line to capture potential remaining mobile constituents in groundwater before leaving the Site.

New monitoring wells will be installed on-site within the constituent plume and along the eastern edge of the Site property. The new monitoring wells will be used to monitor the effectiveness of the ISCO injections and the PRB over time.

Based on the cost comparison for the action alternatives, Alternative 1 is the second most costly alternative at $3,970,000. The total cost includes capital implementation, as well as monitoring and reporting.

Alternative 1 achieves RAOs, complies with ARARs, uses remediation industry standard technologies, and is easily implemented. The key components of Alternative 1 include:

- Engineering design, construction management, and health and safety planning
- Metals sampling investigation of upgradient soil and groundwater to establish Site-specific background and target cleanup levels
- Monitoring well installation
- Bench-scale testing of soil and oxidants
- Pre-implementation baseline sampling of soil and groundwater
- Soil mixing
- In situ chemical oxidation
- Installation of a PRB
- Post-implementation sampling and monitoring
- Project closeout report

## 10.2 Impacts to Vulnerable Populations and Overburdened Communities

In developing the cleanup action for the Sunnyside Soil Builders Site, the project team evaluated whether the selected remedy could disproportionately affect vulnerable populations or

overburdened communities. This evaluation considered the Site's historical use, surrounding community characteristics, potential exposure pathways, and the nature of the proposed cleanup technologies.

Because the Site is zoned and operated for industrial use, and because the selected technologies (ISCO, soil mixing, and installation of a PRB) occur primarily below ground, the potential for community disturbance is low. ISCO and soil mixing will take place entirely within Site boundaries, while the PRB will be installed along the eastern property line to prevent off-site migration of remaining mobile groundwater constituents. These measures are specifically designed to reduce potential impacts to nearby receptors, including any vulnerable or overburdened populations downgradient of the Site.

The remedy does not involve transporting contaminated soil off-site, avoiding impacts commonly associated with heavy-haul operations such as increased diesel emissions, truck traffic, roadway noise, and short-term air-quality degradation. By eliminating off-site soil disposal, the cleanup approach minimizes community-level burdens related to air pollution, roadway safety, and traffic congestion.

As part of the evaluation, the project team also reviewed publicly available data on vulnerable populations and overburdened communities in Washington, including the Washington Environmental Health Disparities (EHD) Map (Washington State Department of Health 2002). These resources highlight several factors that contribute to cumulative community burdens in Sunnyside, Washington such as high poverty rates, comparatively poorer regional air quality, and proximity to Risk Management Plan (RMP) Facilities indicating residents face elevated risk of toxic releases, chemical accidents, and associated health impacts.

While these broader regional conditions indicate elevated community vulnerability, the selected cleanup approach at the Sunnyside Soil Builders Site avoids creating new disproportionate impacts. The remedy relies on subsurface treatment technologies, does not generate off-site soil disposal needs, and therefore does not add traffic, emissions, noise, or other stressors commonly associated with cleanup activities. By keeping treatment activities on-site, reducing off-site migration potential, and minimizing above-ground disturbance, the cleanup action aligns with environmental-justice principles and avoids adding to existing burdens experienced by communities in Sunnyside, Washington and the Yakima Valley.

No disproportionate impacts were identified during remedy evaluation. Nonetheless, consistent with environmental-justice best practices, the project team, including Ecology, will maintain open communication with local stakeholders throughout implementation. Intrusive activities will be scheduled to minimize nuisance impacts such as noise, dust, and temporary access limitations. These measures support equitable protection of public health and environmental quality for all community members within the City of Sunnyside.

## 10.3 Implementation Schedule

Based on the current Agreed Order, the next step in implementation is Ecology's approval of the FS. Public review of the FS will be completed after Ecology has provided comment on the draft FS. Once the FS is approved, a draft CAP will be developed and submitted to Ecology for review. Once the draft CAP is approved, the final CAP will be provided to Ecology for acceptance.

Field implementation of the selected corrective action will begin with the design of the alternative and contracting of qualified contractors to complete the work. A detailed project schedule will be included as part of the CAP with key project milestones called out. The timeframe for implementation of the complete cleanup action is estimated at 12 to 36 months after receipt of final approval of the CAP.

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# TABLES

# FIGURES

# APPENDIX A
## 2023 RI Report—Select Figures

# APPENDIX B

## 2023 RI Report—Table 5b. Summary of Soil Sample Detections and Exceedances Compared to Screening Levels

# APPENDIX C

## 2023 RI Report—Monitoring Well Results Tables

# APPENDIX D
## Alternative Cost Tables