Prepared for
Nevada Environmental Response Trust

Project Number
1690029369-006

Prepared by
Ramboll Americas Engineering Solutions, Inc.
Oakland, California

Date
November 3, 2023

BASELINE HEALTH RISK ASSESSMENT REPORT FOR OU-1 SOIL GAS AND GROUNDWATER, REVISION 1

NEVADA ENVIRONMENTAL RESPONSE TRUST SITE HENDERSON, NEVADA

RAMBOLL

Baseline Health Risk Assessment Report for OU-1 Soil Gas and Groundwater, Revision 1

Nevada Environmental Response Trust Site (Former Tronox LLC Site) Henderson, Nevada

Nevada Environmental Response Trust (NERT) Representative Certification

I certify that this document and all attachments submitted to the Division were prepared at the request of, or under the direction or supervision of NERT. Based on my own involvement and/or my inquiry of the person or persons who manage the system(s) or those directly responsible for gathering the information or preparing the document, or the immediate supervisor of such person(s), the information submitted and provided herein is, to the best of my knowledge and belief, true, accurate, and complete in all material respects.

Office of the Nevada Environmental Response Trust

Le Petomane XXVII, Inc., not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

Not Individually, but Solely as President of the Trustee

Signature: Jay A Steinberg, President

Name: Jay A. Steinberg, not individually, but solely in his representative capacity as President of the Nevada Environmental Response Trust Trustee

Title: Solely as President and not individually

Company: Le Petomane XXVII, Inc., not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

Date: 11/2/23

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Nevada Environmental Response Trust Site
(Former Tronox LLC Site)
Henderson, Nevada

Responsible Certified Environmental Manager (CEM) for this project
I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and, to the best of my knowledge, comply with all applicable federal, state and local statutes, regulations and ordinances.

Kimberly Kuwabara

November 3, 2023

Kimberly Kuwabara, MS
Senior Managing Consultant

Date

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Date **November 3, 2023**
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ACRONYMS AND ABBREVIATIONS

AP	Ammonium Perchlorate
API	American Petroleum Institute
atm	Atmosphere
atm-m3/mol	atmosphere-cubic meter per mole
BCA	bias-corrected accelerated
BCL	basic comparison level
bgs	below ground surface
BHRA	baseline health risk assessment
BMDL	benchmark dose lower bound 95% confidence interval
BMI	Black Mountain Industrial
BRC	Basic Remediation Company
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CAMU	Corrective Action Management Unit
Cal/EPA	California Environmental Protection Agency
CAS	Chemical Abstract Service
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COPC	chemical(s) of potential concern
CSM	conceptual site model
DNAPL	dense non-aqueous phase liquid
DQI	data quality indicator
DUE	data usability evaluation
DVSR	data validation summary report
EDA	exploratory data analysis
EMD	EMD Acquisition LLC
Envirogen	Envirogen Technologies, Inc.
ENSR	ENSR Corporation
ENVIRON	ENVIRON International Corporation
EPC	exposure point concentration
Exponent	Exponent, Inc.
°F	degrees Fahrenheit

FS	Feasibility Study
GWETS	groundwater extraction and treatment system
HI	hazard index
HQ	hazard quotient
HRA	health risk assessment
IRIS	Integrated Risk Information System
ITRC	Interstate Technology Regulatory Council
IQR	interquartile range
IUR	inhalation unit risk
IWF	interceptor well field
kg	kilogram
L	liter
LCS	laboratory control spike
LCSD	laboratory control spike duplicate
LOU	Level of Understanding
LOAEL	lowest-observed-adverse-effect level
m^3	cubic meter
mg/L	milligram per liter
mm Hg	millimeter of mercury
mph	mile per hour
MRL	minimal risk level
MS	matrix spike
MSD	matrix spike duplicate
NCP	National Contingency Plan
NDEP	Nevada Division of Environmental Protection
NERT	Nevada Environmental Response Trust
NFA	No Further Action
NOAEL	no-observed-adverse-effect level
Northgate	Northgate Environmental Management, Inc.
NRC	National Research Council
OEHHA	Office of Environmental Health Hazard Assessment
OSSM	Olin Chlor Alkali/Stauffer/Syngenta/Montrose
OSWER	Office of Solid Waste and Emergency Response

OU-1	Operable Unit 1
OU-2	Operable Unit 2
OU-3	Operable Unit 3
PAH	polynuclear aromatic hydrocarbon
PBPK	physiologically based pharmacokinetic
PPRTV	Provisional Peer Reviewed Toxicity Values
PQL	practical quantitation limit
Q/C	site-specific dispersion factor
Qal	Quaternary alluvial deposits
QAPP	Quality Assurance Project Plan
Ramboll	Ramboll Americas Engineering Solutions, Inc.
Ramboll Environ	Ramboll Environ US Corporation
RAO	Remedial Action Objective
RAS	Remedial Alternatives Study
RBTC	risk-based target concentration
RfC	reference concentration
RfD	reference dose
RI	Remedial Investigation
RME	reasonable maximum exposure
RPD	relative percent difference
RSL	regional screening level
SIM	selective ion monitoring
Site	Nevada Environmental Response Trust Site
SOP	standard operating procedure
SQL	sample quantitation limit
SVOC	semi-volatile organic compound
TIMET	Titanium Metals Corporation
TPH	total petroleum hydrocarbon
Tronox	Tronox, LLC
Trust	Nevada Environmental Response Trust
UCL	upper confidence limit
µg	microgram
µg/L	microgram per liter

$\mu g/m^3$	microgram per cubic meter
UMCf	Upper Muddy Creek Formation
U.S.	United States
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WBZ	water-bearing zone

EXECUTIVE SUMMARY

This Baseline Health Risk Assessment (BHRA) Report for OU-1 Soil Gas and Groundwater, Revision 1 ("BHRA Report") was prepared by Ramboll Americas Engineering Solutions, Inc. (Ramboll) on behalf of the Nevada Environmental Response Trust (NERT or the Trust) to evaluate potential health risks to current and future workers at the NERT Site ("Site") from exposures associated with the vapor intrusion pathway from soil gas and shallow groundwater within the Operations Area (defined below) of Operable Unit 1 (OU-1), referred to in this report as the "Operations Area." This BHRA Report has been prepared consistent with the methodology described in the *BHRA Work Plan for OU-1 and OU-2 Soil Gas and Groundwater, Revision 1* (Ramboll 2018a), submitted on December 19, 2018 and approved by the Nevada Division of Environmental Protection (NDEP) on January 24, 2019.

The BHRA is one step of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. The BHRA was conducted using the data collected from the Remedial Investigation (RI). The risk results and conclusions from the BHRA will be evaluated in the Feasibility Study (FS) to determine if remediation is necessary in the Operations Area to satisfy the remedial action objectives (RAOs).

The initial version of the BHRA Report for OU-1 Soil Gas and Groundwater was submitted to NDEP on September 29, 2021 (Ramboll 2021a), and NDEP comments were received on March 9, 2022. The annotated response to the NDEP comment letter on this report was submitted to NDEP on June 24, 2022; NDEP's responses on the annotated response to comment letter were received on November 3, 2022. As requested by NDEP, this revised version was prepared, consistent with the November 3, 2022 letter, to address pertinent comments on other BHRAs being revised and to address changes associated with the passage of time. Furthermore, and as directed by NDEP, the revised BHRA includes spatial plots consistent with Neptune's draft technical memorandum "NERT Spatial Plot Recommendations" dated February 18, 2022 (Neptune 2022).

Subsequent to the initial version of the BHRA Report submitted in 2021, NDEP released updated Basic Comparison Level (BCL) tables (NDEP 2020a and 2023a) and User's Guide and Background Technical Documents (NDEP 2020b and 2023b), with the latest updates issued in June 2023. In the updates, extensive modifications were made to the soil BCLs, and some toxicity values and methodology used to derive the BCLs were also updated. In addition, the United States Environmental Protection Agency (USEPA) updated toxicity values in recent regional screening level (RSL) tables released in May 2023 (USEPA 2023a). The relevant updates from NDEP and USEPA as described above have been incorporated into this revised BHRA Report.

OU-1, designated for the RI/FS currently in progress, comprises approximately 346 acres within the Black Mountain Industrial (BMI) Complex in unincorporated Clark County, Nevada; it is surrounded by the City of Henderson (Figures ES-1 and ES-2). OU-1 consists of property owned by NERT (the "NERT Site" or "Site", approximately 257 contiguous acres and approximately 8 acres of the non-contiguous Sale Parcel E) as well as five former sale parcels (former Sale Parcels C, D, F, G, and H, comprising 81 acres) which are no longer

owned by NERT (Figure ES-3).[1] Within the Site, the Operations Area is a 257-acre area used by the Trust for Site remediation operations and used by its tenant EMD Acquisition, LLC (EMD), for the operation of their chemical manufacturing business. The Operations Area excludes one sale parcel (Parcel E, comprising 8 acres) at the Site that is not currently used by the Trust or its tenant. Separate, post-remediation health risk assessments (HRAs) for Parcels C, D, F, G and H were completed in late 2017 and early 2018, all of which have been granted No Further Action (NFA) determinations by NDEP. Because Parcel E is not contiguous with the Operations Area, a separate HRA is being performed. Therefore, only the Operations Area is the subject of this soil gas and groundwater BHRA.

In addition to this soil gas and groundwater BHRA, a separate BHRA for soil in the Operations Area of OU-1 (the "OU-1 Soil BHRA") was first submitted to NDEP in January 2020 (Ramboll 2020a). Revision 1 of the OU-1 Soil BHRA Report was submitted to NDEP on October 14, 2021 (Ramboll 2021b), to address NDEP comments received in June 2020. Revision 2 of the OU-1 Soil BHRA Report was submitted on May 6, 2022 (Ramboll 2022a) to address the NDEP comments received in December 2021, and was approved by NDEP on June 2, 2022. The cumulative risks associated with potential exposures to chemicals in OU-1 soil and to volatile compounds[2] in air migrating from OU-1 soil gas and groundwater were evaluated in the OU-1 Soil BHRA Report, Revision 2. The estimated cumulative risks in this BHRA Report have not changed.

With respect to Operable Unit 2 (OU-2) and Operable Unit 3 (OU-3), the initial version of the BHRA Report for OU-2 Soil Gas and Groundwater was submitted to NDEP on July 23, 2021 (Ramboll 2021c), and NDEP comments were received on October 13, 2022. The revised BHRA Report for OU-2 Soil Gas and Groundwater, prepared to address NDEP comments and to incorporate the data collected during the Indoor Air Quality investigation and updates in the toxicity values and methodology used to derive the BCLs published in the NDEP BCL tables (NDEP 2023a) and toxicity values used to derive the USEPA RSLs (USEPA 2023a), was submitted to NDEP on September 15, 2023 (Ramboll 2023a). The forthcoming BHRA for OU-3 will address the potential health risks due to exposures to contaminants migrating from OU-1, through OU-2, and into OU-3. The BHRA Work Plan for OU-3, Revision 1 was submitted to NDEP on December 5, 2022 (Ramboll 2022b) and approved by NDEP on February 1, 2023. The BHRA Report for OU-3 is currently under preparation.

In addition, the initial version of the Parcel E HRA Report was submitted to NDEP on November 18, 2022 (Ramboll 2022c), and NDEP comments were received on February 8, 2022. The revised version, prepared to address NDEP comments and to incorporate the updates in the toxicity values and methodology used to derive the NDEP BCLs (NDEP

[1] Prior to May 2020, OU-1 and the NERT Site were exchangeable terms, both referring to property owned by NERT. Since May 2020, the NERT Site refers to the area excluding former sale parcels which are no longer owned by NERT, while OU-1 and the NERT Site Study Area refers to the same area as before.

[2] Volatile compounds are identified using the following criteria consistent with USEPA (2023b): 1) vapor pressure greater than 1 millimeter of mercury (mm Hg) or 2) Henry's Law constant greater than 0.00001 atmosphere-cubic meter per mole (atm-m^3/mol). Therefore, any chemicals labeled by the laboratory as semi-volatile organic compounds (SVOCs) that meet the USEPA definition of volatile compounds are also included in the vapor intrusion analysis from shallow groundwater. For soil gas, all the analytes were VOCs.

2023a) and updates in the toxicity values used to derive the USEPA RSLs (USEPA 2023a) is currently under preparation.

This BHRA followed the procedures outlined in the USEPA risk assessment guidance and applicable NDEP guidance. NDEP cites the National Contingency Plan (NCP) (40 Code of Federal Regulations [CFR] § 300) as the basis for NDEP's establishment of the target cancer risk range (NDEP 2023b). According to the NCP, lifetime incremental cancer risks posed by a site should not exceed one in a million (1×10^{-6}) to one hundred in a million (1×10^{-4}). According to the NCP and NDEP (2023b), noncarcinogenic chemicals should not be present at levels expected to cause adverse health effects (i.e., a hazard index [HI] greater than one). It should be noted that the cancer risk and noncancer hazard estimated in this BHRA do not represent absolute estimates in OU-1, since generic and conservative assumptions were used when values specific to the Operations Area were not available, which are likely to overestimate actual exposures and calculated risks. Therefore, the actual health risks associated with exposure through the vapor intrusion pathway from soil gas and shallow groundwater within the Operations Area of OU-1 for the on-Site workers are expected to be lower than the risk estimates reported in this BHRA.

In this BHRA Report, the preliminary soil gas and shallow groundwater BHRA data sets presented in the *BHRA Work Plan for OU-1 and OU-2 Soil Gas and Groundwater, Revision 1* (Ramboll 2018a) have been updated by incorporating additional soil gas and shallow groundwater data from the most recent investigations, and potential risks associated with exposure to volatile compounds in air migrating from soil gas and groundwater in the Operations Area were evaluated.

The Site, including the Operations Area, has been the subject of extensive environmental investigations and removal actions dating back to the 1970s. The initial soil gas data for this BHRA, which predated the Trust, were collected by ENSR Corporation (ENSR) on behalf of Tronox, LLC (Tronox) in 2008 as part of their Phase B Soil Gas Investigation.

The primary field investigations for soil gas and shallow groundwater at monitoring wells (i.e., groundwater encountered at depths less than 60 feet below ground surface [bgs]) in the Operations Area conducted by the Trust since 2015 include the following:

- Phase 2 RI Modification No. 11 in 2019 for soil gas;
- Phase 3 RI Modification No. 9 in 2019-2020 for soil gas;
- Phase 1 RI in 2015 for groundwater;[3]
- Phase 2 RI in 2017-2019 for groundwater;
- Unit 4 and 5 Buildings Investigation in 2017 for groundwater; and
- Annual Groundwater Monitoring in 2016-2020.

Analytical results of soil gas and shallow groundwater samples collected within the Operations Area were assessed through data processing and data usability evaluation (DUE) steps (see Section 4.1), and data representative of current conditions within the Operations

[3] Phase 1 RI investigation started in 2014 but the groundwater sampling was conducted in 2015.

Area were selected for purposes of the BHRA. Consistent with USEPA guidance (2015), soil gas data collected within the Operations Area were used to evaluate potential exposure for workers via inhalation of vapors migrating from the subsurface to indoor air, outdoor air, and trench air. The soil gas data used in this BHRA were specifically collected to evaluate the vapor intrusion pathway. Soil gas data is generally the preferred line of evidence for assessing vapor intrusion risks, as opposed to groundwater or soil data, primarily due to higher uncertainties associated with vapor intrusion modeling based on groundwater or soil data (i.e., uncertainties in predicting contaminant partitioning from groundwater or soil moisture to soil gas and in predicting transport through the capillary fringe). Shallow groundwater data were incorporated in this BHRA to provide a secondary line of evidence for the vapor intrusion risk analysis and to check consistency between soil gas and groundwater results. The chemicals of potential concern (COPCs), conceptual site models (CSMs), and estimated cancer risks and noncancer HIs for this BHRA are summarized as follows:

- All volatile compounds detected in one or more soil gas or shallow groundwater samples in the BHRA data sets were selected as COPCs. As summarized in Table ES-1, a total of 66 COPCs were identified for soil gas collected at 5 feet bgs, a total of 60 COPCs were identified for soil gas collected at or around 15 feet bgs, and a total of 34 COPCs were identified for shallow groundwater. Of the soil gas and shallow groundwater COPCs, six COPCs (benzene, carbon tetrachloride, chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene) are primarily associated with a trespassing groundwater plume of chlorinated volatile organic compounds (VOCs) in the western portion of the Operations Area which originates from the adjacent Olin Chlor Alkali/Stauffer/Syngenta/Montrose (OSSM) site, referred to as the OSSM plume.[4]
- Based on the refined CSM developed by NERT for the Operations Area in OU-1, potential exposure to soil gas and shallow groundwater was evaluated for indoor commercial/industrial workers (slab-on-grade), outdoor commercial/industrial workers, and construction workers via inhalation of vapors migrating from soil gas and shallow groundwater to indoor air, outdoor air, and trench air. In addition, a basement scenario was evaluated for indoor commercial/industrial workers present at locations within the area of the Unit Buildings, and a trailer scenario was evaluated for indoor commercial/industrial workers present at locations within the area of office trailers used by the Trust and its contractor, Envirogen Technologies, Inc. (Envirogen). To be conservative, construction workers were assumed to be exposed to vapors migrating from soil gas/shallow groundwater while standing in a 10-foot trench in the unsaturated zone, placing them closer to the potential source.
- Excess lifetime cancer risks and noncancer HIs associated with inhalation of vapors migrating from soil gas and shallow groundwater were estimated for soil gas and shallow groundwater COPCs. These estimations were based on the maximum detected concentrations at each individual sample location for indoor air and trench air scenarios, and based on the 95% upper confidence limits (UCLs) on the mean concentrations over the entire Operations Area (or the maximum detected

[4] See Section 2.1 and Section 4.2.2 of this report and Section 9.4 of the *RI Report for OU-1 and OU-2* (Ramboll 2023b) for additional details.

concentrations over the entire Operations Area if 95% UCLs could not be calculated due to limited detections) for outdoor air scenarios.

- The risk results based on soil gas, which is the preferred line of evidence for assessing vapor intrusion risks, are presented in Table ES-2 and summarized below.
    - The estimated excess lifetime cancer risks for indoor commercial/industrial workers (slab-on-grade) ranged from 3×10^{-9} to 3×10^{-5} for soil gas at 5 feet bgs and from 3×10^{-9} to 1×10^{-4} for soil gas at or around 15 feet bgs (see Table ES-2). As shown in Figures ES-4 and ES-5,[5] the highest estimated total excess lifetime cancer risks for soil gas both at 5 and 15 feet bgs were associated with the trespassing OSSM plume. Within the area associated with the trespassing OSSM plume, for indoor commercial/industrial workers (slab-on-grade), only the maximum total excess lifetime cancer risks at RISG-10 were above 10^{-5}, while there were several other locations with total excess lifetime cancer risks above 1×10^{-6} but at or below 1×10^{-5} which is within or below the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}.
    - As indicated in Figures ES-4 and ES-5, the maximum estimated total excess lifetime cancer risk for indoor commercial/industrial workers (slab-on-grade) exposed to soil gas at 5 feet bgs was 3×10^{-5} at RISG-10 and associated with the trespassing OSSM plume, which was within or below the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}. The maximum estimated total excess lifetime cancer risk for indoor commercial/industrial workers (slab-on-grade) exposed to soil gas at or around 15 feet bgs was 1×10^{-4} and also at RISG-10, which was within or below the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}.
    - The cancer risk driver at most of the soil gas sample locations (except for a few locations with cancer risks lower than 1×10^{-6}) was chloroform (also see the chloroform plumes shown in Figures ES-4 and ES-5), contributing over 90% of the total cancer risk.
    - The Unit 4 Building area also had soil gas cancer risks above 1×10^{-6} for indoor commercial/industrial workers (basement scenario). At 5 and 15 feet bgs, the maximum total excess lifetime cancer risks were 1×10^{-5} and 8×10^{-5}, respectively.
    - The estimated total excess lifetime cancer risks near the Trust trailer were 5×10^{-6} at both 5 and 15 feet bgs for indoor commercial/industrial workers (trailer scenario). The estimated total excess lifetime cancer risk near Envirogen's trailer was 1×10^{-6} at both 5 and 15 feet bgs.
    - The estimated total excess lifetime cancer risks for outdoor commercial/ industrial workers and construction workers in a trench exposed to soil gas at 5 feet bgs and at or around 15 feet bgs were below the lower end of the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}.

[5] As part of the NERT Remedial Investigation, four samples (RISG-16, RISG-17, RISG- 18, and RISG-19), see Figure ES-5, were located beneath the existing basement slab in the center of the Unit 4 Building. Due to the depth of the basement slab, only soil gas samples at 15 feet bgs could be collected at these locations.

- The estimated total noncancer HIs for all the soil gas scenarios were below the NDEP and USEPA target HI of greater than one.

As discussed above, shallow groundwater data were incorporated in this BHRA to provide a secondary line of evidence for the vapor intrusion risk analysis and to check consistency between soil gas and groundwater results. Groundwater data for volatile compounds collected from shallow monitoring wells (with top of well screens less than 60 feet bgs) from 2015 to 2020 within the Operations Area were included in this BHRA. Similar to soil gas, the shallow groundwater cancer risks were above 10^{-6} in the area of the trespassing OSSM plume for indoor commercial/industrial workers (slab-on-grade and trailer scenarios specifically), with a maximum estimated total excess lifetime cancer risk of 1×10^{-4} at M-126 (co-located with the location with maximum soil gas cancer risks, RISG-10), which is within or below the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}. The cancer risk driver at most of the shallow groundwater sample locations (except for a few locations with cancer risks lower than 1×10^{-6}) was chloroform, contributing over 90% of the total cancer risk.

For shallow groundwater, total excess lifetime cancer risks above 1×10^{-6} but at or below 1×10^{-5} for indoor commercial/industrial workers (slab-on-grade) were observed in and adjacent to an area of elevated concentrations of chloroform in groundwater downgradient of the former Beta Ditch within the NERT chloroform plume (see Figures ES-4 and ES-5 as well as discussion in Section 4.2.5), but the cancer risks predicted from soil gas in this area for indoor commercial/industrial workers (slab-on-grade) were below 1×10^{-6}. Near or underneath the Unit 4 Building, soil gas cancer risks above 1×10^{-6} for indoor commercial/industrial workers (basement scenario) were also observed, but the cancer risks estimated from shallow groundwater in this area for indoor commercial/industrial workers (basement scenario) were below 1×10^{-6}.

The estimated total excess lifetime cancer risks for outdoor commercial/industrial workers and construction workers in a trench exposed to shallow groundwater through inhalation were below the lower end of the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}. The estimated total noncancer HIs for all the shallow groundwater scenarios were below the NDEP and USEPA target HI of greater than one.

The results and conclusions of the shallow groundwater risk evaluation are generally consistent with the results and conclusions of the soil gas risk evaluations, supporting the OU-1 CSM developed in the *RI Report for OU-1 and OU-2* (Ramboll 2023b) which identified that groundwater is the main source of VOCs detected in soil gas in OU-1.

In summary, potential exposure to volatile compounds in soil gas and shallow groundwater in the Operations Area of OU-1 through the vapor intrusion pathway does not pose unacceptable carcinogenic and noncarcinogenic human health risks to indoor or outdoor commercial/industrial workers and construction workers under the conditions and assumptions evaluated. Exposure to VOCs in soil gas and shallow groundwater in the OU-1 BHRA Area do not exceed the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4} and the target HI of greater than one for noncarcinogenic health impacts, under the conditions and assumptions evaluated. Therefore, additional assessment of the vapor

intrusion pathway is not warranted based on the risk characterization results for the OU-1 Operations Area.

1. INTRODUCTION

This report has been prepared by Ramboll Americas Engineering Solutions, Inc. (Ramboll), on behalf of the Nevada Environmental Response Trust (NERT or the Trust) and presents the Baseline Health Risk Assessment (BHRA) for OU-1 Soil Gas and Groundwater, Revision 1 ("BHRA Report") for the Operations Area (defined below) of Operable Unit 1 (OU-1). This BHRA evaluated potential health risks to current and future workers at the NERT Site ("Site") from exposures associated with the vapor intrusion pathway from soil gas and shallow groundwater within the Operations Area of OU-1. This BHRA Report has been prepared consistent with the methodology described in the *BHRA Work Plan for OU-1 and OU-2 Soil Gas and Groundwater, Revision 1* (Ramboll 2018a), submitted on December 19, 2018 and approved by the Nevada Division of Environmental Protection (NDEP) on January 24, 2019.

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OU-1, designated for the RI/FS currently in progress, comprises approximately 346 acres within the Black Mountain Industrial (BMI) Complex in unincorporated Clark County, Nevada; it is surrounded by the City of Henderson (Figures 1-1 and 1-2). OU-1 consists of property owned by NERT (the "NERT Site" or "Site", approximately 257 contiguous acres and approximately 8 acres of the non-contiguous Sale Parcel E) as well as five former sale parcels (former Sale Parcels C, D, F, G, and H, comprising 81 acres) which are no longer

owned by NERT (Figure 1-3).[6] Within the Site, the Operations Area[7] is a 257-acre area used by the Trust for Site remediation operations and used by its tenant EMD Acquisition, LLC (EMD) for the operation of a chemical manufacturing business. Tronox, LLC (Tronox) leased approximately 114 acres within the Operations Area from February 2011 to August 2018, on which it initially operated a chemical manufacturing business (Figure 1-4). In August 2018, Tronox's Henderson operations were purchased by EMD, and EMD assumed the lease with the Trust, which is continuing similar manufacturing operations at the Site. The Operations Area excludes one sale parcel (Sale Parcel E, comprising 8 acres) that is not currently used by the Trust or its tenant. Separate post-remediation health risk assessments (HRAs) for Parcels C, D, F, G, and H were completed in late 2017 and early 2018, all of which have been granted No Further Action (NFA) determinations by NDEP. The Trust reviewed information on the historical use of Parcel E, and investigated soil, soil gas, and groundwater in Parcel E. Because Parcel E is not contiguous with the Operations Area, a separate HRA is being performed. Therefore, only the Operations Area is the subject of this soil gas and groundwater BHRA.

1.1 Scope of OU-1 Soil Gas and Groundwater Baseline Health Risk Assessment

The NERT Site has been the subject of extensive environmental investigations since the 1970s, during which time HRAs have been prepared for specific sub-areas of the Site to evaluate potential risks associated with soil and soil gas exposure pathways. In 2010, Northgate Environmental Management, Inc. (Northgate), and Exponent, Inc. (Exponent), prepared an HRA Work Plan (the 2010 HRA Work Plan) that described the risk assessment methodology for evaluating soil and soil gas exposure pathways in future HRAs prepared for the Site (Northgate and Exponent 2010a). The 2010 HRA Work Plan was approved by NDEP on March 16, 2010 (NDEP 2010a).

Northgate and Exponent (2010b) conducted a *Site-Wide Soil Gas Human Health Risk Assessment* (draft 2010 Site-Wide Soil Gas HRA), which evaluated the soil gas samples collected in May 2008 during the Phase B Soil Gas Investigation (ENSR Corporation [ENSR] 2008a), but this HRA was not submitted to or reviewed by NDEP.[8]

In 2014, a separate BHRA Work Plan (2014 BHRA Work Plan; ENVIRON 2014a) was prepared by ENVIRON as part of the RI/FS Work Plan (ENVIRON 2014b), which incorporated all relevant elements from the 2010 HRA Work Plan, updated background information at the Site, and presented preliminary summary statistics for the soil and soil gas data sets representative of current conditions and available for the BHRA. In addition, the CSM

[6] Prior to May 2020, OU-1 and the NERT Site were interchangeable terms, both referring to property owned by NERT. Since May 2020, the NERT Site refers to the area excluding former sale parcels which are no longer owned by NERT, while OU-1 and the NERT Site Study Area refer to the same area as before.

[7] The Operations Area is equivalent to the area referred to as the "Facility Area" in previous reports (with the exception of Parcel E, previously considered as part of the Facility Area for risk assessment purposes). These reports include, e.g., the Remedial Investigation and Feasibility Study Work Plan (Environ International Corporation [ENVIRON] 2014b) and the associated risk assessment work plan and report (ENVIRON 2014a, Ramboll Environ US Corporation [Ramboll Environ] 2015a).

[8] The Draft Soil Gas HRA was submitted in 2010 but not approved by NDEP, since upon establishment of NERT in February 2011, it was recognized that NERT would be performing health risk assessments as part of the RI being planned at the time.

(ENSR 2005) was significantly revised in the 2014 BHRA Work Plan to identify additional transport pathways, evaluate risks to populations in the NERT Off-Site Study Area within OU-2 and OU-3, west of Pabco Road (not previously included in the 2010 HRA Work Plan), and consider soil removal actions that have been completed since 2010.

Based upon the 2014 BHRA Work Plan, and more specific to vapor intrusion pathways, an OU-1 and OU-2 Soil Gas and Groundwater BHRA Work Plan (2018 BHRA Work Plan) was prepared by Ramboll (Ramboll 2018a), submitted to NDEP on December 19, 2018, and approved by NDEP on January 24, 2019. The 2018 BHRA Work Plan presented the preliminary soil gas and shallow groundwater BHRA data sets for the Operations Area. It proposed to update the draft ENSR 2010 *Site-Wide Soil Gas HRA* for consistency with current risk assessment guidance while incorporating shallow groundwater data in the BHRA to provide a secondary line of evidence for the vapor intrusion risk analysis.

In this BHRA Report, the preliminary soil gas and shallow groundwater BHRA data sets presented in the 2018 BHRA Work Plan have been updated by incorporating additional soil gas and shallow groundwater data from the most recent investigations (i.e., the Phase 2 RI Modification No. 11, the Phase 3 RI Modification No. 9, the 2018-2020 Annual Groundwater Monitoring sampling events, and the Unit 4 and 5 Buildings Investigation). Shallow groundwater data from treatability studies are not included in this BHRA because treatability study data were not collected for site characterization purposes and were not always validated to the level required for site characterization and risk assessment in the RI/FS Quality Assurance Project Plans (QAPPs; Ramboll Environ 2017a; Ramboll 2019a). Potential risks associated with exposure to volatile compounds[9] in air migrating from soil gas and shallow groundwater in the Operations Area were evaluated consistent with the methodology as described in the 2018 BHRA Work Plan. The findings of this BHRA will be used in the forthcoming FS for OU-1 and OU-2 to determine which areas (if any) may require remediation to address potential risks to worker populations within the Operations Area.

Complete, direct contact exposure pathways for surface and near surface soils have also been identified in the Operations Area. In accordance with the 2014 BHRA Work Plan (ENVIRON 2014a) and *Identification of Chemicals of Potential Concern (COPCs) and Decision Units for OU-1 Soils, Revision 1* (Ramboll Environ 2017b), a separate BHRA report for evaluating exposure to soils in the Operations Area (the "OU-1 Soil BHRA") was submitted to NDEP. The OU-1 Soil BHRA was first submitted to NDEP in January 2020 (Ramboll 2020a) with Revision 1 of the OU-1 Soil BHRA Report submitted to NDEP on October 14, 2021 (Ramboll 2021b), to address NDEP comments received in June 2020. Revision 2 of the OU-1 Soil BHRA Report was submitted on May 6, 2022 (Ramboll 2022a) to address additional NDEP comments received in December 2021. Revision 2 of the report was approved by NDEP on June 2, 2022. The cumulative risks associated with potential exposures to chemicals in the Operations Area soil and to volatile compounds in air

[9] Volatile compounds are identified using the following criteria consistent with USEPA (2023b): 1) vapor pressure greater than 1 millimeter of mercury (mm Hg) or 2) Henry's Law constant greater than 0.00001 atmosphere-cubic meter per mole (atm-m^3/mol). Therefore, any chemicals labeled by the laboratory as semi-volatile organic compounds (SVOCs) that meet the USEPA definition of volatile compounds are also included in the vapor intrusion analysis from shallow groundwater. For soil gas, all the analytes were VOCs.

migrating from soil gas and groundwater were evaluated in the OU-1 Soil BHRA Report, Revision 2. The estimated cumulative risks in this BHRA Report have not changed.

Complete, direct contact pathways have not been identified for groundwater, which is not used as a source of drinking water in OU-1. Leaching of soil contaminants to groundwater is being addressed as a separate evaluation within the RI/FS process and is detailed in the RI Report for OU-1 and OU-2 (Ramboll 2023b).

Currently, the NERT RI Study Area collectively consists of multiple study areas (Figure 1-2). These include the original NERT RI Study Area, which consisted of the NERT Site Study Area[10] and the NERT Off-Site Study Area, as established in 2012. The Downgradient Study Area was added in 2015. The Eastside Study Area, which consists of the Eastside Sub-Area and the Northeast Sub-Area was established in 2016. In 2017, the RI Study Area was divided into three OUs via the RI/FS Work Plan Addendum, Phase 3 RI, Revision 1 (Ramboll Environ 2017c).

With respect to Operable Unit 2 (OU-2) and Operable Unit 3 (OU-3) (Figure 1-2), the initial version of the BHRA Report for OU-2 Soil Gas and Groundwater, addressing the potential risks associated with the vapor intrusion pathway for volatile compounds released from soil gas and shallow groundwater in the NERT Off-Site Study Area component of OU-2 west of Pabco Road, was submitted to NDEP on July 23, 2021 (Ramboll 2021c), and NDEP comments were received on October 13, 2022. The revised BHRA Report for OU-2 Soil Gas and Groundwater, prepared to address NDEP comments and to incorporate the data collected during the Indoor Air Quality investigation and updates in the toxicity values and methodology used to derive the BCLs published in the NDEP BCL tables (NDEP 2023a) and toxicity values used to derive the USEPA RSLs (USEPA 2023a), was submitted to NDEP on September 15, 2023 (Ramboll 2023a). The forthcoming BHRA for OU-3 will address the potential health risks due to exposures to contaminants migrating from OU-1, through OU-2, and into OU-3. The BHRA Work Plan for OU-3, Revision 1 was submitted to NDEP on December 5, 2022 (Ramboll 2022b) and approved by NDEP on February 1, 2023. The BHRA Report for OU-3 is currently under preparation and will address the potential health risks associated with the direct contact and vapor intrusion pathways due to potential migration of contaminants present in groundwater from OU-1.

In addition, the initial version of the Parcel E HRA Report was submitted to NDEP on November 18, 2022 (Ramboll 2022c), and NDEP comments were received on February 8, 2022. The revised version, prepared to address NDEP comments and to incorporate the updates in the toxicity values and methodology used to derive the NDEP BCLs (NDEP 2023a) and updates in the toxicity values used to derive the USEPA RSLs (USEPA 2023a) is currently under preparation.

1.2 Report Organization

The following elements are included in the remainder of this report:

[10] The original "NERT Site Study Area" area was established as part of the original NERT RI/FS Work Plan in 2012 where it was referred to as simply the "NERT Site." The NERT Site Study Area is identical to the OU-1 area, includes Sale Parcels C, D, and H, and refers to the property owned by the Trust after February 14, 2011, and prior to May 8, 2020.

- Section 2 provides an overview of OU-1, including background, climate, and geologic and hydrogeological settings.
- Section 3 summarizes the environmental investigations of soil gas and shallow groundwater conducted within the Operations Area.
- Section 4 identifies the sources of soil gas and shallow groundwater data available for the BHRA and presents the data usability evaluation (DUE), including the data analysis step of the DUE.
- Section 5 presents the methodology and results from each of the four steps of the risk assessment, i.e., 1) identification of COPCs, 2) exposure assessment, 3) toxicity assessment, and 4) risk characterization.
- Section 6 presents the uncertainty analysis, which discusses the relative impact of data uncertainties and the primary assumptions used in the BHRA on the risk results.
- Section 7 provides the data quality assessment.
- Section 8 summarizes the BHRA and presents conclusions regarding current conditions within the Operations Area.
- Section 9 lists the references cited in this report.

Supporting tables, figures, and appendices follow the text of the report.

2. OVERVIEW

The following sections provide an overview of the background, climate, and geologic and hydrogeological setting in OU-1. Additional details are provided in the RI/FS Work Plan (ENVIRON 2014b) and the RI Report for OU-1 and OU-2, Revision 1 (Ramboll 2023b).

2.1 Background

OU-1 is 346-acres in size and located approximately 13 miles southeast of the City of Las Vegas in an unincorporated area of Clark County, Nevada, within Sections 12 and 13 of Township 22 S, Range 62 E (Figures 1-1 and 1-2). OU-1 is situated within the BMI complex, which consists of several facilities that are owned and/or operated by various entities (Figure 2-1) and is surrounded by the City of Henderson. Prior to May 2020, OU-1 was designated as property owned by NERT, which was also referred to as the NERT Site, consisting of the Operations Area and six sale parcels (Sale Parcels C, D, E, F, G, and H). Since May 2020, five parcels (former Sale Parcels C, D, F, G, and H) are no longer owned by NERT, which reduced the NERT Site to the Operations Area plus one sale parcel (Parcel E), while OU-1 remains the same, consisting of the NERT Site as well as Parcels C, D, F, G, and H (Figure 1-3). EMD currently leases a portion of the Operations Area from the Trust, on which it operates a chemical manufacturing facility.

The BMI complex, including OU-1, has a long, complex ownership and operational history. The BMI complex was first developed by the United States (U.S.) Government in 1942 as a magnesium plant to support World War II operations. Following the war, the Site continued to be the location of industrial activities, including production of perchlorates, boron, and manganese compounds. Former industrial processes and waste management activities conducted at the Site, as well as those conducted at adjacent BMI Complex properties, resulted in contamination of environmental media at the Site, including soil, groundwater, and surface water.

OU-1 has been the subject of extensive environmental investigations and removal actions since the 1970s. In 1994, NDEP issued a Letter of Understanding (LOU), identifying 70 specific areas or items of interest[11] at the Site and the level of environmental investigation required for each LOU (NDEP 1994). The locations of LOUs at the Site are shown in Figure 2-2. In 2005, a CSM Report (2005 CSM Report) was prepared for the Site, which was the first comprehensive effort to integrate information from the soil and groundwater investigations conducted to date in order to document information on Site-specific sources, release mechanisms, transport pathways, exposure routes, and potentially exposed populations (ENSR 2005). Site investigations conducted since completion of the 2005 CSM Report primarily are the Phase A and Phase B Source Area Investigations (Phase A and Phase B Investigations), which were designed to further characterize soil, groundwater, and soil gas across the Site, as described in the RI/FS Work Plan (ENVIRON 2014b). Tronox continued field investigation and remediation efforts at the Site until February 13, 2011. On February 14, 2011, the Trust took title to the Site and took over the existing investigation and removal activities pursuant to an Interim Consent Agreement with NDEP. The soil gas

[11] NDEP identified 69 source areas referred to as LOUs in their document (NDEP 1994). Subsequently, an additional potential source area, the former U.S. Vanadium site, was identified during planning for the 2008 Phase B Investigation (NDEP 2011). Although not formally designated as an LOU, the U.S. Vanadium site is commonly referred to as LOU-70.

and groundwater investigations conducted at the Site since the formation of the Trust include primarily the Phase 1 RI, the Phase 2 RI, the Phase 3 RI, the Unit 4 and 5 Buildings Investigation, and various Annual Groundwater Monitoring program sampling events. Section 3 provides details about the soil gas and shallow groundwater investigations conducted historically by other parties and more recently by the Trust within OU-1. The findings of the RI were documented in the RI Report for OU-1 and OU-2, Revision 1 (Ramboll 2023b), submitted to NDEP in August 15, 2023.

As detailed in the RI Report for OU-1 and OU-2 (Ramboll 2023b), chemicals originating from the Olin Chlor Alkali/Stauffer/Syngenta/Montrose (OSSM) facility to the west of OU-1 are currently trespassing onto OU-1 (referred to as the OSSM groundwater plume). This plume is the subject of on-going remedial action that has been implemented by OSSM under NDEP oversight. This remedial action consists of a groundwater extraction and treatment system (GWETS) located north of the OSSM site and BMI Corrective Action Management Unit (CAMU) to capture contaminated groundwater and to remove VOCs. In 2019, the OSSM Companies submitted a Revised Groundwater Remedial Alternatives Study (RAS) (Revision 3) to NDEP (Geosyntec 2019), which recommends continued operation of the existing GWETS, combined with long-term monitoring of groundwater downgradient of the extraction system and establishment of institutional controls prohibiting groundwater extraction for potable use. While this BHRA evaluates the risk from these trespassing chemicals within OU-1, NERT understands that NDEP is currently overseeing the investigation and remediation of soil and groundwater contamination associated with historical operations at the OSSM site, and NERT continues its dialogue with NDEP regarding the necessity for OSSM to mitigate its trespass into OU-1.

2.2 Climate

The Site is located within Las Vegas Valley, for which the climate is arid, consisting of mild winters and dry, hot summers. Average annual precipitation as measured in Las Vegas between 1980 and 2020 was 4.20 inches (National Oceanic and Atmospheric Administration 2021). Precipitation generally occurs during two periods, December through March and July through September. Winter storms generally produce low-intensity rainfall over a large area. Summer storms generally produce high-intensity rainfall over a smaller area for a short duration. The violent summer thunderstorms account for most of the documented floods in the Las Vegas area. Winds frequently blow from the south or northwest at a mean velocity of approximately nine miles per hour (mph); however, velocities in excess of 50 mph are not atypical when weather fronts move through the area. During these windy events, dust, sand, and soil at the ground surface can become airborne and may travel several miles. Temperatures can rise to 120 degrees Fahrenheit (°F) in the summer, and the average relative humidity is approximately 20% (Schevenell 1996). The mean annual evaporation from lake and reservoir surfaces ranges from 60 to 82 inches per year (Shevenell 1996).

2.3 Geologic and Hydrogeological Setting

The Las Vegas Valley occupies a topographic and structural basin trending northwest-southeast and extending approximately 55 miles from near Indian Springs on the north to Railroad Pass on the south. The valley is bounded by the Las Vegas Range, Sheep Range, and Desert Range to the north; by the Frenchman and Sunrise Mountains to the east; by the McCullough Range and River Mountains to the south and southeast; and by the Spring

Mountains to the west. The mountain ranges bounding the east, north, and west sides of the valley consist primarily of Paleozoic and Mesozoic sedimentary rocks (limestones, sandstones, siltstones, and fanglomerates), whereas the mountains on the south and southeast consist primarily of Tertiary volcanic rocks (basalt, rhyolite, andesite, and related rock types) that overlie Precambrian metamorphic and granitic basement (ENSR 2007).

OU-1 is located on Quaternary alluvial deposits (Qal) that slope north toward Las Vegas Wash. The thickness of the alluvial deposits ranges from less than 20 feet to more than 50 feet beneath OU-1. Soil types identified in on-Site soil borings include poorly sorted gravel, silty gravel, poorly sorted sand, well sorted sand, and silty sand (ENSR 2005). The underlying Upper Muddy Creek Formation (UMCf) of Tertiary age occurs in Las Vegas Valley as valley-fill deposits that are coarse-grained near mountain fronts and become progressively finer-grained toward the center of the valley. The UMCf is composed of at least two thicker units of fine-grained sediments of clay and silt (the first and second fine-grained facies, respectively) interbedded with at least two thinner units of coarse-grained sediments of sand, silt, and gravel (the first and second coarse-grained facies, respectively) (Ramboll 2023b).

Across OU-1, the depth to groundwater ranges from approximately 20 to 60 feet below ground surface (bgs), with the majority of the samples between 30 and 45 feet bgs. Groundwater is generally deepest in the southernmost portion of the Site. The groundwater flow direction at the Site is generally north to north-northwesterly, whereas north of the Site, the direction changes slightly to the north-northeast (ENVIRON 2014b, Ramboll 2023b).

A major feature of the alluvial deposits is the stream-deposited sands and gravels that were laid down within paleochannels that were eroded into the surface of the UMCf during infrequent flood runoff periods (see Figure 2-3). These deposits are thickest within the paleochannel boundaries, which are narrow and linear and trend northeastward. The paleochannels act as preferential pathways for groundwater flow, which significantly influence the chemical distribution in the alluvium. Within OU-1, the alluvium was historically saturated below the northern portion of OU-1, while in the southern portion of OU-1 the first groundwater occurred in the UMCf. However, except for a few small areas, the alluvium, including paleochannels, has become dewatered and the first groundwater encountered now occurs within the underlying UMCf across OU-1 (Ramboll 2023b). Additional details on the regional and local geology and hydrogeology, including information on the water-bearing zones (WBZs), are provided in the RI/FS Work Plan (ENVIRON 2014b) and the RI Report for OU-1 and OU-2 (Ramboll 2023b).

3. ENVIRONMENTAL INVESTIGATIONS

The following sections summarize soil gas investigations conducted within the Operations Area since the 2005 CSM (ENSR 2005) and groundwater sampling conducted from shallow monitoring wells (with top of well screens less than 60 feet bgs) since the Phase 1 RI began in 2014.[12] The data from the soil gas and shallow groundwater samples collected during these investigations are used as multiple lines of evidence to support the vapor intrusion analysis of this BHRA.

3.1 Soil Gas Investigations

The following sections present the soil gas investigations conducted within the Operations Area since the 2005 CSM, which were used as the data sources for this BHRA. Figure 3-1 depicts the location of all soil gas samples included in the BHRA data set.

3.1.1 Phase B Soil Gas Investigation

In OU-1, the Phase B Soil Gas Investigation was conducted in May 2008. Details of the soil gas sampling are provided in the Phase B Source Area Investigation Soil Gas Survey Work Plan (ENSR 2008a) and summarized in the draft 2010 Site Wide Soil Gas HRA (Northgate and Exponent 2010b).[13] Soil gas sample locations were selected based on the following: 1) results of the Phase A Investigation (ENSR 2007), which identified the presence of several volatile organic compounds (VOCs) in soil and/or groundwater samples collected at the Site; 2) historic soil and groundwater data collected during investigations prior to 2006; and 3) an assessment of former chemical usage at the individual LOUs. A total of 18 LOUs in the Operations Area were identified as potential sources of VOCs or in areas where VOCs had been detected in soil or groundwater (ENSR 2008a, see Figure 2-2):

- Former Hardesty Chemical Company site (LOU 4)
- On-site portion of the Beta Ditch, including small diversion ditches (LOU 5)
- Old P-2 (and Replacement P-2), Old P-3, S-1, and P-1 Ponds (LOUs 7, 8, 9, 13, and 14)
- Ammonium Perchlorate (AP) Ponds (AP-1 through AP-5) (LOUs 16, 17, 18, and 19)
- Former Truck Emptying/Dumping site (LOU 35)
- Satellite Accumulation Point/AP Maintenance Shop (LOU 39)
- Unit 4 Building Basement and Old Sodium Chlorate Plant (LOU 43)
- Diesel Storage Tank Area (LOU 45)
- AP Plant Area Change House/Laboratory Septic Tank (LOU 54)
- Acid Drain System (LOU 60)

[12] Shallow groundwater data collected since the Phase 1 RI began are considered to provide an adequate spatial coverage and reflect the current conditions within the Operations Area.

[13] The Draft Soil Gas HRA was submitted in 2010 but not approved by NDEP, since upon establishment of NERT in February 2011, it was recognized that NERT would be performing health risk assessments as part of the RI being planned at the time.

- Former State Industries, including impoundments and catch basin (LOU 62)

A total of 92 soil gas samples were collected in 2008 at 74 locations within the Operations Area, most of which were collected at 5 feet bgs. Five samples were collected at 20 feet bgs at four locations in the vicinity of the Unit 3, 5, and 6 Buildings (Northgate and Exponent 2010b). During a July 18, 2007 conference call (NDEP 2007), NDEP and Tronox agreed that deeper soil gas samples would be collected from areas with higher chemical concentrations in groundwater, as well as from less impacted areas. Further, as specified in NDEP's March 26, 2008, approval (NDEP 2008a) of the Soil Gas Work Plan (ENSR 2008a), NDEP stated that samples in the vicinity of the Unit 3 Building should be collected below the depth of the Unit 3 Building basement, which was occupied with engineering staff (Northgate and Exponent 2010b). Based on these discussions, 20 feet bgs samples were collected near the Unit 3 Building, near an area of higher chloroform concentrations in groundwater, and near areas with relatively lower chloroform concentrations in groundwater (ENSR 2008a).

Elevated concentrations of VOCs in soil gas, compared to the Soil Gas Site Specific Levels calculated by Northgate and Exponent (2010b), appeared to be localized within specific areas, such as along the western Site boundary, the Unit 4 Building, the Old P-3 Pond, the S-1 Pond, the former truck emptying/dumping site, the AP laboratory building and former satellite accumulation point, and the former State Industries catch basin. No actions with respect to soil gas were required by NDEP immediately following this investigation, but soil gas has been further investigated as part of the RI, as discussed in Sections 3.1.2 and 3.1.3.

All soil gas data collected within the Operations Area from the Phase B Investigation are included in the soil gas BHRA data set, except for 12 soil gas samples collected at eight locations (SG35, SG39, SG51, SG53, SG72, SG73, SG85, and SG95) within the excavation zones of the 2010-2011 soil removal actions, which are no longer representative of the current conditions in the Operations Area. Soil gas data from 2008 Phase B Investigation are used in the DUE to analyze the trends in concentrations over time (Section 4.2.3); however, only the more recent soil gas data described below have been used in the risk calculations.

3.1.2 Phase 2 Remedial Investigation

Because groundwater is considered to be the primary source of VOCs in soil gas (Ramboll 2023b), review and identification of data gaps in the Phase B Soil Gas Investigation was completed by Ramboll following further evaluation of VOC data in shallow groundwater in the Operations Area. In the Phase 2 RI Modification No. 11 (Ramboll 2018b), which was submitted on May 23, 2018, and approved by NDEP on June 21, 2018 (NDEP 2018a), Ramboll proposed soil gas sampling for VOCs at 17 locations identified in the Operations Area.[14] This soil gas investigation was proposed in response to NDEP comments received on July 13, 2016 (NDEP 2016a), on the *Technical Memorandum, Remedial Investigation Data Evaluation* (the "RI Tech Memo", Ramboll Environ 2016a) and NDEP comments received on

[14] The first soil gas investigation by Ramboll on behalf of NERT was conducted at three sample locations within the NERT Off-Site Study Area in OU-2 during the Phase 1 RI in March 2015.

August 23, 2016 (NDEP 2016b), on the NERT Response to NDEP Comments, Remedial Investigation Data Evaluation/Phase 2 Work Plan (Ramboll Environ 2016b).

In accordance with the Phase 2 RI Modification No. 11, soil gas samples were collected from 17 locations in the Operations Area in March 2019 to evaluate areas where higher chloroform concentrations were detected in the previous soil gas and/or groundwater sampling. Samples were also collected to obtain data at a deeper depth (15 feet bgs), consistent with current vapor intrusion guidance (USEPA 2015) that recommends samples closer to the source (i.e., VOCs in groundwater). The results of the soil gas samples collected during this investigation were summarized in the *Technical Memorandum, Soil Gas Sampling Results for OU-1 and OU-2* (Ramboll 2020b) and the OU-1 and OU-2 RI report (Ramboll 2023b). The 17 soil gas sample locations are summarized below and presented in Figure 3-1:

- Four locations (RISG-10, RISG-11, RISG-12, and RISG-26) were within the chloroform groundwater plume area in the western portion of the NERT Site, which were sampled at both 5 and 15 feet bgs;
- One location (RISG-25) was to the north of the trespassing OSSM chloroform groundwater plume and to the west of the GW-11 pond, which was sampled at both 5 and 15 feet bgs;
- Two locations (RISG-23 and RISG-24) were downgradient of the former Beta Ditch near the interceptor well field (IWF) and barrier wall within the chloroform groundwater plume in the central portion of the NERT Site (see discussion in Section 4.2.5), which were sampled at both 5 and 15 feet bgs;
- Three locations (RISG-13, RISG-21, and RISG-22) were in the central portion of the NERT Site (just north of Lhoist property) where relatively high soil gas chloroform concentrations were identified during the Phase B Soil Gas Investigation, which were sampled at both 5 and 15 feet bgs;
- One location (RISG-20) was between the Lhoist property and the EMD Leach Plant, which was sampled at both 5 and 15 feet bgs; and
- Six locations were in the Unit 4 Building area, where no soil gas samples were collected during the Unit 4 and 5 Buildings Investigation. Two locations (RISG-14 and RISG-15) were at the southern edge of the chloroform groundwater plume area near the Unit 4 Building, which were sampled at both 5 and 15 feet bgs. Four locations (RISG-16 through RISG-19) were beneath the currently existing basement slab in the center of the Unit 4 Building with relatively higher concentrations of chloroform detected in grab groundwater samples (Tetra Tech 2017), which were sampled at approximately 15 feet bgs.

Based on the recommendations in the USEPA Vapor Intrusion Guidance (USEPA 2015), Ramboll has utilized 100 feet to define an initial lateral inclusion zone for vapor intrusion assessment (i.e., for identifying buildings or infrastructure that are 'near' a subsurface vapor source and generally warrant assessment) for purposes of a preliminary analysis. Consistent with the above, and as requested by NDEP (2018b), the infrastructure and soil cover within 100 feet (defined as the zone of influence, USEPA 2015) of each 5-foot sample location were documented (Appendix A). Field observations indicated that there is minimal

interference from infrastructure and soil cover and that the soil gas data are suitable for use in the vapor intrusion evaluation. All soil gas data collected within the Operations Area from the Phase 2 RI Modification No. 11 are included in the soil gas BHRA data set.

3.1.3 Phase 3 Remedial Investigation

Upon evaluation of the 2019 soil gas sampling results from the Phase 2 RI Modification No. 11, Ramboll determined that additional soil gas samples were necessary to delineate the horizontal and vertical extent of VOCs in soil gas, both to characterize the Site as required for completion of the RI for OU-1 and OU-2 and to assess potential vapor intrusion risks as part of the BHRAs for OU-1 and OU-2 Soil Gas and Groundwater. In accordance with the Phase 3 RI Modification No. 9 (Ramboll 2019b), which was submitted on October 7, 2019, and approved by NDEP on October 14, 2019, soil gas sampling for VOCs was conducted from November 2019 to January 2020 at 5 feet bgs and at or around 15 feet bgs at 12 additional locations identified in the Operations Area. This sampling event also included resampling at the original 17 soil gas locations in the Operations Area sampled during the Phase 2 RI Modification No. 11. Among the 12 additional locations, five of the sample locations were in the vicinity of Unit Buildings 1 through 6, two of the sample locations were in the central portion of the Site, and the remaining five sample locations were in the northern portion of the Site, generally around the GW-11 pond. The results of the soil gas samples collected during this RI modification were summarized in the Technical Memorandum, Soil Gas Sampling Results for OU-1 and OU-2 (Ramboll 2020b) and the RI Report for OU-1 and OU-2 (Ramboll 2023b).

As indicated in Appendix A, the soil gas data collected are representative of the Operations Area with minimal interference from infrastructure and soil cover and suitable for use in the vapor intrusion evaluation. All soil gas data collected within the Operations Area from the Phase 3 RI Modification No. 9 are included in the soil gas BHRA data set.

3.2 Groundwater Investigations

The following sections present the groundwater investigations conducted within the Operations Area of OU-1 from 2015 to 2020, which were used as the data sources for the BHRA. Additional information regarding the migration of the OSSM plume across OU-1 has also been included as requested by NDEP. Figure 3-2 depicts the location of all shallow groundwater samples included in the BHRA data set, and Figure 3-3 shows a geologic cross-section in the northern portion of OU-1.

3.2.1 Remedial Investigation

3.2.1.1 Phase 1 Remedial Investigation

Per the RI/FS Work Plan (ENVIRON 2014b), field work for the Phase 1 RI was conducted between October 2014 and May 2015. The purpose of the Phase 1 RI was to determine the nature and extent of chemicals in soil and groundwater within OU-1 and in the NERT Off-Site Study Area (including what is now parts of OU-2 and OU-3, west of Pabco Road).

The Phase 1 RI groundwater sampling was conducted from January to May 2015 and comprised installation and sampling of new groundwater monitoring wells, collection of grab groundwater samples, performing slug tests, and sampling of existing groundwater monitoring wells. The results of the Phase 1 RI were summarized in the RI Tech Memo

(Ramboll Environ 2016a). Data gaps to be addressed in the Phase 2 RI were identified in the same submittal.

All the data for volatile compounds from groundwater samples collected at shallow monitoring wells within the Operations Area during the Phase 1 RI are included in the shallow groundwater BHRA data set.

3.2.1.2 Phase 2 Remedial Investigation

In accordance with the RI Tech Memo (Ramboll Environ 2016a), the Trust implemented a second phase of remedial investigation (Phase 2 RI) from February to November 2017. Field work was conducted both within OU-1 and within the NERT Off-Site Study Area (including what is now parts of OU-2 and OU-3, west of Pabco Road). The primary purposes of the Phase 2 RI were to obtain data necessary to further understand the nature and extent of impacts to soil and groundwater and to address remaining data gaps identified subsequent to the Phase 1 RI. In addition, 15 Phase 2 RI Modifications were also conducted from April 2017 to April 2019, and VOC data were collected at shallow groundwater monitoring wells within the Operations Area during implementation of the Phase 2 RI Modification No. 1 (Ramboll Environ 2017d) and Phase 2 RI Modification No. 9 (Ramboll Environ 2017e).

Within OU-1, new monitoring wells were installed as part of the Phase 2 RI throughout the Operations Area, from just north of the Unit Buildings to the northern boundary of the Operations Area. Groundwater at each newly installed monitoring well was sampled twice, including during the initial round immediately following the well development and during the second round a couple of months after well development.[15] Water quality measurements were monitored to determine when well development was complete and to ensure adequate time for water levels to recover in between sampling events. In addition, existing monitoring wells in OU-1 were sampled once during the Phase 2 RI.

All the data for volatile compounds from groundwater samples collected at shallow monitoring wells within the Operations Area during the Phase 2 RI are included in the shallow groundwater BHRA data set.

3.2.1.3 Phase 3 Remedial Investigation

As discussed in the RI/FS Work Plan Addendum: Phase 3 Remedial Investigation, Revision 1 (Ramboll Environ 2017c), the Trust implemented a third phase of remedial investigation (Phase 3 RI) from December 2017[16] to November 2018[17] within the Eastside Study Area (including the Eastside Sub-Area in OU-2 and Northeast Sub-Area in OU-3), located immediately east of the NERT Off-Site Study Area.

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[15] The second round of groundwater sampling was conducted after the depth to groundwater was no longer recovering from pumping and was consistent with the depth to groundwater in other comparable monitoring wells in the vicinity.

[16] Prior to the start of the Phase 3 RI, well inspections were performed as part of Phase 3 RI Modification No. 1 beginning in August 2017.

[17] Additionally, 15 Phase 3 RI Modifications (to date) were planned or implemented beginning in December 2017 and are continuing as of the date of this report. None of the Phase 3 RI Modifications involved the collection of groundwater data within OU-1.

No Phase 3 RI groundwater samples were collected within the Operations Area, and, therefore, this investigation is not a data source for the BHRA.

3.2.1.4 Unit 4 and 5 Buildings Investigation

As part of the RI/FS, the Unit 4 and 5 Buildings Investigation Work Plan (Tetra Tech 2015) was submitted to NDEP on March 30, 2015, and approved by NDEP on April 13, 2015. The work plan documented the proposed environmental investigation in the area of the Unit 4 and 5 Buildings located at the Site to determine the nature of contamination and the vertical extent of impacted soil and groundwater underneath the Unit 4 and 5 Buildings. The work plan replaced Section 5.4.1.2 of the RI/FS Work Plan and included demolition of the Unit 4 Building floor, construction of an access ramp, and an environmental investigation using conventional drilling techniques on the basement level of the building. The work was divided into three field mobilizations and subsequent reporting, as summarized below.

Field work for the first mobilization was conducted in late 2015 and included advancing four borings near the four exterior corners of the Unit 4 Building cell floor and collecting soil samples and discrete-depth groundwater samples from each borehole.

Field work for the second mobilization was conducted from June 2016 to January 2017 and included advancing 69 boreholes and collecting soil and discrete-depth groundwater samples at selected intervals throughout the area of the Unit 4 and 5 Buildings. Groundwater samples were only collected from temporary wells during these two mobilizations (except for one deep monitoring well installed in the second mobilization), the data of which are not representative of long-term groundwater concentrations. Since only groundwater data from permanent shallow monitoring wells are used for the vapor intrusion analysis, and adequate groundwater data from shallow groundwater monitoring wells are available in the area of the Unit 4 and 5 Buildings, the groundwater data collected during these two mobilizations are not included in the shallow groundwater BHRA data set for the Operations Area.

Field work associated with the third mobilization was commenced in August 2017 and completed in December 2017. The third mobilization included advancing four angled boreholes and installing 20 groundwater monitoring wells to verify the results obtained from discrete-depth groundwater samples collected from temporary wells (Tetra Tech 2020). All the data for volatile compounds from groundwater samples collected at monitoring wells with top of well screens less than 60 feet bgs from the third mobilization are included in the shallow groundwater BHRA data set for the Operations Area.

The results from all three field mobilizations were summarized in the Unit 4 and 5 Buildings Investigation Source Area Characterization Report (Tetra Tech 2020).

3.2.2 Annual Groundwater Monitoring

As directed by NDEP, VOCs were first added to the groundwater monitoring program as part of the 2016 Groundwater Monitoring Optimization Plan (Ramboll Environ 2016c) after initial evaluations of Phase 1 RI data suggested that these chemicals were present at detectable levels in groundwater throughout OU-1 and the NERT Off-Site Study Area (Ramboll Environ 2016a). The 2016 Annual Remedial Performance Report for Chromium and Perchlorate (Ramboll Environ 2016d) detailed the results of groundwater sampling from the second half

of 2015 through the first half of 2016. This report was submitted to NDEP on October 31, 2016, and approved by NDEP on December 6, 2016. Groundwater samples collected in February and June 2016 were analyzed for VOCs.

An additional groundwater sampling for VOCs was also conducted in the third quarter of 2016. The analytical results for groundwater samples collected during this sampling event were detailed in the 2017 Annual Remedial Performance Report for Chromium and Perchlorate (Ramboll Environ 2017f).

Comprehensive groundwater sampling for VOCs has been conducted on an annual basis (usually in May every year) as part of the Annual Groundwater Monitoring program since 2017. The results of groundwater sampling for VOCs conducted in May 2017, 2018, 2019, and 2020 were presented in the Annual Remedial Performance Report for Chromium and Perchlorate for 2017 (Ramboll Environ 2017f), 2018 (Ramboll 2018c), and 2019 (Ramboll 2019c), and the Annual Groundwater Monitoring and GWETS Performance Report for 2020 (Ramboll 2021d), respectively.

All data for VOCs from groundwater samples collected from shallow monitoring wells within the Operations Area during the February 2016 to May 2020 sampling events are included in the shallow groundwater BHRA data set.

4. DATA USABILITY EVALUATION AND DATA ANALYSIS

This section presents the DUE. Section 4.1 presents the first component of the DUE, in which the available soil gas and shallow groundwater data are reviewed to ensure that the quality of the data is sufficient to support the BHRA; this component of the evaluation focuses on the quality of each individual data point. Section 4.2 presents the data analysis component of the DUE, which focuses on the entire BHRA data sets. Through statistical summaries, spatial plots, and other exploratory analyses, the data are reviewed relative to our current understanding of the Operations Area (as represented by the CSM) and for possible data gaps.

4.1 Data Usability Evaluation

The DUE was conducted in accordance with NDEP's *Supplemental Guidance for Assessing Data Usability for Environmental Investigations* at the BMI Facility in Henderson, NV (NDEP 2010b), which is based on the USEPA's *Guidance for Data Usability in Risk Assessment* (Parts A and B) (USEPA 1992a, b). The USEPA DUE framework provides the basis for identifying and evaluating uncertainties in HRAs with regard to site characterization data. USEPA (1992a) states that "data usability is the process of assuring or determining that the quality of data generated meets the intended use," and that when risk assessment is the intended use, USEPA's guidance "provide[s] direction for planning and assessing analytical data collection activities for the HRA." USEPA has established a specific framework to provide risk assessors a consistent basis for making decisions about the minimum quality and quantity of environmental analytical data to support risk assessment decisions (USEPA 1992a, b; NDEP 2010b). The USEPA data usability guidance identifies the following data quality criteria for evaluating the usability of site investigation data in the risk assessment process:

- Criterion I – Reports to Risk Assessor;
- Criterion II – Documentation;
- Criterion III – Data Sources;
- Criterion IV – Analytical Methods and Detection Limits;
- Criterion V – Data Review; and
- Criterion VI – Data Quality Indicators.

The soil gas and shallow groundwater data sets evaluated using the data quality criteria is identified in Section 4.1.1. Sections 4.1.2 through 4.1.7 briefly describe the evaluation criteria and results of the evaluation. The detailed results are presented in tabular form (Tables 4-1 and 4-2) using the worksheet templates provided by NDEP (2010b).

4.1.1 Soil Gas and Shallow Groundwater Data Sets and Data Processing

Consistent with USEPA guidance (2015), soil gas data collected within the Operations Area were used to evaluate potential exposure for current and future workers via inhalation of vapors migrating from the subsurface to indoor air, outdoor air, and trench air. The soil gas data used in this BHRA were specifically collected to evaluate the vapor intrusion pathway. Soil gas data is generally the preferred line of evidence for assessing vapor intrusion risks as opposed to groundwater or soil data primarily due to higher uncertainties associated with

vapor intrusion modeling based on groundwater or soil data (i.e., uncertainties in predicting contaminant partitioning from groundwater or soil moisture to soil gas and in predicting transport through the capillary fringe). In addition, the groundwater data used in this BHRA was collected to delineate the groundwater plume and not necessarily for the evaluation of vapor intrusion. Therefore, this BHRA considers the soil gas data as the primary line of evidence for evaluation of the vapor intrusion pathway; the groundwater data were evaluated to provide a secondary line of evidence and to check consistency between soil gas and groundwater results.

The soil gas BHRA data set for the Operations Area includes data for VOCs from post-removal action[18] soil gas samples collected at 5 and 20 feet bgs as part of the 2008 Phase B Soil Gas Investigation (which were also used in the draft 2010 Site-Wide Soil Gas HRA), as well as from soil gas samples collected at 5 feet bgs and at or close to 15 feet bgs in the 2019 Phase 2 RI Modification No. 11 (Ramboll 2018b) and the 2019-2020 Phase 3 RI Modification No. 9 (Ramboll 2019b).

Only soil gas data collected from 2019 Phase 2 RI Modification No. 11 and 2019-2020 Phase 3 RI Modification No. 9 were used in the risk characterization (see Section 5.4) (see Table 4-3a). Historical soil gas data collected during 2008 Phase B Soil Gas Investigation were mainly used in the DUE, e.g., time trend comparison, and the risk results of these data are not reported.

Consistent with USEPA's most recent vapor intrusion guidance (USEPA 2015), shallow groundwater data were incorporated in this BHRA to provide a secondary line of evidence for the vapor intrusion risk analysis. All monitoring wells with the top of the screen shallower than 60 feet bgs were included in this BHRA as they were deemed to provide the most representative data for the vapor intrusion models. The shallow groundwater wells included in the BHRA data set are presented in Table 4-3b. Specifically, the data set includes data for volatile compounds from shallow groundwater samples collected as part of the following groundwater investigations since 2015:

- 2015 Phase 1 RI[19]
- 2017-2019 Phase 2 RI
- 2017 Unit 4 and 5 Buildings Investigation (third mobilization only)
- 2016-2020 Annual Groundwater Monitoring sampling events

According to USEPA (2015), when collecting groundwater data for vapor intrusion analysis it is recommended that groundwater samples be taken from wells screened (preferably over short intervals) across the top of the water table and that to the extent practical, groundwater samples be collected over a narrow interval (e.g., a few feet or less) just below the water table. As shown in Table 4-3b, some of the groundwater VOC data were collected at depths below the first encountered groundwater and may not be the most representative

[18] Twelve Phase B soil gas samples collected at eight locations (SG35, SG39, SG51, SG53, SG72, SG73, SG85, and SG95) within the excavation zones of the 2010-2011 soil removal actions, which are no longer representative of the current conditions in the Operations Area, are excluded from the soil gas BHRA data set.

[19] The Phase 1 RI investigation started in 2014, but the groundwater sampling was conducted in 2015.

data for evaluating the vapor intrusion pathway. However, to ensure an adequate spatial coverage of source areas across the Operations Area (Figure 3-2), these shallow groundwater wells are retained in the shallow groundwater BHRA data set and used in various components of the BHRA (except for the soil gas and groundwater correlation analysis discussed in Section 4.2.4).

After identifying the preliminary sets of soil gas and shallow groundwater data for the BHRA, an initial task before the DUE was implemented to 1) identify and correct inconsistencies in data field entries and 2) create additional fields to support data management and interpretation for the BHRA data set. The following items were completed:

- Standardize chemical names and Chemical Abstract Service (CAS) registry numbers;
- Standardize reporting units, e.g., milligram per liter (mg/L) for formaldehyde and microgram per liter (µg/L) for other VOCs;
- Standardize analytical method names;
- Correct errors in data entry (e.g., typos in sample identification codes);
- Identify a unique result for use in the BHRA for sample/analyte pairs for which more than one result was reported. For example, if two results were reported for a chemical in the same sample – one by USEPA Method 8270 and the other by USEPA Method 8260 – the result used in the BHRA was identified as the value reported by the most appropriate analytical method for that chemical or the most conservative value if the two analytical methods are equally suitable for that chemical;
- Calculate the data for total isomers for use in the BHRA. The purpose of this step is to generate the data in the same chemical form as the toxicity values. For example, the data for m,p-xylenes and o-xylene in the same sample were summed to calculate the data for xylenes (total) for which the toxicity values are reported; the data for cis-1,3-dichloropropene and trans-1,3-dichloropropene in the same sample were summed to calculate the data for 1,3-dichloropropene (total) for which the toxicity values are reported; and
- Develop database queries and confirm that queries returned the correct output.

The above steps were necessary due to the approximately 12-year period over which the soil gas data were collected and the approximately six-year period over which the groundwater data were collected. This can be understood in the context of soil gas and groundwater samples collected by different entities, analyzed by different analytical laboratories for overlapping suites of chemicals, and the use of different reporting conventions.

No change was made to a datum without first understanding the issue and the steps necessary to correct the issue. As needed, sampling plans, laboratory reports, data validation summary reports (DVSRs, Appendices B and C), and other supporting documents were reviewed. Data points were considered unusable for risk assessment if information could not be located to confirm and/or correct an identified issue. No soil gas data were excluded from the BHRA data set during data processing. Shallow groundwater data excluded from the BHRA data set during data processing are summarized in Appendix C, Table C-1.

The soil gas and shallow groundwater BHRA data sets are presented in Appendices D and E, respectively. Only data for target compounds, not tentatively identified compounds, are included in the BHRA data sets. Data for volatile total petroleum hydrocarbon (TPH) in shallow groundwater were excluded from the shallow groundwater BHRA data set, consistent with NDEP guidance (NDEP 2023b). Volatile TPH was evaluated through the indicator chemicals, including benzene, toluene, ethylbenzene, and total xylenes (BTEX), and volatile polynuclear aromatic hydrocarbons (PAHs). Over 450 samples in the shallow groundwater BHRA data set were analyzed for BTEX and volatile PAHs (primarily naphthalene) (Appendix E). These samples provide an adequate data set for evaluating volatile TPH in shallow groundwater.

The soil gas BHRA data set includes 168 soil gas samples collected at 5 feet bgs and at or around 15 feet bgs at 95 locations, consisting of 80 soil gas samples at 66 locations collected from the 2008 Phase B Investigation, 33 soil gas samples at 17 locations collected from the Phase 2 RI Modification No. 11, and 55 soil gas samples at 29 locations[20] collected from the Phase 3 RI Modification No. 9.

The shallow groundwater BHRA data set includes 482 groundwater samples collected from 119 monitoring wells[21], consisting of 149 groundwater samples from 106 monitoring wells collected during the RI (i.e., Phase 1 RI, Phase 2 RI, and Unit 4 and 5 Buildings Investigation), and 333 groundwater samples from 83 monitoring wells collected during Annual Groundwater Monitoring sampling events.

In the following sections, the usability of the soil gas and shallow groundwater BHRA data sets was evaluated using the data quality criteria described in NDEP (2010b).

4.1.2 Criterion I – Reports to Risk Assessor

Criterion I requires confirmation that the reports relied upon are complete and appropriate for use in the BHRA. The required information specified under this criterion was verified and is available in the documents associated with the Operations Area data collection efforts, as listed in Tables 4-1 and 4-2.

4.1.3 Criterion II – Documentation

The objective of the documentation review is to ensure that each analytical result can be associated with a specific sampling location and that the procedures used to collect the samples are appropriate. As part of this DUE step, a comprehensive review was completed of the soil gas and shallow groundwater samples collected and reported in the documents listed under Criterion I and/or in the NERT project database. The steps completed during the review are listed in Tables 4-1 and 4-2. Figure 3-1 depicts the location of all soil gas samples included in the BHRA data set; Figure 3-2 depicts the location of all shallow groundwater samples included in the BHRA data set. The analytical results for each sample are included in Appendix D for soil gas and Appendix E for shallow groundwater.

[20] As discussed in Section 3.1.3, the 17 locations in the Operations Area sampled during the Phase 2 RI Modification No. 11 were resampled during the Phase 3 RI Modification No. 9, along with 12 new locations.

[21] As indicated in Table 4-3, several monitoring wells were sampled during both the RI and the Annual Groundwater Monitoring sampling events.

4.1.4 Criterion III – Data Sources

The objective of the data sources review is to ensure that adequate sample coverage of source areas has been obtained and that the analytical methods are appropriate to identify chemicals and derive associated exposure point concentrations (EPCs) for the BHRA.

The review of sample coverage from the BHRA data sets is described in Tables 4-1 and 4-2. Sample coverage is considered adequate for purposes of the BHRA.

The analytical methods used in the Operations Area investigations are described in Tables 4-1 and 4-2. The USEPA analytical methods were adequate for characterizing potential contaminants in soil gas and shallow groundwater and provide quantitative analytical results that are of adequate quality for deriving EPCs.

4.1.5 Criterion IV – Analytical Methods and Detection Limits

Criterion IV requires that the analytical method appropriately identifies the chemical form or species, and that for each chemical, the sample quantitation limit (SQL) is sufficiently low for risk characterization. The analytical methods used for the soil gas and shallow groundwater investigations are listed in Tables 4-1 and 4-2.

During Ramboll's review of the analytical results reported in the NDEP-approved DVSR for the Phase B Soil Gas Investigation, Ramboll noted that for some samples, non-detect results were reported to the practical quantitation limit (PQL) rather than the SQL. Based on review of the laboratory data packages, and as discussed with the laboratory, the procedure for evaluating these results consisted of the following steps, according to the current NDEP guidance on the use of censoring limits (NDEP 2008b). If a chemical was detected above the PQL, then the value was reported. If the chemical was detected above the SQL, but below the PQL, the value was reported and flagged as a J value. If there was no indication that the chemical was detected, it was reported as a non-detect value at the PQL. In the soil gas BHRA data set, non-detect results from Phase B Soil Gas Investigation are reported to the SQL.

For analytes where the detection frequency was less than 100%, the SQLs from the BHRA data set were compared to 0.1 times the risk–based target concentration (RBTC)[22] to confirm that they were sufficiently low for risk characterization, in the absence of NDEP BCLs for soil gas and groundwater for the vapor intrusion pathway (NDEP 2023b). The derivation of RBTCs is detailed in Section 5.4. Tables 4-4 through 4-6 present the results of the SQL evaluation along with the RBTCs. Chemicals with SQLs above the RBTCs are summarized in Tables 4-1 and 4-2.

Overall, the SQLs were sufficiently low for risk characterization. The impacts of the few exceptions with elevated SQLs on the overall risk evaluation are further discussed in Section 6.1.2.

[22] The lowest RBTCs among indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers were used for the comparison (see detailed discussion on the RBTCs in Section 5.4).

4.1.6 Criterion V – Data Review

The data review included evaluation of completeness, instrument calibration, laboratory precision, laboratory accuracy, blanks, adherence to method specification and quality control (QC) limits, and method performance in sample matrix. Details of this review are presented in Tables 4-1 and 4-2. In summary, the tabular summaries of the data qualifications included in the NDEP-approved DVSRs listed in Criterion I were reviewed, and with the exception of the rejected data discussed in the DVSRs, all data are deemed to be usable for risk assessment purposes. These data qualifications are further discussed below as a component of Criterion VI.

4.1.7 Criterion VI – Data Quality Indicators

The project QAPPs (ENSR 2008b; ENVIRON 2014c; Ramboll Environ 2017a; Ramboll 2019a) identified five data quality indicators (DQIs) to ensure that the overall quality of the data is sufficient to support the risk assessment, as follows: completeness, comparability, representativeness, precision, and accuracy. The DQIs provide quantitative and qualitative measures for evaluating the risk assessment data, as they relate to uncertainties in the selection of COPCs, characterization of EPCs, and risk descriptors used in support of the BHRA, as well as the risk management decisions that will be made for the Operations Area. Specifically, the DQIs address field and analytical data quality aspects as they affect uncertainties in the data collected for site characterization and risk assessment.

The DQI evaluation is presented in Tables 4-1 and 4-2. Based on the evaluation, the overall goals for data quality for risk assessment were achieved, and all DVSRs were reviewed and approved by NDEP (with the exception of the DVSR for groundwater samples collected during the 2020 Annual Groundwater Monitoring Report, which is under revision in response to NDEP comments at the time of this report). In summary, except the rejected shallow groundwater data discussed in Table 4-2 and listed in Appendix C, Table C-2, all soil gas and shallow groundwater data are deemed to be usable for risk assessment purposes.

4.2 Data Analysis

As described in NDEP guidance (NDEP 2010b), the purpose of the data analysis step is to "use simple exploratory data analysis to compare data to the expectations of the CSM, to determine if the data adequately represent the source terms and exposure areas or evaluation areas." Consistent with guidance (NDEP 2010b), the steps of the exploratory data analysis (EDA), as described in the following sections, include: 1) preparation of summary statistics for the soil gas and shallow groundwater BHRA data sets (Section 4.2.1), 2) preparation and review of spatial plots for selected VOCs in soil gas and groundwater (Section 4.2.2), 3) preparation and review of plots for temporal trends of chloroform concentrations in soil gas and groundwater (Section 4.2.3), and 4) preparation and review of plots for chloroform concentrations in co-located soil gas and groundwater samples (Section 4.2.4). Section 4.2.5 discusses the results of the EDA in comparison with the OU-1 CSM.

4.2.1 Summary Statistics

Summary statistics for analytical data are presented in Tables 4-7 and 4-8 for the soil gas samples collected at 5 feet bgs and at or around 15 feet bgs, respectively. Summary statistics for analytical data collected from the shallow groundwater samples are presented

in Table 4-9. Individual sample locations are shown in Figure 3-1 for soil gas and Figure 3-2 for shallow groundwater.

NDEP guidance (2008c) recommends including field duplicates in a data set when the variance of the duplicates is similar to the variance of the primary samples. As noted in the guidance, field duplicate samples represent a discrete and unique measurement of soil gas or shallow groundwater chemical conditions proximal to the primary sample (unlike split samples). In developing the summary statistics, soil gas and shallow groundwater samples with primary and field duplicate results were treated as independent samples, consistent with Option 2 in NDEP's guidance (2008c).

For most analytes, the summary statistics are based on the results of between 50 and 400 samples, although for some analytes the analytical data set is much more limited (<30 samples). However, the analytes with limited sample size were either never detected or were not identified as NERT COPCs as provided in the RI Report for OU-1 and OU-2 (Ramboll 2023b). Therefore, the limited sample size for these analytes does not have a significant impact on the overall risk evaluation.

Considering the data validation conducted by Ramboll and DVSRs reviewed and approved by NDEP for each soil gas and shallow groundwater investigation, and based on the DUE discussed in Section 4.1, the OU-1 soil gas and shallow groundwater BHRA data sets are considered adequate for risk assessment purposes.

4.2.2 Spatial Analysis of VOCs in Soil Gas and Groundwater

Spatial quartile plots (Figures 4-1 through 4-9) were prepared for selected VOCs in soil gas and groundwater to illustrate the spatial distribution of the data and compare the results to the expectations of the CSM. Each spatial quartile plot presents the following information:

- Sample locations;
- Chloroform Plume; and
- Chemical concentrations. The concentration shown at each location is the maximum detected concentration among all samples, unless results for all samples at that location were reported as less than the detection limits; concentration bins are defined as follows:
    - Dark green – concentrations < detection limits;
    - Light green – concentrations <Q1 (25th percentiles);
    - Yellow – concentrations within the interquartile range (IQR, the difference between the 75th and 25th percentiles);
    - Orange – concentrations >Q3 (75th percentiles) and <= (Q3 + 1.5×IQR); and
    - Red – concentrations >(Q3 + 1.5×IQR).

Chloroform, carbon tetrachloride, and 1,4-dichlorobenzene were selected for the preparation of spatial quartile plots because they are among the highest contributors to total risk (see Section 5.4) and could be used to examine co-location of the chlorinated VOCs.

The spatial quartile plots are presented in Figures 4-1 through 4-3 for chloroform, carbon tetrachloride, and 1,4-dichlorobenzene in soil gas at 5 feet bgs, in Figures 4-4 through 4-6 for chloroform, carbon tetrachloride, and 1,4-dichlorobenzene in soil gas at or around 15 feet bgs, and in Figures 4-7 through 4-9 for chloroform, carbon tetrachloride, and 1,4-dichlorobenzene in groundwater. The spatial quartile plots include the chloroform plume for the Shallow WBZ (0-55 ft bgs) as depicted in the RI Report for OU-1 and OU-2 (Ramboll 2023b). The chloroform plume is shown on the spatial quartile plots because chloroform is the most widespread VOC detected in OU-1 groundwater, and the configuration of the plume illustrates the locations of the identified sources of VOCs in groundwater.

In addition, spatial concentration bubble plots were also prepared for these three VOCs to support the spatial analysis of chlorinated VOC plumes in the OU-1 BHRA Area for soil gas at 5 feet bgs, for soil gas at or around 15 feet bgs, and for shallow groundwater (Figures 4-10 through 4-12 for chloroform, Figures 4-13 through 4-15 for carbon tetrachloride, and Figures 4-16 through 4-18 for 1,4-dichlorobenzene).

As shown in the spatial quartile and concentration plots, the area with the highest chloroform groundwater concentrations is associated with a trespassing VOC plume originating at the adjacent OSSM site. This trespassing VOC plume, referred to as the OSSM plume, also contains VOCs besides chloroform, including the risk drivers carbon tetrachloride and 1,4-dichlorobenzene. The Unit 4 and 5 Buildings within OU-1 have been identified as a source of chloroform, but not as a source of other VOCs besides chloroform. The chloroform plume originating from the Unit 4 and 5 Buildings is referred to as the Unit 4 plume. As detailed in the RI Report for OU-1 and OU-2, the highest concentrations of chloroform in the trespassing OSSM plume area are approximately three times higher than chloroform in groundwater located near the Unit 4 and 5 buildings. The OSSM plume and the Unit 4 plume are separated by an area of lower chloroform concentrations except in the northern portion of OU-1, where they become commingled. There is also an area of higher concentrations of chloroform and other VOCs in the vicinity of the former Beta Ditch in the eastern half of OU-1, likely associated with the use of the Beta Ditch by both OSSM and operations within OU-1.

As shown on Figures 4-10 and 4-11, the highest concentrations of chloroform in soil gas are generally within the OSSM plume and the Unit 4 plume, while the highest groundwater concentrations shown in Figure 4-12 are within the OSSM plume. The areas with the highest concentrations of carbon tetrachloride (Figures 4-13, 4-14, and 4-15) in soil gas and groundwater are associated with the OSSM plume, which contains this VOC in addition to chloroform. For 1,4-dichlorobenzene, the concentration plots show minimal impact in soil gas (Figures 4-16 and 4-17) throughout the OU-1 BHRA Area. The highest concentrations of 1,4-dichlorobenzene in shallow groundwater (Figure 4-18) are within the trespassing OSSM plume, which contains this VOC in addition to chloroform.

As shown on Figure 3-2, the OSSM plume bifurcates into two lobes in the northwest corner of OU-1. This bifurcation was caused by the presence of a topographic high of the less permeable Upper Muddy Creek Formation (UMCf) beginning near wells M-5A and MW-16 (NERT) and extending to the north near wells M-6A, M-7B, M-205, and M-206. This UMCf high is illustrated on the cross-section along the southern boundary of Former Parcels C & D

in Figure 3-3 (Subsurface Cross-Section F-F'). As shown on the cross-section, the UMCf high extends from approximately well M-6A to well M-206. The bifurcation of the OSSM plume would have occurred prior to the startup of the IWF in 1987 when groundwater levels were higher within OU-1. Under the current conditions shown on the cross-section, the groundwater level within OU-1 is generally below the contact between the alluvium and the UMCf. However, the groundwater levels measured in 1985 were approximately 20 ft higher in the central portion of OU-1 along the line of the cross-section causing the higher permeability alluvium to be saturated to the east of the UMCf high (Ramboll 2023b). Under these historical higher water levels, the OSSM plume bifurcated into the two lobes observed on the chloroform plume map as the groundwater flow followed the preferential pathways represented by saturated alluvium to the west and east of the UMCf high.

4.2.3 Temporal Trends of Chloroform in Soil Gas and Groundwater

As will be discussed in Sections 5.4.1 and 5.4.2 of this report, chloroform is the primary cancer risk driver in both soil gas and vapor migration to air from shallow groundwater. Besides chloroform, no other COPC had an estimated excess lifetime cancer risk greater than 1×10^{-6}. Chlorobenzene was the primary contributor to noncancer effects at all soil gas and groundwater locations though all calculated noncancer effects were below the NDEP and USEPA target of one. Therefore, chloroform is the only analyte examined temporally in this BHRA.

Soil Gas

To analyze the temporal trend of chloroform concentrations in soil gas in OU-1, soil gas samples collected from 5 feet bgs at nearby locations during the Phase B Investigation in May 2008, the Phase 2 RI Modification No. 11 in March 2019, and the Phase 3 RI Modification No. 9 in November 2019 were selected for time series plots. For this analysis, Phase 2 and Phase 3 soil gas samples taken within approximately 100 feet of Phase B samples were compared (see Table 4-3c; see Section 6.1.8). Since very limited soil gas samples at or around 15 feet bgs were collected during the 2008 Phase B Investigation, a temporal trend analysis was not conducted for deep soil gas samples.

As indicated in Figure 4-19, for soil gas sample locations within the trespassing OSSM plume (see Figure 3-1 and Table 4-3c), the chloroform concentrations at RISG-10/SG54 increased approximately 300% from 2008 to March 2019, then dropped approximately back to the 2008 level in November 2019; the chloroform concentrations at RISG-11/SG31 increased approximately 350% from 2008 to March 2019, then remained stable in November 2019; the chloroform concentration at RISG-12/SG83 dropped by more than half between 2008 and March 2019 and continued a downward trend in November 2019; and concentrations in RISG-84/SG61 decreased by 300% between 2008 and 2019.

For RISG-14/SG69 and RISG-15/SG71 near the Unit 4 Building, a source of chloroform in soil gas within the BHRA Area, the chloroform concentrations for RISG-14/SG69 dropped approximately 270% from 2008 to March 2019, then remained stable in November 2019 while they dropped by more than a factor of ten in RISG-15/SG71 over the same time period. These sample points are in the vicinity of other soil gas locations within the Unit 4 Building footprint, which do not have results available from nearby Phase B locations or at a depth of 5 feet bgs. The chloroform results at RISG-14 are similar in magnitude to the results from the locations within the Unit 4 Building footprint. Thus, the results from

RISG-14 (and Phase B location SG69) can be used to evaluate how the source of chloroform at the Unit 4 Building is changing over time. The chloroform concentrations at RISG-14/SG69 were significantly lower in 2019 than in 2008 indicating that there is a decreasing temporal concentration trend at the Unit 4 Building.

Other locations within the Unit 4 plume, RISG-20/SG84, RISG-22/SG28, and RISG-82/SG23, had low chloroform concentrations over all the sampling events. These samples indicate slight decreases or virtually no change in chloroform concentrations between the 2008 and 2019 sampling events. Chloroform concentrations at location RISG-13/SG89 decreased by a factor of approximately 40 between 2008 and 2019. This temporal analysis indicates a substantial decrease in soil gas chloroform concentrations between 2008 and 2019. Chloroform was not detected in any sampling event at RISG-90/SG48, which is located south of the unit buildings and not within either plume.

The chloroform groundwater plume (as shown in Figure 3-1), including the trespassing OSSM plume and the Unit 4 plume originating near the Unit 4 and 5 Buildings and downgradient of the former Beta Ditch, is discussed in detail in Section 4.2.5.

As presented in Figure 4-19, most of the concentrations measured in soil gas samples with high initial concentrations decreased substantially between the May 2008 sampling and the 2019/2020 sampling events. This was particularly evident in the two samples near the Unit 4 building. Others, along with those samples where the concentrations have always been low, showed mixed results.

Shallow Groundwater

To analyze the temporal trend of chloroform concentrations in shallow groundwater in OU-1, chloroform concentrations in selected wells from the OU-1 shallow groundwater BHRA data set (Appendix E) were plotted over the time period from 2015 to 2020 (see Figures 4-20 and 4-21a and 4-21b). The wells for the time series plots were selected based on the following criteria:

- Wells within the trespassing OSSM plume in the western portion of OU-1 or in and adjacent to the NERT chloroform plume;
- Wells sampled in at least three investigations (see Table 4-3c); and
- Wells with chloroform concentrations greater than the minimum RBTC for all scenarios, 150 µg/L).

The wells selected for time series plots within the OSSM plume were M-14A, M-57A, M-123, M-124, M-125, M-126, M-134, and M-135. The selected wells in the Unit 4 plume were M-2A, M-12A, M-22A, M-25, M-35, M-38, M-52, M-64, M-65, M-66, M-67, M-68, M-70, M-71, M-72, M-73, M-74, M-80, M-81A, M-133, M-141, and M-164. As indicated in Figure 4-20, the OSSM wells within the center of the plume, are at least one order of magnitude higher than the OSSM plume wells on the fringes of the plume. For wells in the trespassing OSSM plume, the chloroform concentrations in groundwater at wells M-123 and M-126 increased approximately 30% to 45% from 2015 to 2017, then dropped approximately 60% from 2017 to 2020 in groundwater at well M-123 but remained mostly stable from 2017 to 2020 in groundwater at well M-126 (changes within 10%). The chloroform concentrations

in groundwater at well M-125 remained mostly stable from 2015 to 2020 (changes within approximately 20%).

In Figure 4-21a, the chloroform concentrations in the Unit 4 plume are shown with the same vertical scale as in Figure 4-20 to illustrate chloroform concentrations are significantly lower within the Unit 4 chloroform plume as compared to the trespassing OSSM plume. The wells located in the trespassing OSSM plume with the highest concentrations are shown in Figure 4-21a and illustrate an approximate one order of magnitude difference between the OSSM plume and the Unit 4 plume. In Figure 4-21b, the chloroform concentrations in the Unit 4 plume are shown with a smaller scale to better illustrate the relative concentrations of chloroform in wells within and adjacent to the Unit 4 chloroform plume.

For most of the wells in and adjacent to the Unit 4 plume, the chloroform concentrations in groundwater either remained stable or decreased (see Figure 4-21b). The wells having a chloroform concentration exceeding 1,000 µg/L in 2015 dropped below 1,000 µg/L by 2020. Only five wells (M-64, M-71, M-72, M-74, and M-80 had chloroform concentrations in 2020 that exceed those measured in 2015. The largest percent change was at M-64 where the concentration increased from 33 µg/L in 2015 to 240 µg/L in 2020. The highest concentration measured in any of these five wells was at M-72 where the 2020 concentration was 740 µg/L compared to 560 µg/L in 2015.

Results for chloroform in groundwater presented in Figures 4-20, 4-21a, and 4-21b show that groundwater concentrations measured in the OSSM and Unit 4 plumes have either decreased slightly or remained stable over the years.

In summary, the chloroform concentrations in soil gas and groundwater showed a similar trend to decrease slightly or remain stable over the years.

4.2.4 Chloroform in Co-located Soil Gas and Groundwater Samples

A comparison of chloroform concentrations in co-located soil gas and shallow groundwater samples was conducted to support the assumption that groundwater is the source of chloroform detected in soil gas. The soil gas and shallow groundwater samples used to examine this assumption were collected within the same general timeframe, i.e., soil gas samples were collected during the Phase 2 RI Modification No. 11 in March 2019 or Phase 3 RI Modification No. 9 in 2019-2020 and shallow groundwater samples were collected during the Annual Groundwater Monitoring sampling event in May 2019.

As seen in Figure 3-1, no soil gas samples were obtained in the area with highest groundwater concentrations (Figure 3-2) in the Unit 4 chloroform plume. Soil gas sample (RISG-23) was originally proposed to be obtained from this area. The proposed location was on the northern berm of the Central Retention Basin within the area showing the highest groundwater concentrations. Due to the ongoing treatability studies immediately adjacent to the planned location and inaccessibility from steep grades, the soil gas location proposed in the Phase 2 RI Modification No. 11 was relocated to the southwest of the proposed location (Ramboll 2018b).

Correlation analysis between shallow groundwater samples and soil gas sample locations taken within approximately 100 feet of each other was conducted but is not presented.

Although strong, significant positive correlations were indicated when using all data, regression diagnostics tended to support the conclusion that distinct sets of data exist between the lower and higher concentrations. This was also indicated by the strength of the correlation being defined primarily by the sample pairs in the high concentration range.

The high concentrations of groundwater are collocated with the higher concentrations in the soil gas (both 5 and 15 feet bgs) while those with low concentrations of groundwater are collocated with low concentrations in the soil gas. This supports the CSM conclusion that groundwater, not shallow soil, is the source of chloroform detected in soil gas in the Operations area.

4.2.5 Comparison with Conceptual Site Model

In addition to the EDA steps discussed in the above sections, as part of the ongoing RI/FS, a comprehensive review and analysis of historical and recently collected sampling results was conducted to assess the magnitude and extent of chloroform impacts to soil, soil gas, and groundwater at the Site. The conclusions of the review and the results from the EDA are presented below in comparison with the expectations of the OU-1 CSM, as summarized in the RI Report for OU-1 and OU-2 (Ramboll 2023b). This section focuses on the comparison of EDA results to the CSM components of historical operations, sources of impacts, and migration and distribution of contaminants within the Operations Area.

As detailed in Section 9.4 of the RI Report for OU-1 and OU-2 (Ramboll 2023b), chloroform is the most prevalent VOC found in soil gas and groundwater in OU-1. Furthermore, the area with the highest concentrations of chloroform in OU-1 is associated with the trespassing OSSM plume. Based on the data presented in the RI Report for OU-1 and OU-2 (Ramboll 2023b) the trespassing dissolved OSSM plume has largely been mitigated by their GWETS, although some COPC migration is still occurring. However, a significant mass of Trespass Contaminants remains under the NERT property resulting from the uncontrolled migration of contaminants located on the OSSM site prior to the startup of their GWETS (the "Historic Mass"). This Historic Mass continues to migrate across the NERT property in a northeasterly direction, passes between OSSM's GWETS and NERT's Interceptor Well Field (Figure 1-4), and migrates north off of the NERT property and across Warm Springs Road (the boundary between OU-1 and OU-2, see Figure 4-7). In addition to the dissolved phase contaminants, a dense non-aqueous phase liquid (DNAPL) plume from the OSSM site continues to migrate onto the NERT property and, unlike the dissolved phase contaminants, is not mitigated by the OSSM GWETS. The DNAPL is present at depths of 100-120 feet bgs, while VOCs in the dissolved phase are present in the Shallow and Middle WBZs and affect concentrations in soil gas. Furthermore, the deep DNAPL will continue to serve as a long-term, uncontrolled source of groundwater and soil gas contamination in OU-1 until OSSM initiates remedial action to address the impacts of the DNAPL.

In addition to chloroform, OSSM-related VOCs that are detected in shallow groundwater near the western Site boundary include benzene, carbon tetrachloride, chlorobenzene, and dichlorobenzenes (1,2-, 1,3-, and 1,4-). These VOCs were not reportedly used in the industrial processes that occurred in OU-1 (except de minimis use of chlorobenzene and dichlorobenzene by Hardesty), which indicates their presence in groundwater in the western portion of OU-1 is a result of trespassing groundwater from the OSSM site. Additional details regarding the migration of dissolved COPCs and DNAPL into OU-1 from the OSSM

site are discussed in greater detail in Section 9 of the RI Report for OU-1 and OU-2, Revision 1 (Ramboll 2023b). The higher concentrations of these VOCs tend to be within the OSSM plume and decrease rapidly with distance due to their lower solubility, lower persistence, and high affinity to adsorb to soils. Figures 4-22a through 4-22f provide the distribution of the concentrations for each of these six VOCs in groundwater. As presented in the figures, elevated concentrations of these six VOCs are present on the western portion of the Site within the OSSM plume while significantly lower concentrations or no detectable concentrations of these six VOCs are present within the Unit 4 chloroform plume. These chemicals associated with the OSSM plume have not migrated as far eastward as chloroform due to their relative mobility in the subsurface as compared to chloroform. As shown on Figure 3-2, the OSSM chloroform plume and the Unit 4 chloroform plume are separated by an area of very low chloroform concentrations north of the Unit 3 Building. Only the dichlorobenzenes have been identified in other areas of OU-1 with detections that, while above the groundwater screening level, do not appear to be associated with the OSSM plume.

Further, no VOCs were identified as COPCs in soil in the OU-1 Soil BHRA Report, Revision 2 (Ramboll 2022a), indicating that most of the VOCs in OU-1 groundwater are trespassing chemicals that have migrated in groundwater from OSSM onto OU-1 and from former operations at the Unit 4 Building source area. As discussed in Section 4.2.4, although some strong positive correlations do exist between soil gas and shallow groundwater, the data shows the very high concentrations of groundwater are collocated with the higher concentrations in the soil gas (both 5 and 15 feet bgs) while those with low concentrations of groundwater are collocated with low concentrations in the soil gas. This supports the CSM conclusion that groundwater, not shallow soil, is the source of chloroform detected in soil gas in the Operations area. Additionally, soil gas concentrations generally increase with depth, indicating that VOCs present in soil gas are migrating upward from groundwater rather than a shallow vadose zone source associated with a surface spill. This increase is evident when comparing the soil gas samples collected at the five-foot interval to those near the fifteen-foot interval collected during the Phase 2 and Phase 3 sampling events as shown in Figures 4-23a and 4-23b[23]. Table 4-10 provides the percent difference between the co-located five-foot and fifteen-foot sample concentrations. For all but four samples, the concentration in the fifteen-foot sample is larger than the concentration in the five-foot sample. The average percent difference in the concentrations between the five-foot and fifteen-foot samples was 234%. Excluding those samples where the concentration in the five-foot was larger than the concentration in the fifteen-foot the average percent difference for the other samples was 280%. If the highest percent difference is excluded, the average percent difference was 212% including all sample concentrations and 257% if those with five-foot sample concentrations greater than the fifteen-foot sample concentrations were also excluded.

When evaluating VOC concentrations in other portions of the Operations Area not associated with the trespassing OSSM plume, chloroform concentrations in shallow groundwater are approximately one to five orders of magnitude lower than concentrations along the western

[23] Sample locations presented in Figure 4-23a had at least one of the two concentrations in excess of 10,000 µg/m^3. Sample locations with concentrations less than 10,000 µg/m^3 in both 5 feet and 15 feet are presented in Figure 4-23b.

boundary of OU-1. In general, the highest chloroform concentrations outside the trespassing OSSM plume are in the vicinity and downgradient of the former Beta Ditch, related to the Unit 4 chloroform plume and in part to historical wastewater discharges. The groundwater barrier wall was constructed in 2001 as a physical barrier across the higher concentration portion of the Unit 4 plume (Figure 4-1). The IWF captures groundwater with higher chloroform concentrations and is located downgradient of OU-1 source areas. The interceptor wells and barrier wall have significantly decreased chemical concentrations in the alluvium downgradient of the IWF (Ramboll 2021d).

In the Unit 4 and 5 Buildings area, the presence of elevated chloroform concentrations was observed in groundwater at deeper depths as well as in soil gas, but chloroform concentrations were relatively low in the shallow WBZ. The presence of chloroform in this area is believed to have been released during former operations at the Unit 4 and 5 Buildings, but no written records documenting the use of chloroform in manufacturing operations have been identified.

In summary, the soil gas and shallow groundwater data are consistent with the expectations of the OU-1 CSM, indicating that the highest concentrations of VOCs in OU-1 groundwater are associated with trespassing chemicals that have migrated in groundwater from the OSSM site onto OU-1, and groundwater is the source of VOCs detected in soil gas in the Operations Area. Elevated chloroform concentrations in groundwater are also present in the eastern portion of the BHRA area originating from the Unit 4 Building and the former Beta Ditch but at lower concentrations than within the OSSM trespassing plume.

5. BASELINE HEALTH RISK ASSESSMENT

The following sections present the BHRA for evaluating potential health risks associated with vapor migration from soil gas and shallow groundwater, which includes the following elements:

- Identification of COPCs;
- Exposure assessment;
- Toxicity assessment; and
- Risk characterization.

This BHRA has been prepared consistent with the methodology described in the BHRA Work Plan for OU-1 and OU-2 Soil Gas and Groundwater, Revision 1 (Ramboll 2018a), and follows the procedures outlined in USEPA's *Risk Assessment Guidance for Superfund: Volume I—Human Health Evaluation Manual* (USEPA 1989). Other guidance documents consulted in preparing the BHRAs include:

- *Exposure Factors Handbook* (USEPA 2011a);
- *Soil Screening Guidance: Technical Background Document* (USEPA 1996);
- *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (USEPA 2002);
- *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual* (Part F, Supplemental Guidance for Inhalation Risk Assessment) (USEPA 2009a);
- Office of Solid Waste and Emergency Response *(OSWER) Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air* (USEPA 2015);
- *Technical and Regulatory Guidance, Vapor Intrusion Pathway: A Practical Guideline* (Interstate Technology & Regulatory Council [ITRC] 2007);
- *User's Guide and Background Technical Document for NDEP Basic Comparison Levels (BCLs) for Human Health for the BMI Complex and Common Areas* (NDEP 2023b); and
- *Soil Physical and Chemical Property Measurement and Calculation Guidance, BMI Plant Sites and Common Areas Projects, Henderson, Nevada* (NDEP 2010c).

5.1 Identification of COPCs

All volatile compounds detected in one or more soil gas or shallow groundwater samples in the BHRA data sets described in Section 4 above were selected as COPCs. The list of soil gas and shallow groundwater COPCs is presented in Table 5-1. A total of 66 COPCs were identified for soil gas collected at 5 feet bgs and a total of 60 COPCs were identified for soil gas collected at or around 15 feet bgs. A total of 34 COPCs were identified for shallow groundwater. Of the soil gas and shallow groundwater COPCs, six COPCs (benzene, carbon tetrachloride, chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, and

1,4-dichlorobenzene) are primarily associated with the trespassing OSSM plume (Ramboll 2023b) (see Section 4.2.5).

5.2 Exposure Assessment

The exposure assessment analyzes chemical releases and the physical setting, identifies exposed populations and exposure pathways, and estimates exposure concentrations and chemical intakes for the identified pathways. This exposure assessment includes the updated OU-1 CSM, fate and transport modeling, and exposure assumptions and calculations, as discussed in the following sections.

5.2.1 Conceptual Site Model and Exposure Scenarios

To evaluate the human health risks posed by a site, it is necessary to identify the populations that may potentially be exposed to the chemicals present and to determine the pathways by which these exposures may occur. Specifically, a CSM outlines information relevant to conducting the exposure assessment by 1) evaluating potential chemical sources and releases, 2) identifying populations that could potentially be exposed to chemicals present, and 3) identifying complete exposure pathways and routes through which human exposure might occur. The CSM is an important tool in guiding site characterization, evaluating data quality in the context of potential risks to exposure populations, and developing exposure scenarios.

Development of the CSM is an iterative process; the CSM is revised, as appropriate, over the course of an RI based on additional information and understanding gained following review of existing and newly collected data. A CSM was first developed for the NERT Site in 2005 based on the information available at that time (ENSR 2005). The 2005 CSM presented detailed information on the LOU source areas identified by NDEP, summarized available analytical results for each LOU, and identified site-related chemicals based on a review of the activities and/or processes associated with each LOU. Potential contaminant migration pathways and receptors were also described. The CSM was updated in 2014 during development of the RI/FS Work Plan (ENVIRON 2014b) and addressed both the NERT Site and downgradient areas (the extent of the RI Study Area at the time), which provided a refined, but still preliminary, identification of sources, release mechanisms, exposure media, exposure routes, and potentially exposed populations based on a then current understanding of on-Site and off-Site environmental conditions. In this BHRA, the CSM for the Operations Area in OU-1 has been updated by incorporating the findings from the RI Report for OU-1 and OU-2 (Ramboll 2023b) and is presented in Figure 5-1. The historical operations, sources of impacts and migration, and distribution of contaminants are discussed in Section 4.2.5 as the last step of the DUE, while the elements of the OU-1 CSM as part of the exposure assessment in the BHRA are discussed below.

5.2.1.1 Potential Chemical Sources and Release Mechanisms

In 1994, NDEP identified 70 LOUs[24] at the Site (NDEP 1994, Figure 2-2), which consisted of areas that were then used for chemical production (e.g., Unit Buildings 4 and 5), areas that

[24] NDEP identified 69 source areas referred to as LOUs in their document (NDEP 1994). Subsequently, an additional potential source area, the former U.S. Vanadium site, was identified during planning for the 2008 Phase B Investigation (NDEP 2011). Although not formally designated as an LOU, the U.S. Vanadium site is commonly referred to as LOU-70.

are no longer active (e.g., the former AP Plant and associated facilities), and/or areas where near surface soil contamination has been addressed (e.g., former surface water impoundments that have been closed). As discussed in Section 3.1.1, among these LOUs, a total of 18 LOUs within the Operations Area were identified as potential sources of VOCs or in areas where VOCs had been detected in soil or groundwater (ENSR 2008a).

In addition to sources of contamination present within OU-1, contaminated surface soils and groundwater associated with industrial operations on the OSSM site are considered potential former and/or current off-Site sources of contaminants to OU-1 (Figure 2-1). Particularly, the trespassing OSSM plume, which originates on the adjacent OSSM site and enters OU-1 along the western boundary, is a source of VOCs (Ramboll 2023b).

Historical releases from potential source areas have been documented or inferred from field investigations. As indicated in the CSM (Figure 5-1), chemicals were released from sources in OU-1 and neighboring sites through several primary release mechanisms, such as spills/leaks and infiltration/overtopping to soils and runoff to surface water from potential sources within OU-1, as well as groundwater transport (particularly from the west of OU-1), storm water runoff to soils, wind erosion/mechanical disturbance of surface soil particulates to outdoor air, and volatilization of VOCs in soil to outdoor air from potential off-Site sources. In addition to the potential primary release mechanisms, secondary/tertiary release mechanisms included wind erosion/mechanical disturbance of surface soil particulates to outdoor air, migration of VOCs in the subsurface through the soil column to indoor air, outdoor air, or trench air, and leaching from soils to groundwater. The potentially contaminated exposure media in the Operations Area include air, soil, and groundwater. Potential exposures to surface water (i.e., runoff) by on-Site populations were not quantitatively evaluated in the BHRA because such exposures would be intermittent and of short duration.

5.2.1.2 Potentially Exposed Human Populations and Exposure Pathways

The identification of potentially exposed populations and exposure pathways is supported by the CSM. For a complete exposure pathway to exist, all of the following elements must be present (USEPA 1989):

- A source and mechanism for chemical release;
- An environmental transport medium (i.e., air, water, soil);
- A point of potential human contact with the exposure medium; and
- A route of exposure (e.g., inhalation, ingestion, dermal contact).

As detailed in the RI Report for OU-1 and OU-2 (Ramboll 2023b) and noted previously, the land within OU-1 is currently used by the Trust for groundwater treatment operations and is used by its tenant EMD for the operation of a chemical manufacturing business. It is currently contemplated that future land use in the Operations Area will still be restricted to industrial and/or commercial purposes through a land-use covenant. Accordingly, the potentially exposed populations evaluated in the BHRA for the Operations Area are indoor commercial/industrial workers, outdoor commercial/industrial workers, and short-term construction workers, consistent with the BHRA Work Plans (ENVIRON 2014a; Ramboll 2018a) and USEPA guidance (2002).

Other potentially exposed populations, such as visitors or trespassers, do not warrant additional assessment; as discussed by USEPA (2002), evaluation of exposures to members of the public under a non-residential land-use scenario is generally not warranted, based on the following considerations:

- Public access is generally restricted at industrial sites; and
- While the public may have access to commercial sites, workers have a much higher exposure potential because they spend substantially more time at a site.

Current and future receptors outside of the Operations Area include indoor and outdoor commercial/industrial workers as well as residents located outside the Operations Area boundaries who could be exposed to airborne chemicals (vapors and particulates) emitted during routine operations or construction projects (USEPA 2002). The Operations Area is located within the BMI complex, surrounding by several industrial facilities, including the OSSM site and BMI CAMU to the west, Lhoist North America Facility (surrounded by OU-1), the Titanium Metals Corporation (TIMET) property to the east, and various industrial facilities to the north and south. The nearest residents are located approximately 1,550 feet away from the northern OU-1 boundary and approximately 500 feet away from the southern OU-1 boundary. A qualitative discussion of the potential risks to populations outside of the Operations Area to the west, east, and south of OU-1 is presented in Section 6.2.2.1. The potential risks to populations to the north of OU-1 within OU-2 were evaluated in the BHRA for OU-2 Soil Gas and Groundwater, Revision 1 (Ramboll 2023a).

This BHRA focused on the vapor intrusion pathways associated with VOCs migrating from soil gas and shallow groundwater in the Operations Area. Based on the source and release mechanisms presented in the CSM, the following receptor populations and exposure pathways were identified for quantitative evaluation:

- Indoor commercial/industrial workers: Inhalation of vapors migrating from soil gas/shallow groundwater to indoor air
- Outdoor commercial/industrial workers: Inhalation of vapors migrating from soil gas/shallow groundwater to outdoor air
- Construction workers: Inhalation of vapors migrating from soil gas/shallow groundwater to trench air

In addition, a basement scenario was evaluated for indoor commercial/industrial workers present at locations within the area of the Unit Buildings, and a trailer scenario was evaluated for indoor commercial/industrial workers present at locations within the area of office trailers used by the Trust and its contractor, Envirogen Technologies, Inc. (Envirogen). To be conservative, construction workers were assumed to be exposed to vapors migrating from soil gas and/or shallow groundwater while standing in a 10-foot trench in the unsaturated zone, placing them closer to the potential source.

The potential risks from exposures of populations in the Operations Area to vapors from soil gas and shallow groundwater within neighboring sites were not evaluated quantitatively in this BHRA. The trespassing OSSM plume, which originates on the adjacent OSSM site to the west of OU-1, is a source of VOC contamination within OU-1 and the Operations Area.

Historical and ongoing groundwater transport from the OSSM site is the dominant release mechanism of VOCs, the impacts of which were quantitatively evaluated in this BHRA using soil gas and shallow groundwater data from the Operations Area. Other neighboring sites are either not the major source of VOCs (i.e., BMI CAMU, Lhoist North America Facility) or located cross-gradient of the Operations Area (i.e., TIMET sites). Exposure of populations in the Operations Area to VOCs volatilized from soil gas or shallow groundwater into ambient air at locations outside of the Operations Area is expected to be much lower than exposure to VOCs migrating from the subsurface. The potential risks from exposures of populations in the Operations Area to vapors from soil gas and shallow groundwater from neighboring sites are qualitatively discussed as presented in Section 6.2.2.1.

It should be noted that complete direct-contact exposure pathways for surface and near surface soils (i.e., ingestion, dermal contact, and inhalation of soil particulates) have also been identified in the Operations Area. This is presented in a separate BHRA Report for soil in the Operations Area of OU-1 (Ramboll 2022a) and was approved by NDEP on June 2, 2022 (see details in Section 1.1). The cumulative risks associated with potential exposures to chemicals in OU-1 soil and to volatile compounds in air migrating from OU-1 soil gas and groundwater were evaluated in the OU-1 Soil BHRA Report, Revision 2. The estimated cumulative risks in this report have not changed.

Exposure via domestic use of groundwater was not evaluated because groundwater is not and will not be used as a domestic water supply within the Operations Area. Incidental ingestion of and dermal contact with groundwater during short-term construction activities are not considered complete exposure pathways due to the groundwater depth being greater than 10 feet bgs.

5.2.2 Fate and Transport Modeling

Fate and transport modeling was conducted to characterize the VOCs migrating from soil gas or groundwater into indoor air, outdoor air, and trench air for the on-Site workers in the OU-1 BHRA Area.

The migration of VOCs detected in soil gas (originating from groundwater sources) or shallow groundwater is quantified for the purposes of this assessment through an intermedia transfer factor. When the transfer factor is multiplied by the source concentration of a chemical in soil gas (in microgram per cubic meter [$\mu g/m^3$]) or shallow groundwater (in µg/L), the product is the predicted steady-state concentration in indoor, outdoor, or trench air (in $\mu g/m^3$). This represents the EPC in the exposure medium (i.e., air) to which a receptor (i.e., a member of a potentially exposed population) is exposed over an assumed duration of exposure. In general, we use the term "transfer factor" to refer to transport from either soil gas or groundwater to air in lieu of the term "attenuation factor", which is applicable to only transport from soil gas to air (i.e., within the same medium). For groundwater, the transfer factor is the product of a partitioning factor (from groundwater to soil gas) and an attenuation factor (from soil gas to air). For soil gas, the transfer factor is equal to the attenuation factor, but we use the term transfer factor for consistency.

For populations in the Operations Area, transfer factors were developed for the following scenarios:

- Transport of soil gas from 5 feet bgs into a commercial/industrial slab-on-grade building;
- Transport of soil gas from 15 feet bgs into a commercial/industrial slab-on-grade building;
- Transport of soil gas from 5 feet bgs to outdoor air;
- Transport of soil gas from 15 feet bgs to outdoor air;
- Transport of soil gas from 5 feet below the base or beside the walls into a 10-foot construction trench;[25]
- Transport of soil gas from 5 feet below the base or beside the walls into a commercial/industrial slab-on-grade building with a 10-feet basement;[26]
- Transport of soil gas from 5 feet bgs into a commercial/industrial trailer used as an office;
- Transport of soil gas from 15 feet bgs into a commercial/industrial trailer used as an office;
- Transport of vapors from groundwater at 25 feet bgs migrating into a commercial/industrial slab-on-grade building;
- Transport of vapors from groundwater at 25 feet bgs migrating to outdoor air;
- Transport of vapors from groundwater at 25 feet bgs migrating into a 10-foot construction trench;
- Transport of vapors from groundwater at 25 feet bgs migrating into a commercial/industrial slab-on-grade building with a 10-feet basement; and
- Transport of vapors from groundwater at 25 feet bgs migrating into a commercial/industrial trailer used as an office.

The intermedia transfer factors were calculated using the screening-level model described by Johnson and Ettinger (1991). Specifically, the USEPA Spreadsheet Modeling Subsurface Vapor Intrusion, version 6.0 (USEPA 2017) was used. The Johnson and Ettinger model was originally developed to predict vapor intrusion into buildings using a combination of diffusion and advection. However, as described below, it is easily adapted to predict vapor intrusion into outdoor air or trench air. The calculation of transfer factors was based on the properties of the chemicals evaluated (Table 5-2), and the parameters describing the vadose zone, the surface barrier, and the air dispersion zone (Table 5-3), as discussed below.

Based on the USEPA *Regional Screening Levels User's Guide* (USEPA 2023b), only chemicals that easily volatilize were included in the evaluation of vapor migration. These include chemicals with a Henry's Law constant of greater than 1 x 10^{-5} atm-m^3/mol or a vapor pressure of greater than 1 mm Hg. The physical/chemical properties along with the sources

[25] A 15-foot soil gas sample is assumed to be 5 feet below the base of the trench and a 5-foot soil gas sample is assumed to be 5 feet away from the sides of the trench.

[26] A 15-foot soil gas sample is assumed to be 5 feet below the basement slab and a 5-foot soil gas sample is assumed to be 5 feet away from the sides of the building.

for all the analytes in the soil gas and shallow groundwater BHRA data sets (Appendices D and E) are presented in Table 5-2. In general, priority is given to the most recent physical/chemical data as well as the most relevant data for a site located in Nevada. As such, the hierarchy for selecting physical/chemical properties was:

1. NDEP values from the BCL table (NDEP 2023a);
2. USEPA values from the Johnson and Ettinger model (USEPA 2017);
3. USEPA values from the regional screening level (RSL) tables (USEPA 2023a); and
4. USEPA values from EPISuite (USEPA 2012) combined with using surrogate chemicals for diffusivities in air and water.

As reported in the draft 2010 Site-Wide Soil Gas HRA (Northgate and Exponent 2010b), soil samples were collected to determine soil properties representative of the unsaturated zone in the Operations Area. Soil samples were collected at 16 locations at depths of 9 to 15 feet bgs (mostly at 10 feet) throughout the Operations Area to determine volumetric water content, total porosity, dry bulk density, and grain density in accordance with NDEP guidance (NDEP 2010c). The average of the 15 soil property results measured from 9-10 feet bgs (as shown in Table 5-4) within the Operations Area was used for modeling purposes in this BHRA. One sample collected at a depth of 15 feet bgs was not included as it represents wetter than average conditions within the Operations Area. Soil sampling locations and boring logs are included in Appendix F.

A review of OU-1 stratigraphy and boring logs indicated that these soil samples collected at 9-10 feet bgs are representative of the entire Qal stratigraphic unit and there is not expected to be significant variation laterally or with depth within that stratigraphic unit. In general, the groundwater table occurs between zero and 10 feet below the base of the Qal in the underlying fine-grained UMCf. In some places, the groundwater table occurs above the base of the Qal. For simplicity and to be conservative, the entire vadose zone was modeled as Qal with no UMCf included. Each soil sample was also plotted on a ternary diagram to determine the soil type for Johnson and Ettinger modeling. The soil samples clustered near the border between sand and loamy sand, with the average soil type being loamy sand (Table 5-4). This is generally consistent with the soil types identified in soil borings within OU-1 (Ramboll 2023b), including poorly sorted gravel, silty gravel, poorly sorted sand, well sorted sand, and silty sand.

Depth to groundwater in OU-1 was determined by evaluating both current and historic groundwater elevations for non-artesian wells within the Operations Area. Depth to groundwater ranges from approximately 20 to 60 feet bgs (Table 4-3), with the majority of the measurements between 30 and 45 feet bgs. To be conservative, a depth of groundwater of 25 feet bgs was selected for modeling.

The modeling parameters are presented in Table 5-3. The Johnson and Ettinger modeling files are included in Appendix G. A conservative default commercial/industrial building was assumed for the indoor air scenario with an enclosed floor space area of approximately 16,146 square feet (or 1,500 square meters) (USEPA 2017). A default air exchange rate of 1.5 air changes per hour for a commercial/industrial building was used, and a default building height of three meters was assumed (USEPA 2017). In addition to a slab-on-grade

scenario for indoor commercial/industrial workers, a basement scenario and a trailer scenario for indoor commercial/industrial workers were also evaluated. The basement scenario assumed a basement depth of 10 feet with the same slab-on-grade foundation, enclosed floor dimensions, and air exchange rate as a default commercial/industrial building. Further, the model assumed the soil gas source could be 5 feet away from any part of the basement (i.e., wall or bottom). Therefore, the transfer factors for soil gas migrating from 5 feet below the base or beside the walls into a commercial/industrial slab-on-grade building with a 10-feet basement were used in the exposure scenario for soil gas collected at 5 feet bgs and at or around 15 feet bgs. The trailer scenario assumed a dirt floor without a building foundation (i.e., the building foundation thickness was assumed to be zero) with the same enclosed floor dimensions and air exchange rate as a default commercial/industrial building.

When modeling the above-ground outdoor air scenario, the site-specific dispersion factor (Q/C) model described in USEPA (2002) was used assuming the entire size of the Operations Area (i.e., 259 acres) as the source area. For the construction trench scenario, a box model was used to simulate dispersion. Construction trench dimensions of 10 feet deep, 20 feet long, and 5 feet wide were assumed. For this box model, the air flow through the construction trench was controlled by a windspeed within the Operations Area that was reduced by a factor of 10 to ensure it would be conservative for a construction trench scenario where the breathing zone may be a few feet bgs. The flux of VOCs from the source assuming unit concentration into the trench air was calculated using the effective diffusion coefficient through the unsaturated zone estimated in the Johnson and Ettinger model spreadsheet (USEPA 2017). The transfer factors were estimated by dividing the flux into the trench air with dispersion factors. Further, VOCs were assumed to be emitted from all the trench walls in addition to the base of the trench. Therefore, the transfer factors for soil gas migrating from 5 feet below the base or beside the walls into a 10-foot construction trench were used in the exposure scenario for soil gas collected at 5 feet bgs and at or around 15 feet bgs. The transfer factors for groundwater migrating from 25 feet bgs into a trench were conservatively assumed to be emitted from 15 feet from all the trench walls and below the base of the trench.

The vapor intrusion calculations used to predict the transfer factors for each scenario, using chloroform as an example, are provided in Appendix G-1 of this report.

Benzene readily biodegrades under natural aerobic conditions in shallow soil. In the NERT RI Study Area, measured concentrations of benzene at shallower depths are consistently lower than would be predicted from deeper sources (soil gas and groundwater) using the Johnson and Ettinger model which conservatively assumes that there is no biodegradation. Consistent with the BHRA Work Plan, the BioVapor model (American Petroleum Institute [API] 2012) was used to calculate the relative impact of benzene biodegradation within the unsaturated zone for all soil gas and groundwater scenarios. BioVapor is virtually identical to the Johnson and Ettinger model except it includes biodegradation. The model breaks the soil into a shallow soil layer near the surface where oxygen is present and first-order biodegradation occurs, and a deeper anaerobic layer where no biodegradation occurs. To quantify the effect of biodegradation in the unsaturated zone, the ratio of the BioVapor results with biodegradation and without biodegradation was calculated. This ratio was then multiplied by the indoor and outdoor Johnson and Ettinger transfer factors for benzene

calculated using the approach described above. Consistent with the 2018 BHRA Work Plan, biodegradation was only quantified for benzene. The input parameters for this calculation are also presented in Table 5-3. The biodegradation rate for benzene used in the evaluation is the BioVapor default value, which represents the median of measured rates for benzene, ethylbenzene, toluene, xylenes, and alkylbenzenes. The biodegradation ratios for soil gas migrating to outdoor air are conservatively estimated using the ratios calculated for soil gas migrating to commercial indoor air. The biodegradation ratios for soil gas migrating to the air in the trailers are conservatively estimated using the ratios calculated for soil gas migrating to residential indoor air. The BioVapor modeling files along with a summary table of biodegradation ratio for the scenarios for benzene are included in Appendix G-2.

Tables 5-5 and 5-6 summarize the transfer factors for analytes migrating from soil gas and shallow groundwater to indoor air, outdoor air, and trench air. The conservative nature of the model input parameters and modeling uncertainties are discussed in Section 6.2.2.3.

5.2.3 Exposure Assumptions and Calculations

The magnitude of exposure for any given receptor is a function of the amount of chemical in the exposure medium (e.g., air, groundwater, soil), and the frequency, intensity, and duration of contact with that medium. In order to quantify inhalation exposures, the air EPC adjusted by the intake factor, rather than exposure dose, is used as the basis for estimating inhalation risks based on *Risk Assessment Guidance for Superfund, Part F, Supplemental Guidance for Inhalation Risk Assessment* (USEPA 2009a).

The exposure assessment in this BHRA is based on a reasonable maximum exposure (RME) scenario, which is defined by USEPA as the highest exposure that could reasonably be expected to occur for a given exposure pathway at a site (USEPA 1989). The intent of the RME is to estimate a conservative exposure case (i.e., well above the average case) that is still within the range of possible exposures. As shown in Table 5-7, exposure assumptions recommended by NDEP (2023b) were used for indoor and outdoor commercial/industrial workers. For construction workers, exposure assumptions recommended by USEPA (2023b) were used. In addition, a construction trench scenario was evaluated assuming that construction workers could be exposed to volatile compounds migrating from soil gas and shallow groundwater to air in a construction trench when conducting excavation activities for four hours per day, 30 days per year, for one year per NDEP's comment on the soil gas HRA for Parcels C, D, F, G, and H (NDEP 2017, General Comment #3).

The intake factor for inhalation of volatile compounds migrating from soil gas or shallow groundwater to air was calculated using the following equation (USEPA 2009a):

$$IF_{inh} = \frac{ET \times EF \times ED}{AT \times CF}$$

where:

IF_{inh}	=	Intake Factor for inhalation (unitless)
ET	=	Exposure Time (hour/day)
EF	=	Exposure Frequency (day/year)

ED	=	Exposure Duration (year)
AT	=	Averaging Time (day)
CF	=	Conversion Factor (hour/day)

For carcinogens, the intake factor averaged over a 70-year lifetime was used in the risk characterization, while for noncarcinogens, the intake factor averaged over the exposure period was used (USEPA 1989).

5.3 Toxicity Assessment

The purpose of toxicity assessment is to present the weight-of-evidence regarding the potential for a chemical to cause adverse effects in exposed individuals, and to quantitatively characterize, where possible, the relationship between exposure to a chemical and the increased likelihood and/or severity of adverse effects (i.e., the dose-response assessment). Well conducted epidemiological studies that show a positive association between exposure to a chemical and a specific health effect are the most convincing evidence for predicting potential hazards for humans. However, human data that would be adequate to serve as the basis for the dose-response assessment are available for only a few chemicals. In most cases, toxicity assessment for a chemical has to rely on information derived from experiments conducted on non-human mammals, such as rat, mouse, rabbit, guinea pig, hamster, dog, or monkey.

Chemicals are usually evaluated for their potential health effects in two categories, carcinogenic and noncarcinogenic. Different methods are used to estimate the potential for carcinogenic and noncarcinogenic health effects to occur. Several chemicals produce noncarcinogenic effects at sufficiently high doses but only some chemicals are associated with carcinogenic effects. Most regulatory agencies consider carcinogens to pose a risk for cancer at all exposure levels (i.e., a "no-threshold" assumption); that is, any increase in dose is associated with an increase in the probability of developing cancer. In contrast, noncarcinogens generally are thought to produce adverse health effects only when some minimum exposure level is reached (i.e., a threshold dose).

Inhalation unit risks (IURs), which are expressed in units of $(\mu g/m^3)^{-1}$, are chemical specific and experimentally derived potency values that are used to calculate the risk of cancer resulting from inhalation exposure to potentially carcinogenic chemicals. The IUR is defined as an upper-bound estimate of the probability of an individual developing cancer per unit concentration of a potential carcinogen over a lifetime. With IURs, a higher value implies a more potent carcinogenic potential.

Noncancer inhalation reference concentrations (RfCs), which are expressed in units of $\mu g/m^3$, are experimentally derived levels not expected to cause adverse health effects that are used to quantify the extent of toxic effects other than cancer due to inhalation exposure to chemicals. The RfC is intended to represent the concentration of a chemical that is not expected to cause adverse health effects, assuming daily exposure over the exposure duration, even in sensitive individuals, with a substantial margin of safety. With RfCs, a lower value implies a more potent toxicant.

For chemicals analyzed in soil gas and shallow groundwater, an initial list of chronic toxicity values was developed based on the values used by NDEP for the derivation of the 2020 BCLs (NDEP 2023a). For most chemicals in the BCL table, NDEP selected toxicity values from the USEPA's Integrated Risk Information System (IRIS); however, on a case-by-case basis, values provided by other sources (e.g., California Office of Environmental Health Hazard Assessment [OEHHA] Toxicity Criteria Database) were selected over the IRIS values. For chemicals not included in IRIS, NDEP relied on other sources for toxicity values. Ramboll checked the chronic toxicity values from the 2023 BCL table against the identified source to confirm that the most current values were being used. Particularly, the most recent toxicity values from IRIS (USEPA 2023a) were used for trimethylbenzenes and benzo[a]anthracene.

For chemicals not listed in the 2023 BCL table, the following approach was used:

- Toxicity values from IRIS were selected; if a toxicity value was not available in IRIS, toxicity values from the USEPA RSL table (USEPA 2023a) were used; and
- For chemicals for which toxicity values are not available from any of the sources listed, the toxicity values from surrogate chemicals (chemicals with similar chemical structure) were used, when available.

For construction workers assumed to be present in the Operations Area for one year, subchronic toxicity values were used whenever available for the evaluation of adverse noncancer effects in accordance with recommendations by USEPA (2023b). The subchronic toxicity values were obtained from the USEPA RSL subchronic toxicity table (USEPA 2023c).

Route-to-route extrapolation was not applied, which is consistent with the updated BCL Guidance (NDEP 2023b) and *Risk Assessment Guidance for Superfund, Part F, Supplemental Guidance for Inhalation Risk Assessment* (USEPA 2009a).

In addition, for each carcinogen, the USEPA weight-of-evidence classification was also identified.

The chronic and subchronic toxicity values for all the analytes in the soil gas and shallow groundwater BHRA data sets (Appendices D and E) are presented in Table 5-8. The uncertainties in the selection of toxicity values are further discussed in Section 6.2.3.

5.4 Risk Characterization

Risk characterization represents the final step in the risk assessment process. In this step, the results of exposure and toxicity assessments are integrated into quantitative or qualitative estimates of potential health risks. In order to evaluate the potential human health risk from each exposure medium (i.e., soil gas and shallow groundwater) to the potentially exposed populations within the Operations Area, cancer and noncancer RBTCs, representing the concentrations of a chemical protective of human health, were first developed for all the analytes in the soil gas and shallow groundwater BHRA data sets (Appendices D and E). Then, potential excess lifetime cancer risks and noncancer adverse health effects for each soil gas and shallow groundwater COPC were characterized separately by comparing concentrations of COPCs in soil gas and shallow groundwater (i.e., maximum detected concentrations at each individual sample location for indoor air and

trench air scenarios and 95% upper confidence limit [UCL] on the average concentrations over the entire Operations Area for the outdoor air scenario) to the cancer and noncancer RBTCs. In addition, 0.1xRBTC was used to evaluate the SQLs for the non-detects as discussed in Section 4.1.5. The uncertainties associated with the SQLs higher than 0.1xRBTC are discussed in Section 6.1.2.

NDEP cites the NCP (40 CFR § 300) as the basis for NDEP's establishment of the target cancer risk range (NDEP 2023b). According to the NCP, lifetime incremental cancer risks posed by a site should be less than or within the cancer risk management range of 1×10^{-6} to 1×10^{-4}. According to the NCP and NDEP (2023b), noncarcinogenic chemicals should not be present at levels expected to cause adverse health effects (i.e., a hazard index [HI] greater than one). As a conservative measure, the cancer RBTCs were calculated to correspond to a target cancer risk of 1×10^{-6} (to the lower end of the target risk range), and the noncancer RBTCs were calculated to correspond to a target hazard quotient (HQ) of one.

It should be noted that the cancer risk and noncancer hazard estimated in this BHRA do not represent absolute estimates in the Operations Area, since generic and conservative assumptions were used when values specific to the Operations Area were not available, which are likely to overestimate actual exposures and calculated risks. Exceedance of the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4} or the target noncancer HI of greater than one does not indicate that adverse impacts to human health are occurring or will occur, but it suggests that further evaluation may be warranted.

Consistent with USEPA guidance (2015), soil gas data collected within the Operations Area during the RI were used to evaluate potential exposure for current and future workers via inhalation of vapors migrating from the subsurface to indoor air, outdoor air, and trench air. The soil gas data used in this BHRA were specifically collected to evaluate the vapor intrusion pathway. Soil gas data is generally the preferred line of evidence for assessing vapor intrusion risks as opposed to groundwater or soil data primarily due to higher uncertainties associated with vapor intrusion modeling based on groundwater or soil data (i.e., uncertainties in predicting contaminant partitioning from groundwater or soil moisture to soil gas and in predicting transport through the capillary fringe). In addition, shallow groundwater data were incorporated in this BHRA to provide a secondary line of evidence for the vapor intrusion risk analysis and to check consistency between soil gas and groundwater results.

5.4.1 Soil Gas

5.4.1.1 Cancer Risks

The excess lifetime cancer risk is estimated as the upper-bound incremental probability of an individual developing cancer over a lifetime (i.e., 70 years) as a result of exposure to a potential carcinogen at a given concentration. The equation used to calculate soil gas cancer RBTCs for vapor migration to air is as follows:

$$RBTC_{SG.c} = \frac{TR}{IF_{inh} \times a \times IUR}$$

where:

$RBTC_{SG.c}$	=	Risk-Based Target Concentration, soil gas, carcinogenic endpoint (µg/m^3)
TR	=	Target Risk (unitless)
IF_{inh}	=	Inhalation Intake Factor (unitless)
α	=	Transfer Factor for soil gas migrating to air (µg/m^3 per µg/m^3)
IUR	=	Inhalation Unit Risk (µg/m^3)$^{-1}$

The cancer RBTCs for all the analytes in the soil gas BHRA data set (Appendix D) are presented in Tables 5-9 through 5-11 for indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers, respectively.

The equation used to calculate excess lifetime cancer risks due to exposure via inhalation of VOCs migrating from soil gas to air is as follows:

$$Cancer\ Risk = \frac{Soil\ Gas\ Concentration}{Cancer\ RBTC} \times 10^{-6}$$

Soil gas data collected from 2019 Phase 2 RI Modification No. 11 and 2019-2020 Phase 3 RI Modification No. 9 were used in the risk characterization, while historical soil gas data collected during the 2008 Phase B Soil Gas Investigation (see Appendix D) were mainly used in the DUE, e.g., time trend comparison (see Section 4). Indoor air, outdoor air, and trench air scenarios were evaluated for all the soil gas sample locations. In addition, a basement scenario was evaluated for soil gas sample locations within the area of the Unit Buildings, and a trailer scenario was evaluated for soil gas sample locations near the Trust and Envirogen's trailers. The methodology used for the risk characterization of each soil gas scenario is discussed below:

- *Indoor Commercial/Industrial Worker (Slab-on-grade)*: The maximum detected concentrations at 5 feet bgs and at or around 15 feet bgs for each soil gas carcinogenic COPC at each individual sample location were compared to the cancer RBTCs for soil gas at 5 and 15 feet bgs migrating to indoor air, respectively.
- *Outdoor Commercial/Industrial Worker*: The 95% UCLs on the average concentrations over the entire Operations Area at 5 feet bgs and at or around 15 feet bgs for each soil gas carcinogenic COPC were compared to the cancer RBTCs for soil gas at 5 and 15 feet bgs migrating to outdoor air, respectively. This approach assumes a commercial/industrial outdoor worker may be present over the entire Operations Area during the exposure period. This approach is also consistent with the assumption used in the Q/C calculation that the entire size of the Operations Area (i.e., 259 acres) is the source area. When calculating the 95% UCL, the maximum detected concentration at each individual sample location (or the maximum SQL if no sample was detected) was used as the input data, and then the non-detect results were treated as detects at one half of the SQL. If a 95% UCL could not be calculated due to limited detection over the entire Operations Area, the maximum detected concentration over the entire Operations Area was used to compare to the cancer RBTC. The R codes provided by NDEP's consultant, Neptune,

were used to calculate the UCLs.[27] The UCL output files along with a copy of the R codes used in the UCL calculation are included in Appendix H.

- *Construction Worker (Trench Scenario)*: The maximum detected concentrations at 5 feet bgs and at or around 15 feet bgs for each soil gas carcinogenic COPC at each individual sample location were compared to the cancer RBTCs for soil gas migrating from 5 feet below the base or beside the walls into a 10-foot construction trench.
- *Indoor Commercial/Industrial Worker (Basement Scenario)*: A basement scenario was evaluated for all the soil gas sample locations underneath or near the Unit Buildings, including RISG-14 through RISG-19 and RISG-87 through RISG-89 (Figure 3-1). The vapor intrusion modeling estimated the concentrations within the basement, conservatively assuming that there is no mixing between the basement and the upper level. The scenario evaluated a commercial/industrial worker present at any location within the building. The maximum detected concentrations at 5 and 15 feet bgs for each soil gas carcinogenic COPC at each individual sample location were compared to the cancer RBTCs for soil gas migrating from 5 feet below the base or beside the walls into a commercial/industrial building with a 10-foot deep basement.
- *Indoor Commercial/Industrial Worker (Trailer Scenario)*: A trailer scenario was evaluated for RISG-83 near the Trust trailer and RISG-82 near Envirogen's trailer (Figure 3-1). The maximum detected concentrations at 5 and 15 feet bgs for each soil gas carcinogenic COPC at each individual sample location were compared to the cancer RBTCs for soil gas at 5 and 15 feet bgs migrating to indoor air in a commercial/industrial trailer, respectively.

Also, the estimated excess lifetime cancer risk for each carcinogenic soil gas COPC was conservatively summed (at each individual sample location for indoor commercial/industrial workers and construction workers in a trench, and over the entire Operations Area for the outdoor commercial/industrial workers), regardless of the type of cancer, to estimate the total excess lifetime cancer risk from soil gas COPCs for an exposed individual.

The estimated total excess lifetime cancer risks for each soil gas scenario are summarized in Table 5-12. The estimated total excess lifetime cancer risks for the indoor air scenario at each sample location associated with chloroform in groundwater are shown in Figure 5-2 for soil gas at 5 feet bgs and in Figure 5-3 for soil gas at or around 15 feet bgs. The chemical contributions to the maximum total excess lifetime cancer risks for indoor air and trench air scenarios and over the entire Operations Area for the outdoor air scenario are shown in Appendix G, Tables G-1 through G-10. All by-location soil gas risks are included in Appendix G, Table G-11. The cancer risk results for each soil gas scenario are discussed below.

[27] The higher UCL value generated between the bias-corrected accelerated bootstrap method (BCA UCL) and the t-test method was selected, when the two UCLs values were not significantly different from each other (relative percent difference [RPD] < 50%). Neptune provided Ramboll with a copy of the R codes used for the UCL calculation on May 18, 2020.

Indoor Commercial/Industrial Worker (Slab-on-grade)

- The estimated excess lifetime cancer risks for indoor commercial/industrial workers (slab-on-grade) ranged from 3×10^{-9} to 3×10^{-5} for soil gas at 5 feet bgs and from 3×10^{-9} to 1×10^{-4} for soil gas at or around 15 feet bgs (see Table 5-12). As shown in Figures 5-2 and 5-3, the highest estimated total excess lifetime cancer risks for soil gas both at 5 and 15 feet bgs were associated with the trespassing OSSM plume. Within the area associated with the trespassing OSSM plume, for indoor commercial/industrial workers (slab-on-grade), only the maximum total excess lifetime cancer risks at RISG-10 were above 1×10^{-5}, while there were several other locations with total cancer risks above 1×10^{-6} but at or below 1×10^{-5}.
- The maximum estimated total excess lifetime cancer risk for soil gas at 5 feet bgs was 3×10^{-5} at RISG-10 and associated with the trespassing OSSM plume, which was within or below the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}; the maximum estimated total excess lifetime cancer risk for soil gas at or around 15 feet bgs was 1×10^{-4} and also at RISG-10, which was within or below the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}.
- As indicated in Appendix G, Tables G-1 and G-2, the cancer risk driver at the locations with the maximum cancer risks (RISG-10) was chloroform, contributing over 90% of the total cancer risk. Chloroform was also the major cancer risk driver at most of the other soil gas sample locations (except for a few locations with cancer risks lower than 1×10^{-6}). There were no other COPCs with cancer risks above 1×10^{-6}.
- For soil gas at 5 feet bgs at RISG-10 associated with the trespassing OSSM plume, the chloroform concentration detected in March 2019 (75,000 µg/m^3, Phase 2 RI Modification No. 11) was the maximum detected concentration used in the risk calculation. The most recent chloroform concentration in November 2019 (Phase 3 RI Modification No. 9) at the same location decreased to 18,000 µg/m^3, which was comparable to a concentration collected at a nearby location (SG54) in 2008 (Phase B Investigation) and would correspond to a cancer risk of 6×10^{-6}.
- For soil gas at 15 feet bgs at RISG-10 associated with the trespassing OSSM plume, the chloroform concentration detected in March 2019 (850,000 µg/m^3, Phase 2 RI Modification No. 11) was the maximum detected concentration used in the risk calculation. The most recent chloroform concentration in November 2019 (Phase 3 RI Modification No. 9) at the same location decreased to 92,000 µg/m^3, which would correspond to a cancer risk of 1×10^{-5}.

Outdoor Commercial/Industrial Worker

For an outdoor commercial/industrial worker, the estimated total excess lifetime cancer risks for soil gas at 5 feet bgs and at or around 15 feet bgs over the entire Operations Area were 2×10^{-9} and 5×10^{-9}, respectively, which were below the lower end of the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}.

Construction Worker (Trench Scenario)

For a construction worker in a trench, the maximum estimated total excess lifetime cancer risks for soil gas at 5 feet bgs and at or around 15 feet bgs were 1×10^{-10} and 1×10^{-9},

respectively, both at RISG-10, which were below the lower end of the NDEP and USEPA cancer risk management range of 1 x 10^{-6} to 1 x 10^{-4}.

Indoor Commercial/Industrial Worker (Basement Scenario)

As discussed earlier in this section, soil gas samples collected near or underneath the Unit 4 Building were evaluated for indoor commercial/industrial workers (both slab-on-grade and basement scenarios). At 5 feet bgs, the total excess lifetime cancer risks at RISG-14 and RISG-15 were 1 x 10^{-5} and 3 x 10^{-6}, respectively for both slab-on-grade and basement scenarios (Figure 5-2), which were within or below the NDEP and USEPA cancer risk management range of 1 x 10^{-6} to 1 x 10^{-4}. At 15 feet bgs, the total excess lifetime cancer risks at RISG-14 through RISG-19 ranged from 5 x 10^{-6} and 3 x 10^{-5}, for slab-on-grade scenario; when a basement scenario was considered (the receptor is 10 feet closer to the source), the total excess lifetime cancer risks at RISG-14 through RISG-19 all increased above 1 x 10^{-5}, ranging from 2 x 10^{-5} and 8 x 10^{-5} (Figure 5-3), which were within or below the NDEP and USEPA cancer risk management range of 1 x 10^{-6} to 1 x 10^{-4}. Most of the maximum detected chloroform concentrations used in the risk calculation for these locations came from the most recent sampling event in November 2019 (Phase 3 RI Modification No. 9).

Indoor Commercial/Industrial Worker (Trailer Scenario)

For RISG-83 near the Trust trailer, the total excess lifetime cancer risks were 5 x 10^{-6} at both 5 and 15 feet bgs, which were within or below the NDEP and USEPA cancer risk management range of 1 x 10^{-6} to 1 x 10^{-4}. RISG-83 is located near RISG-10 where higher excess lifetime cancer risks were estimated (3 x 10^{-5} at 5 feet bgs and 1 x 10^{-4} at 15 feet bgs). For RISG-82 near Envirogen's trailer, the total cancer risks were 1 x 10^{-6} at both 5 and 15 feet bgs, which were at the lower end of the NDEP and USEPA cancer risk management range of 1 x 10^{-6} to 1 x 10^{-4}.

5.4.1.2 Noncancer Health Effects

The likelihood of noncancer adverse effects is quantified by the development of an HQ. The HQ represents the ratio of the estimated exposure to a noncarcinogen at a given concentration to a value that is believed not to produce noncancer adverse health effects. The equation used to calculate soil gas noncancer RBTCs for vapor migration to air is as follows:

$$RBTC_{SG.nc} = \frac{THQ}{IF_{inh} \times \alpha / RfC_{inh}}$$

where:

$RBTC_{SG.nc}$	=	Risk-Based Target Concentration, soil gas, noncarcinogenic endpoint (µg/m^3)
THQ	=	Target Hazard Quotient (unitless)
IF_{inh}	=	Inhalation Intake Factor (unitless)
α	=	

		Transfer Factor for soil gas migrating to air ($\mu g/m^3$ per $\mu g/m^3$)
RfC_{inh}	=	Inhalation Reference Concentration ($\mu g/m^3$)

The noncancer RBTCs for all the analytes in the soil gas BHRA data set (Appendix D) are presented in Tables 5-9 through 5-11 for indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers, respectively.

The equation used to calculate noncancer HQs due to exposure via inhalation of VOCs migrating from soil gas to air is as follows:

$$HQ = \frac{Soil\ Gas\ Concentration}{Noncancer\ RBTC}$$

A similar approach as described in Section 5.4.1.1 was used for the calculation of noncancer HQs for different scenarios. Also, the estimated noncancer HQ for each soil gas COPC was conservatively summed (at each individual sample location for indoor air and trench air scenarios and over the entire Operations Area for the outdoor air scenario), regardless of the target organ, to estimate the total noncancer HI from soil gas COPCs for an exposed individual.

The estimated total noncancer HIs for each soil gas scenario are summarized in Table 5-12. The chemical contributions to the maximum total noncancer HIs for indoor air and trench air scenarios and over the entire Operations Area for the outdoor air scenario are shown in Appendix G, Tables G-1 through G-10. All by-location soil gas risks are included in Appendix G, Table G-11. As indicated in Table 5-12, the estimated total noncancer HIs for all the soil gas scenarios were below the NDEP target HI of greater than one, as discussed below:

- For an indoor commercial/industrial worker (slab-on-grade), the maximum estimated total noncancer HIs for soil gas at 5 feet bgs and at or around 15 feet bgs were 0.03 and 0.1, respectively, both at RISG-10.
- For an outdoor commercial/industrial worker, the estimated total noncancer HIs for soil gas at 5 feet bgs and at or around 15 feet bgs over the entire Operations Area were 0.000003 and 0.000008, respectively.
- For a construction worker in a trench, the maximum estimated total noncancer HIs for soil gas at 5 feet bgs and at or around 15 feet bgs were 0.000002 and 0.00002, respectively, both at RISG-10.
- For an indoor commercial/industrial worker (basement scenario), the maximum estimated total noncancer HIs for soil gas at 5 feet bgs and at or around 15 feet bgs were 0.02 at RISG-14 and 0.1 at RISG-17, respectively.
- For an indoor commercial/industrial worker (trailer scenario), for RISG-83 near the Trust trailer, the total noncancer HIs were 0.006 for soil gas at 5 feet bgs and 0.007 for soil gas at 15 feet bgs; for RISG-82 near Envirogen's trailer, the total noncancer HIs were 0.006 for soil gas at 5 feet bgs and 0.005 for soil gas at 15 feet bgs.

5.4.2 Shallow Groundwater

5.4.2.1 Cancer Risks

The equation used to calculate shallow groundwater cancer RBTCs for vapor migration to air is as follows:

$$RBTC_{GW.c} = \frac{TR}{IF_{inh} \times \alpha \times IUR}$$

where:

$RBTC_{GW.c}$	=	Risk-Based Target Concentration, groundwater, carcinogenic endpoint (µg/L)
TR	=	Target Risk (unitless)
IF_{inh}	=	Inhalation Intake Factor (unitless)
α	=	Transfer Factor for groundwater vapor migrating to air (µg/m^3 per µg/L)
IUR	=	Inhalation Unit Risk (µg/m^3)$^{-1}$

The cancer RBTCs for all the analytes in the shallow groundwater BHRA data set (Appendix E) are presented in Tables 5-13 through 5-15 for indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers, respectively.

The equation used to calculate excess lifetime cancer risks due to exposure via inhalation of VOCs migrating from shallow groundwater to air is as follows:

$$Cancer\ Risk = \frac{Shallow\ Groundwater\ Concentration}{Cancer\ RBTC} \times 10^{-6}$$

Shallow groundwater data collected since the Phase 1 RI began in 2014 (see Appendix E) were used in the risk characterization. Indoor air, outdoor air, and trench air scenarios were evaluated for all the shallow groundwater sample locations. In addition, a basement scenario was evaluated for shallow groundwater sample locations within the area of the Unit Buildings, and a trailer scenario was evaluated for shallow groundwater sample locations near the Trust and Envirogen's trailers. The methodology used for the risk characterization of each shallow groundwater scenario is discussed below:

- *Indoor Commercial/Industrial Worker (Slab-on-grade)*: The maximum detected concentration for each shallow groundwater carcinogenic COPC at each individual sample location was compared to the cancer RBTC for shallow groundwater vapor migrating to indoor air.
- *Outdoor Commercial/Industrial Worker*: The 95% UCL on the average concentration over the entire Operations Area for each shallow groundwater carcinogenic COPC was compared to the cancer RBTC for shallow groundwater vapor migrating to outdoor air. This approach assumes a commercial/industrial outdoor worker may be present over the entire Operations Area during the exposure period. This approach

is also consistent with the assumption used in the Q/C calculation that the entire size of the Operations Area in OU-1 (i.e., 259 acres) is the source area. When calculating the 95% UCL, the maximum detected concentration at each individual sample location (or the maximum SQL if no sample was detected) was used as the input data, and then the non-detect results were treated as detects at one half of SQL. If a 95% UCL could not be calculated due to limited detections over the entire Operations Area, the maximum detected concentration over the entire Operations Area was used to compare to the cancer RBTC. The R codes provided by NDEP's consultant, Neptune, were used to calculate the UCLs. The UCL output files along with a copy of the R codes used in the UCL calculation are included in Appendix H.

- *Construction Worker (Trench Scenario)*: The maximum detected concentration for each shallow groundwater carcinogenic COPC at each individual sample location was compared to the cancer RBTC for shallow groundwater vapor migrating into a 10-foot construction trench.
- *Indoor Commercial/Industrial Worker (Basement Scenario)*: A basement scenario was evaluated for all the shallow groundwater sample locations underneath or near the Unit Buildings, including M-139, M-144 through M-146, M-189 through M-193, M-249-60, and M-251-60 (Figure 3-2). The vapor intrusion modeling estimated the concentrations within the basement, conservatively assuming that there is no mixing between the basement and the upper levels. This scenario is conservatively used to evaluate a commercial/industrial worker present at any location within the building. The maximum detected concentration for each shallow groundwater carcinogenic COPC at each individual sample location was compared to the cancer RBTC for shallow groundwater vapor migrating into a commercial/industrial building with a 10-feet-deep basement.
- *Indoor Commercial/Industrial Worker (Trailer Scenario)*: A trailer scenario was evaluated for M-126 near the Trust trailer and M-64 near Envirogen's trailer (Figure 3-2). The maximum detected concentration for each shallow groundwater carcinogenic COPC at each individual sample location was compared to the cancer RBTC for shallow groundwater vapor migrating to indoor air in a commercial/industrial trailer.

Also, the estimated excess lifetime cancer risk for each carcinogenic shallow groundwater COPC was conservatively summed (at each individual sample location for indoor air and trench air scenarios and over the entire Operations Area for the outdoor air scenario), regardless of the type of cancer, to estimate the total cancer risk from shallow groundwater COPCs for an exposed individual.

The estimated total excess lifetime cancer risk for each shallow groundwater scenario is summarized in Table 5-16. The estimated total excess lifetime cancer risks for the indoor air scenario at each shallow groundwater sample location associated with chloroform in groundwater are shown in Figure 5-4. The chemical contributions to the maximum total excess lifetime cancer risks for indoor air and trench air scenarios and over the entire Operations Area for the outdoor air scenario are shown in Appendix G, Tables G-12 through G-16. All by-location shallow groundwater risks are included in Appendix G, Table G-17. The cancer risk results for each shallow groundwater scenario are discussed below.

Indoor Commercial/Industrial Worker (Slab-on-grade)

- The maximum estimated total excess lifetime cancer risk for shallow groundwater was 1×10^{-4} at M-126 associated with the trespassing OSSM plume, which is within or below the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}. The estimated total excess lifetime cancer risk for shallow groundwater at M-126 was consistent with the estimated total excess lifetime cancer risk for soil gas at 15 feet bgs at the same location (RISG-10, Figure 5-3).
- As indicated in Appendix G, Table G-12, the cancer risk driver at the location with the maximum cancer risk was chloroform, contributing over 90% of the total cancer risk. Chloroform was also the major cancer risk driver at most of the other well locations (except for a few locations with cancer risks lower than 1×10^{-6}). In addition, at M-123 associated with the trespassing OSSM plume, carbon tetrachloride and 1,4-dichlorobenzene were the other two COPCs with cancer risk estimates above 1×10^{-6} (5×10^{-6} and 2×10^{-6}, respectively), while the total cancer risk at M-123 was 9×10^{-5} with chloroform contributing 92% at 8×10^{-5}, which was within or below the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}.
- As shown in Figure 5-4, within the trespassing OSSM plume, the total excess lifetime cancer risks at most shallow groundwater sample locations were above 1×10^{-5}, which were higher than the total excess lifetime cancer risks predicted from soil gas at both 5 and 15 feet bgs at the same or nearby locations (Figures 5-2 and 5-3), but within or below the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}. One possible explanation is that only shallow groundwater samples collected in two monitoring wells (M-123 and M-126) were suitable for vapor intrusion assessment. The top screen depths of several other wells (e.g., M-160, M-202, M-223, and M-226) were deeper than 5 feet from the water table, and the saturated screen thickness of one well (M-125) was greater than 10 feet. The VOC concentrations from these wells were not representative of the conditions at the air-water interface and not ideal for vapor intrusion assessment. The maximum detected shallow groundwater concentrations from 2015 to 2020 were conservatively used in the risk calculation. As discussed in Section 4.2.3, although some fluctuations existed, the chloroform concentrations in the monitoring wells within the trespassing OSSM plume remained mostly stable during this time period.
- Shallow groundwater cancer risks above 1×10^{-6} but at or below 1×10^{-5} were observed for monitoring wells in and adjacent to the NERT chloroform plume downgradient of the former Beta Ditch (see Figure 3-2 and discussion in Section 4.2.5), which were within or below the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}. However, the total excess lifetime cancer risks predicted from soil gas at both 5 and 15 feet bgs at the same or nearby locations were all below 1×10^{-6} (Figures 5-2 and 5-3). Thus, shallow groundwater data provided a more conservative characterization of vapor intrusion risks than soil gas.

Outdoor Commercial/Industrial Worker

For an outdoor commercial/industrial worker, the estimated total excess lifetime cancer risk for shallow groundwater over the entire Operations Area was 3×10^{-7}, which was below the lower end of the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}.

Construction Worker (Trench Scenario)

For a construction worker in a trench, the maximum estimated total excess lifetime cancer risk for shallow groundwater was 7 x 10^{-8} at M-126, which was below the lower end of the NDEP and USEPA cancer risk management range of 1 x 10^{-6} to 1 x 10^{-4}.

Indoor Commercial/Industrial Worker (Basement Scenario)

Although cancer risks above 1 x 10^{-6} were observed near or underneath the Unit 4 Building based on soil gas samples collected at 15 feet bgs, the cancer risks estimated from shallow groundwater samples collected from monitoring wells near or underneath the Unit 4 Building were all below 1 x 10^{-6}, the lower end of the NDEP and USEPA cancer risk management range, even when a basement scenario was considered (the receptor is 10 feet closer to the source).

Indoor Commercial/Industrial Worker (Trailer Scenario)

For the nearest monitoring well to the Trust trailer (M-126), the total excess lifetime cancer risk was 1 x 10^{-4}, which was higher than the total cancer risks at both 5 and 15 feet bgs (5 x 10^{-6}) from the soil gas sample location RISG-83 closer to the Trust trailer. For M-64, near Envirogen's trailer, the total excess lifetime cancer risk was 1 x 10^{-6}, which was consistent with the total excess lifetime cancer risks at both 5 and 15 feet bgs from the nearby soil gas sample location RISG-82.

In summary, shallow groundwater data were incorporated in this BHRA to provide a secondary line of evidence for the vapor intrusion risk analysis and to check consistency between soil gas and groundwater results. The spatial distribution of locations with cancer risk above 1 x 10^{-6} for shallow groundwater are generally consistent with those for soil gas in the Operations Area, with exceptions in and adjacent to the NERT chloroform plume downgradient of the former Beta Ditch and near or underneath the Unit 4 Building as well as some shallow groundwater sample locations where there were no nearby soil gas samples collected. The results and conclusions of the shallow groundwater risk evaluation are generally consistent with the results and conclusions of the soil gas risk evaluations, supporting the OU-1 CSM developed in the RI Report for OU-1 and OU-2 (Ramboll 2023b) which identified that groundwater is the main source of VOCs detected in soil gas in OU-1.

5.4.2.2 Noncancer Health Effects

The equation used to calculate shallow groundwater noncancer RBTCs for vapor migration to air is as follows:

$$RBTC_{GW.nc} = \frac{THQ}{IF_{inh} \times a \,/\, RfC_{inh}}$$

where:

$RBTC_{GW.nc}$	=	Risk-Based Target Concentration, groundwater, noncarcinogenic endpoint (µg/L)
THQ	=	Target Hazard Quotient (unitless)
IF_{inh}	=	Inhalation Intake Factor (unitless)

α	=	Transfer Factor for soil gas migrating to air ($\mu g/m^3$ per $\mu g/L$)
RfC_{inh}	=	Inhalation Reference Concentration ($\mu g/m^3$)

The noncancer RBTCs for all the analytes in the shallow groundwater BHRA data set (Appendix E) are presented in Tables 5-13 through 5-15 for indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers, respectively.

The equation used to calculate noncancer HQs due to exposure via inhalation of VOCs migrating from shallow groundwater to air is as follows:

$$HQ = \frac{Shallow\ Groundwater\ Concentration}{Noncancer\ RBTC}$$

A similar approach as described in Section 5.4.2.1 was used for the calculation of noncancer HQs. Also, the estimated noncancer HQ for each shallow groundwater COPC was conservatively summed (at each individual sample location for indoor air and trench air scenarios and over the entire Operations Area for the outdoor air scenario), regardless of the target organ, to estimate the total noncancer HI from soil gas COPCs for an exposed individual.

The estimated total noncancer HI for each shallow groundwater scenario is summarized in Table 5-16. The chemical contributions to the maximum total noncancer His for indoor air and trench air scenarios and over the entire Operations Area for the outdoor air scenario are shown in Appendix G, Tables G-12 through G-16. All by-location shallow groundwater risks are included in Appendix G, Table G-17. As indicated in Table 5-16, the estimated total noncancer His for all the shallow groundwater scenarios were below the NDEP target HI of greater than one, as discussed below:

- For an indoor commercial/industrial worker (slab-on-grade), the maximum estimated total HI for shallow groundwater was 0.4 at M-123.
- For an outdoor commercial/industrial worker, the estimated total noncancer HI for shallow groundwater over the entire Operations Area was 0.001.
- For a construction worker in a trench, the maximum estimated total noncancer HI for shallow groundwater was 0.003 at M-97.
- For an indoor commercial/industrial worker (basement scenario), the maximum estimated HI for shallow groundwater was 0.003 at M-144.
- For an indoor commercial/industrial worker (trailer scenario), for M-126 near the Trust trailer, the noncancer HI for shallow groundwater was 0.2; for M-64, near Envirogen's trailer, the total noncancer HI for shallow groundwater was 0.004.

As discussed above, shallow groundwater data were incorporated in this BHRA to provide a secondary line of evidence for the vapor intrusion risk analysis and to check consistency between soil gas and groundwater results. Consistent with the soil gas results, the estimated total noncancer His for all the shallow groundwater scenarios were below the NDEP target HI of greater than one. The results and conclusions of the shallow

groundwater risk evaluation are generally consistent with the results and conclusions of the soil gas risk evaluations, supporting the OU-1 CSM developed in the RI Report for OU-1 and OU-2 (Ramboll 2023b) which identified that groundwater is the main source of VOCs detected in soil gas in OU-1.

6. UNCERTAINTY ANALYSIS

The process of risk assessment has inherent uncertainties associated with the calculations and assumptions used in the BHRA. The approach used in this BHRA is health protective and tends to overestimate potential exposure, resulting in estimated cancer risks and hazard levels that are likely to be higher than the actual risks or hazards experienced by the potentially exposed populations. These uncertainties are generally difficult to quantify. A qualitative discussion of key uncertainties associated with the available data and the methodology used in this BHRA is presented below.

6.1 Uncertainties Identified in the Data Usability Evaluation

6.1.1 Site Characterization Data

For field sampling, it is impossible to collect samples from every possible location; therefore, there are always some uncertainties associated with the representativeness of site characterization data.

Sample locations for soil gas data used in this BHRA were selected based on the former chemical usage at the individual LOUs and the presence of several VOCs in the soil and groundwater samples within the Operations Area. Soil gas samples collected from these locations were analyzed for the full suite of VOCs using USEPA Method TO-15.

Sample locations for shallow groundwater data used in this BHRA were identified based on the review of available historical groundwater data and in areas associated with historical activities within the Operations Area to characterize the vertical and horizontal extent of impacted groundwater. It should be noted that only soil gas samples were specifically collected to support evaluation of the vapor intrusion pathway. The objectives of groundwater sampling in the Operations Area have been primarily to characterize chemicals in groundwater near suspected source areas and plume delineation; that is, no groundwater investigation was conducted to specifically provide data to evaluate the vapor intrusion pathway. However, along with the soil gas data, shallow groundwater data are sufficient to provide a secondary line of evidence for the vapor intrusion risk analysis. In addition, maximum shallow groundwater results at each well were used in the risk analysis which is a conservative approach.

According to USEPA (2015), for vapor intrusion analysis it is recommended that groundwater samples be taken from wells screened (preferably over short intervals) across the top of the water table and that to the extent practical, groundwater samples be collected over a narrow interval (e.g., a few feet or less) just below the water table. As shown in Table 4-3, some of the groundwater VOC data were collected at depths below the first encountered groundwater and may not be the most representative data for evaluating the vapor intrusion pathway. However, to ensure an adequate spatial coverage of source areas across the Operations Area (Figure 3-2), these shallow groundwater wells are retained in the shallow groundwater BHRA data set and used in various components of the BHRA (except for the soil gas and groundwater correlation analysis discussed in Section 4.2.4). Overall, the placement of the soil gas and shallow groundwater sample locations was deemed representative to evaluate the current conditions within the Operations Area in the context of the CSM, and the relative uncertainty in the Site characterization data was considered to be low.

6.1.2 Detection Limit

For soil gas and shallow groundwater analytes for which the detection frequency was less than 100%, the SQLs from the soil gas and shallow groundwater BHRA data sets were compared to 0.1×RBTC to confirm that they were sufficiently low for risk characterization (see Section 4.1.5). As presented in Tables 4-4 through 4-6, most of the SQLs in the Operations Area were less than 0.1×RBTC, with a few exceptions. The impacts of elevated SQLs on the overall risk evaluation are discussed below.

Soil Gas at 5 feet bgs:

- For acrylonitrile, benzyl chloride, bromodichloromethane, hexachlorobutadiene, and 1,1,2,2-tetrachloroethane, the estimated cancer risks associated with the maximum SQLs of these chemicals for the most conservative scenarios (indoor commercial/industrial worker [slab-on-grade] and indoor commercial/industrial worker [basement scenario]) are below the lower end of the NDEP and USEPA cancer risk management range of 10^{-6} to 10^{-4}. The estimated noncancer HQs associated with the maximum SQLs of these chemicals for the most conservative scenarios (indoor commercial/industrial worker [slab-on-grade] and indoor commercial/industrial worker [basement scenario]) are below the NDEP target HQ of greater than one. Therefore, these chemicals would not be expected to have a significant impact on the overall risk evaluation.
- For 1,2-dibromoethane, which was never detected, the estimated cancer risks associated with the SQLs for the most conservative scenarios (indoor commercial/industrial worker [slab-on-grade] and indoor commercial/industrial worker [basement scenario]) would be above the lower end of the NDEP and USEPA cancer risk management range of 10^{-6} to 10^{-4} in only one out of 113 samples (at 2×10^{-6}). The estimated noncancer HQs associated with the SQLs for the most conservative scenarios (indoor commercial/industrial worker [slab-on-grade] and indoor commercial/industrial worker [basement scenario]) are all below the NDEP target HQ of greater than one. Therefore, even if 1,2-dibromoethane was identified as a COPC, it would not be expected to have a significant impact on the overall risk evaluation.
- For 1,2-dibromo-3-chloropropane, which was never detected, the estimated cancer risks associated with the SQLs for the most conservative scenarios (indoor commercial/industrial worker [slab-on-grade] and indoor commercial/industrial worker [basement scenario]) would be above the lower end of the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4} in only 19 out of 100 samples (2×10^{-5} at maximum) scattered across the Operations Area. The estimated noncancer HQs associated with the SQLs for the most conservative scenarios (indoor commercial/industrial worker [slab-on-grade] and indoor commercial/industrial worker [basement scenario]) are all below the NDEP target HQ of greater than one. Therefore, even if 1,2-dibromo-3-chloropropane was identified as a COPC, it would not be expected to have a significant impact on the overall risk evaluation.

Soil Gas at or around 15 feet bgs:

- For acrylonitrile, benzyl chloride, bromodichloromethane, 1,4-dichlorobenzene, 1,2-dichloroethane, 1,2-dichloropropane, hexachlorobutadiene,

1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, and 1,2,3-trichloropropane, the estimated cancer risks associated with the maximum SQLs of these chemicals for the most conservative scenarios (indoor commercial/industrial worker [basement scenario] within the Unit Buildings area and indoor commercial/industrial worker [slab-on-grade] outside the Unit Buildings area) are below the lower end of the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}. The estimated noncancer HQs associated with the maximum SQLs of these chemicals for the most conservative scenarios (indoor commercial/industrial worker [basement scenario] within the Unit Buildings area and indoor commercial/industrial worker [slab-on-grade] outside the Unit Buildings area) are below the NDEP target HQ of greater than one. Therefore, these chemicals would not be expected to have a significant impact on the overall risk evaluation.

- For 1,2-dibromoethane, which was never detected, the estimated cancer risks associated with the SQLs for the most conservative scenarios (indoor commercial/industrial worker [basement scenario] within the Unit Buildings area and indoor commercial/industrial worker [slab-on-grade] outside the Unit Buildings area) would be above the lower end of the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4} in only two out of 55 samples, with one sample at 4×10^{-6} underneath the Unit Building 4, and the other sample at 5×10^{-6} within the trespassing OSSM plume. The estimated noncancer HQs associated with the SQLs for the most conservative scenarios (indoor commercial/industrial worker [basement scenario] within the Unit Buildings area and indoor commercial/industrial worker [slab-on-grade] outside the Unit Buildings area) are all below the NDEP target HQ of greater than one. Therefore, even if 1,2-dibromoethane was identified as a COPC, it would not be expected to have a significant impact on the overall risk evaluation.
- For 1,2-dibromo-3-chloropropane, which was never detected, the estimated cancer risks associated with the SQLs for the most conservative scenarios (indoor commercial/industrial worker [basement scenario] within the Unit Buildings area and indoor commercial/industrial worker [slab-on-grade] outside the Unit Buildings area) would be above the lower end of the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4} in 18 out of 35 samples (6×10^{-5} at maximum), the majority of which are located within the trespassing OSSM plume or the Unit Buildings area. The estimated noncancer HQs associated with the SQLs for the most conservative scenarios (indoor commercial/industrial worker [basement scenario] within the Unit Buildings area and indoor commercial/industrial worker [slab-on-grade] outside the Unit Buildings area) are all below the NDEP target HQ of greater than one. Therefore, even if 1,2-dibromo-3-chloropropane was identified as a COPC, it would not be expected to have a significant impact on the overall risk evaluation.

Shallow Groundwater:

- For bromodichloromethane, carbon tetrachloride, 1,2-dibromoethane, 1,2-dichloroethane, 1,2-dichloropropane, 2,2-dichloropropane, hexachlorobutadiene, naphthalene, trichloroethene, and vinyl chloride, the estimated cancer risks associated with the maximum SQLs of these chemicals for the most conservative scenarios (indoor commercial/industrial worker [basement scenario] within the Unit Buildings area and indoor commercial/industrial worker [slab-on-grade] outside the Unit Buildings area) are below the lower end of the NDEP and USEPA cancer risk

management range of 1×10^{-6} to 1×10^{-4}. The estimated noncancer HQs associated with the maximum SQLs of these chemicals for the most conservative scenarios (indoor commercial/industrial worker [basement scenario] within the Unit Buildings area and indoor commercial/industrial worker [slab-on-grade] outside the Unit Buildings area) are below the NDEP target HQ of greater than one. Therefore, these chemicals would not be expected to have a significant impact on the overall risk evaluation.

- For 1,2-dibromo-3-chloropropane, which was never detected, the estimated cancer risks associated with the SQLs for the most conservative scenarios (indoor commercial/industrial worker [basement scenario] within the Unit Buildings area and indoor commercial/industrial worker [slab-on-grade] outside the Unit Buildings area) would be above the lower end of the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4} in only 11 out of 479 samples (5×10^{-6} at maximum), all of which are located within the trespassing OSSM plume. The estimated noncancer HQs associated with the SQLs for the most conservative scenarios (indoor commercial/industrial worker [basement scenario] within the Unit Buildings area and indoor commercial/industrial worker [slab-on-grade] outside the Unit Buildings area) are all below the NDEP target HQ of greater than one. Therefore, even if 1,2-dibromo-3-chloropropane was identified as a COPC, it would not be expected to have a significant impact on the overall risk evaluation.

In summary, the total estimated excess lifetime cancer risk associated with the elevated SQLs in this soil gas BHRA data would be 2×10^{-5} at 5 feet bgs, 2×10^{-5} at 10 to 15 feet bgs and 7×10^{-5} for a basement scenario, all within the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}. The total HIs associated with the elevated SQLs in this soil gas BHRA data are also well below the target HI of one at 5 feet bgs and 10 to 15 feet bgs. For the groundwater BHRA data, the total estimated excess lifetime cancer risk associated with the elevated SQLs would be 9×10^{-6}. This is within the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}. The total HIs associated with the elevated SQLs in groundwater BHRA data are also well below the target HI of one. Therefore, the elevated SQLs are not expected to have a significant impact on either the soil gas risk evaluation or the overall groundwater risk evaluation for the OU-1 BHRA Area.

6.1.3 Completeness

No soil gas data were rejected, and the percent completeness for the soil gas BHRA data set is 100%. Therefore, the completeness of the soil gas BHRA data set has no impact on the overall risk evaluation.

The rejected ("R" qualified) data associated with shallow groundwater samples are summarized in Appendix C, Table C-2. The percent completeness for the shallow groundwater BHRA data set is 99.9%. For most chemicals, with the exception of 2-chlorophenol and 2-nitrophenol, given the small percentage of rejected data, these rejected data are not expected to have a significant impact on the spatial coverage of the shallow groundwater BHRA data set. For 2-chlorophenol and 2-nitrophenol, seven out of 12 shallow groundwater samples collected were rejected, which limited the spatial coverage for these chemicals. However, all the rejected data were non-detects, and all the chemicals

with rejected data were never identified as COPCs at any well locations. Additionally, the rejected data were all well below the lowest RBTCs among different exposure scenarios, indicating low potential risks. Therefore, even if these shallow groundwater data were not rejected, it is not expected to affect the COPC identification or have a significant impact on the overall risk evaluation.

6.1.4 Comparability

As discussed in Tables 4-1 and 4-2, different reporting limits for the same analyte in soil gas or shallow groundwater may impact the comparability of the data sets. For most of the analytes, the SQLs are well below 0.1xRBTC. There are some soil gas and shallow groundwater analytes with SQLs exceeding 0.1xRBTC, as summarized in Tables 4-4 through 4-6, and their impacts on the overall risk evaluation are discussed in Section 6.1.2. In summary, different reporting limits for the same soil gas or shallow groundwater analyte are not expected to have a significant impact on the overall risk evaluation.

6.1.5 Precision

Soil Gas

As presented in Appendix B, Table B-1, in the soil gas BHRA data set, a total of 14 pairs of primary and field duplicate results were qualified due to RPD or PQL criterion exceedance. For laboratory duplicates, there were no data points qualified due to RPD or PQL criterion exceedance (see DVSR tables in Appendix B). The impacts of field duplicate data qualified due to RPD or PQL criterion exceedance are discussed as follows:

- First, all the qualified field duplicate data came from the 2008 Phase B Investigation, which were not included in the risk calculation. Therefore, these data would not affect the overall risk evaluation.
- Further, all the qualified field duplicate data were well below the lowest RBTCs among different exposure scenarios, indicating low potential risks.

Therefore, the field duplicate data qualified due to RPD or PQL criterion exceedance are not expected to have any impact on the overall risk evaluation.

Shallow Groundwater

As presented in Appendix C, Table C-3, in the shallow groundwater BHRA data set, only one pair of primary and field duplicate results at M-135 were qualified due to RPD criterion exceedance:

- The chloroform concentration of the field duplicate sample (670 µg/L) collected in 2017 was the highest detected concentration at this well location between 2015 and 2020 and was used in the risk calculation. This concentration would correspond to an estimated total cancer risk of 3×10^{-6} for indoor commercial/industrial workers (slab-on-grade) (see Figure 5-4), which was slightly higher than the lower end of the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}.
- If the chloroform concentration of the field duplicate sample (670 µg/L) collected in 2017 is eliminated, the next highest detected concentration at this well location between 2015 and 2020 would be 290 µg/L (see Appendix E). The corresponding

total cancer risk would be 1 x 10^{-6} for indoor commercial/industrial workers (slab-on-grade), which is at the NDEP and USEPA cancer risk management range of 1 x 10^{-6} to 1 x 10^{-4}.

- If the average chloroform concentration between the primary and field duplicate samples collected in 2017 (405 µg/L) is considered, it is the highest detected concentration at this well location between 2015 and 2020 (see Appendix E). The corresponding total cancer risk would be 2 x 10^{-6} for indoor commercial/industrial workers (slab-on-grade), which is slightly higher than the lower end of the NDEP and USEPA cancer risk management range of 1 x 10^{-6} to 1 x 10^{-4}.
- The estimated total cancer risks for outdoor commercial/industrial workers and construction workers would always be below the NDEP and USEPA cancer risk management range of 1 x 10^{-6} to 1 x 10^{-4}, no matter which chloroform concentration described above is used in the risk calculation.
- The estimated total noncancer His for indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers would always be below the NDEP target HI of greater than one, no matter which chloroform concentration described above is used in the risk calculation.

Therefore, the field duplicate data qualified due to RPD criterion exceedance are not expected to have a significant impact on the overall risk evaluation.

For laboratory duplicates, there were two data points qualified due to RPD or PQL criterion exceedance (see DVSR tables in Appendix C). The effects of these qualified data on the overall risk evaluation are further discussed in Section 6.1.6 below along with other J qualified data.

6.1.6 Accuracy

Soil Gas

The soil gas analytical data were evaluated in DVSRs presented in Appendix B, with a subset of the data qualified with a J qualifier (J, J-, or J+) based on method blank, field duplicate, and/or other quantitation issues (1,366 out of 10,252 data points, see Appendix D); that is, the reported value was estimated, with no (J), low (J-), or high (J+) bias. The potential impact of the J qualified data on the overall risk analysis was evaluated:

- J and J+ Qualified Data:
    - A review of the J and J+ qualified data indicated that the estimated results were well below the lowest RBTCs among different exposure scenarios, except for chloroform at 5 feet bgs (Appendix B, Table B-3). Only one estimated chloroform result at 5 feet bgs was above the lowest RBTC, but it came from the 2008 Phase B Investigation, which was not included in the risk calculation (see Appendix D). In summary, correction for the bias of the J and J+ qualified data does not have any impact on the overall risk evaluation.
- J- Qualified Data:
    - A review of the J- qualified data indicated that the estimated results with low bias were below the lowest RBTCs among different exposure scenarios, except

for chloroform at 5 and 15 feet bgs (Appendix B, Table B-3). The estimated chloroform results from six soil gas samples at RISG-12 (5 and 15 feet bgs), RISG-14 (5 and 15 feet bgs, including a field duplicate sample at 15 feet bgs), and RISG-15 (15 feet bgs) collected during the Phase 2 RI Modification No. 11 were above the lowest RBTCs for their applicable scenarios (see Appendix D).

- Among these six results, four results (RISG-12, RISG-14 [primary and field duplicate sample], and RISG-15 at 15 feet bgs) were lower than the corresponding results collected at the same locations and depths during the Phase 3 RI Modification No. 9. Therefore, these four results were not used in the risk calculation and correction for the low bias does not have any impact on the risk conclusion.
- The two estimated chloroform results at 5 feet bgs at RISG-12 and RISG-14 were the highest detected concentrations at the same locations between Phase 2 RI Modification No. 11 and Phase 3 RI Modification No. 9, and they were used in the risk calculation. These concentrations would correspond to estimated total cancer risks of 9×10^{-6} at RISG-12 and 1×10^{-5} at RISG-14 for indoor commercial/ industrial workers (slab-on-grade) (see Figure 5-2), which were within the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}. Correction for the low bias of these two results is not expected to have a significant impact on the cancer risk estimates for indoor commercial/industrial workers (slab-on-grade). The estimated total excess lifetime cancer risks for outdoor commercial/industrial workers and construction workers as well as the estimated total excess lifetime noncancer His for indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers would not be affected either, because these risk estimates were well below the NDEP acceptable targets.

As discussed in Table 4-1, in accordance with the most recent guidance (NDEP 2012) for evaluating data associated with blank contamination, if there were detections between the SQL and PQL for samples with blank contamination, these data were changed from non-detected values (U qualified) to detected values (J qualified) at reported concentrations. The revisions of censored soil gas data for blank contamination are summarized in Appendix B, Table B-2. The corrected results were well below the lowest RBTCs among different exposure scenarios, indicating the risks of these results were low. Further, all these data came from the 2008 Phase B Investigation, which were not included in the risk calculation. Therefore, the revisions of censored soil gas data associated with blank contamination to estimated detected values are not expected to have any impact on the overall risk evaluation.

Shallow Groundwater

The shallow groundwater analytical data were evaluated in DVSRs presented in Appendix C, with a subset of the data qualified with a J qualifier (J, J-, or J+) based on method blank, field duplicate, and/or other quantitation issues (668 out of 29,031 data points, see

Appendix E); that is, the reported value was estimated, with no (J), low (J-), or high (J+) bias. The potential impact of the J qualified data on the overall risk analysis was evaluated:

- J and J+ Qualified Data:
    - A review of the J and J+ qualified data indicated that the estimated results were below the lowest RBTCs among different exposure scenarios, except for chloroform and vinyl chloride (Appendix C, Table C-4). Only one estimated chloroform result at M-135 was above the lowest RBTC, which was the highest detected concentration at this well location between 2015 and 2020 and was used in the risk calculation (Appendix E). This concentration would correspond to an estimated total cancer risk of 3×10^{-6} for indoor commercial/industrial workers (slab-on-grade) (see Figure 5-4), which was within or below the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}. Only one estimated vinyl chloride result at M-125 was above the lowest RBTC, which was the highest detected concentration at this well location between 2015 and 2020 and was used in the risk calculation (Appendix E). This concentration would correspond to an estimated total cancer risk of 1×10^{-6} for indoor commercial/industrial workers (slab-on-grade), which was at the lower end of the NDEP and USEPA cancer risk management range 1×10^{-6} to 1×10^{-4}. Correction for the bias of these two results is not expected to have a significant impact on the cancer risk estimates for indoor commercial/industrial workers (slab-on-grade). The estimated total excess lifetime cancer risks for outdoor commercial/industrial workers and construction workers as well as the estimated total noncancer His for indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers would not be affected because these risk estimates were well below the NDEP acceptable targets.
- J- Qualified Data:
    - A review of the J- qualified data indicated that the estimated results with low bias were below the lowest RBTCs among different exposure scenarios, except for chloroform (Appendix C, Table C-4). The estimated chloroform results from five shallow groundwater samples at M-14A, M-25, M-81A, M-124, and M-125 were above the lowest RBTCs for their applicable scenarios (see Appendix E).
        - Among these five results, four results at M-14A, M-25, M-124, and M-125 were lower than the highest detected concentrations at the same locations between 2015 and 2020. Therefore, these four results were not used in the risk calculation and correction for the low bias does not have any impact on the risk conclusion.
        - The estimated chloroform result at M-81A was the highest detected concentrations at the same location between 2015 and 2020, and it was used in the risk calculation. This concentration would correspond to an estimated total excess lifetime cancer risk of 2×10^{-6} for indoor commercial/industrial workers (slab-on-grade) (see Figure 5-4), which was within or below the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}. Correction for the low bias of this result

is not expected to have a significant impact on the cancer risk estimate for indoor commercial/industrial workers (slab-on-grade). The estimated total excess lifetime cancer risks for outdoor commercial/industrial workers and construction workers as well as the estimated total noncancer His for indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers would not be affected either, because these risk estimates were well below the NDEP acceptable targets.

6.1.7 Duplicate Treatment

For soil gas and shallow groundwater samples with primary and field duplicate results, the maximum detected concentrations at the same locations were used in the risk evaluation, although the variance of the duplicate and primary samples was not tested. The impacts are discussed as follows.

Soil Gas

As discussed throughout this BHRA, chloroform is the cancer risk driver in soil gas, and the maximum detected chloroform concentration at each sample location among the RI data used in the risk calculation did not occur in any field duplicate sample with a cancer risk above 10^{-6} for indoor commercial/industrial workers (slab-on-grade). Therefore, duplicate treatment of soil gas data is not expected to have any impact on the overall risk evaluation.

Shallow Groundwater

As discussed throughout this BHRA, chloroform is also the cancer risk driver in shallow groundwater, and the maximum detected chloroform concentration at each sample location used in the risk calculation occurred in the field duplicate samples at seven wells with cancer risks above 10^{-6} for indoor commercial/industrial workers (slab-on-grade): M-25, M-35, M-38, M-60, M-66, M-135, and M-209.

- In M-25, M-38, and M-66, the maximum detected chloroform concentrations in the field duplicate samples were equal to the chloroform concentrations in the primary samples (see Appendix E). Therefore, no matter how the duplicate samples are treated, the same concentrations would be used in the risk calculation, and the risk results won't change.
- In M-35, the chloroform concentrations were 490 µg/L and 500 µg/L in the primary and field duplicate sample collected in 2015, and 490 µg/L was also the second highest concentration detected at this well location between 2015 and 2020 (see Appendix E). If the chloroform concentration of the field duplicate sample is eliminated, the concentration of 490 µg/L would be used in the risk calculation; if the average chloroform concentration between the primary and field duplicate sample is considered, the concentration of 495 µg/L would be used in the risk calculation. No matter how the duplicate samples are treated, the risk results would only change slightly.
- In M-60, the chloroform concentrations were 1,200 µg/L and 1,300 µg/L in the primary and field duplicate sample collected in 2017, and 1,200 µg/L was also the second highest concentration detected at this well location between 2015 and 2020 (see Appendix E). If the chloroform concentration of the field duplicate sample is

eliminated, the concentration of 1,200 µg/L would be used in the risk calculation; if the average chloroform concentration between the primary and field duplicate sample is considered, the concentration of 1,250 µg/L would be used in the risk calculation. No matter how the duplicate samples are treated, the risk results would only change slightly.

- In M-135, the chloroform concentrations were 140 µg/L and 670 µg/L in the primary and field duplicate sample collected in 2017, and the second highest concentration at this well location between 2015 and 2020 was 290 µg/L detected in 2020 (see Appendix E). If the chloroform concentration of the field duplicate sample is eliminated, the concentration of 290 µg/L would be used in the risk calculation, and the corresponding total cancer risk for Indoor commercial/industrial workers (slab-on-grade) would decrease from 3×10^{-6} to 1×10^{-6}. If the average chloroform concentration between the primary and field duplicate sample is considered, the concentration of 405 µg/L would be used in the risk calculation, and the corresponding total excess lifetime cancer risk for indoor commercial/industrial workers (slab-on-grade) would decrease from 3×10^{-6} to 2×10^{-6}.
- In M-209, the chloroform concentrations were 440 µg/L and 460 µg/L in the primary and field duplicate sample collected in 2020, and 440 µg/L was also the second highest concentration detected at this well location between 2015 and 2020 (see Appendix E). If the chloroform concentration of the field duplicate sample is eliminated, the concentration of 440 µg/L would be used in the risk calculation; if the average chloroform concentration between the primary and field duplicate sample is considered, the concentration of 450 µg/L would be used in the risk calculation. No matter how the duplicate samples are treated, the risk results would only change slightly.

In summary, duplicate treatment of shallow groundwater data is not expected to have a significant impact on the overall risk evaluation.

6.1.8 Selection of Co-located Sample Points for Temporal Trend Analysis

Grouping of samples for the temporal trends analysis of chloroform in soil gas samples collected in the 5-foot bgs within 50 feet of each other was initially considered. However, only three combinations of samples collected in May 2008 and March/November/December 2019 could be paired. To maximize the number of comparisons and still maintain the grouping of samples that were in close proximity, samples within 100 feet were selected. In both situations, the trend for the selected samples to include in the temporal trend analysis generally indicated a decrease in concentrations between 2008 and 2019. Therefore, the use of 100 feet is not expected to have a significant impact on the results.

6.2 Uncertainties Identified in the Risk Assessment

6.2.1 Identification of COPCs

All volatile compounds detected in one or more soil gas or shallow groundwater samples in the BHRA data sets were selected as COPCs. Among the 76 soil gas analytes, 66 and 60 COPCs were identified for samples collected at 5 feet bgs and at or around 15 feet bgs, respectively. A total of 34 out of 83 analytes were identified as COPCs for shallow groundwater samples. For most of the chemicals that were not selected as COPCs, the

SQLs were well below the 0.1xRBTC; therefore, exclusion of these chemicals from the quantitative risk assessment is not expected to have a significant impact on the overall results of the BHRA. It should be noted that, for a few chemicals, the SQLs were higher than the 0.1xRBTC in a few soil gas or shallow groundwater samples (see Tables 4-4 through 4-6). The impacts of elevated SQLs on the risk evaluation are discussed in Section 6.1.2.

6.2.2 Exposure Assessment

6.2.2.1 Exposure Scenarios

The exposure assessment in this BHRA is based on an RME scenario, which is defined by USEPA as the highest exposure that could reasonably be expected to occur for a given exposure pathway at a site (USEPA 1989). To achieve this goal, the RME scenario uses highly conservative exposure assumptions. For example, this BHRA assumes that an outdoor commercial/industrial worker inhales vapor migrating from soil gas or shallow groundwater to outdoor air eight hours per day, 225 days per year, for 25 years. These and other upper-bound, default exposure assumptions most likely overestimate the potential health risks associated with the Operations Area.

As discussed in USEPA's *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (USEPA 2002), evaluation of exposures to members of the public entering an operating facility is generally not warranted for two reasons: (1) public access is restricted or controlled at industrial sites, and (2) while the public may have access to a property, exposures of an on-site worker would be much higher than those of a visitor because workers spend substantially more time at a site. Accordingly, visitors and trespassers were not quantitatively evaluated in the BHRA. The potential health risks for outdoor commercial/industrial workers in the Operations Area were estimated to be below the levels of concern, and the potential health risks for visitors and trespassers would also be below the levels of concern.

Populations outside the Operations Area include indoor and outdoor commercial/industrial workers as well as residents. Populations outside the Operations Area could be exposed to airborne chemicals (vapors and particulates) emitted during events such as routine operations or construction projects (USEPA 2002). The potential vapor intrusion risks to populations within the NERT Off-Site Study Area component of OU-2 located west of Pabco Road (north of OU-1, which is located downgradient of groundwater in the Operations Area) were evaluated in the BHRA for OU-2 Soil Gas and Groundwater, Revision 1 (Ramboll 2023a). The potential risks to populations in the areas to the west, east, and south of the Operations Area were not quantitatively evaluated in this BHRA. For the areas to the west, east, and south of the Operations Area (which are not downgradient of on-Site groundwater), volatile compounds migrating from shallow groundwater through the soil column to outdoor air in the Operations Area would travel long distances and mix with ambient air before reaching these populations. Since the risks associated with vapor inhalation by outdoor commercial/industrial workers in the Operations Area were estimated to be well below the levels of concern, the potential health risks associated with vapor inhalation by populations in the areas to the west, east, and south of the Operations Area would also be below the levels of concern.

6.2.2.2 EPCs

The maximum detected concentrations in soil gas and shallow groundwater at each individual sample location were multiplied by the transfer factors estimated from the fate and transport modeling to predict the air EPCs in indoor air and trench air. This approach is expected to overestimate the EPCs (and associated risks), because the maximum concentration at a single location is not likely representative for an entire exposure area (e.g., rooms within an entire building). Furthermore, this is a conservative procedure for the purposes of estimating potential health risks associated with the inhalation of vapors in a construction trench because it is unlikely that a construction worker would stay at only a single location over an extended period of time. In addition, it is a conservative approach when calculating the total risks across COPCs at each sample location because the maximum detected concentrations of different COPCs may occur in different samples collected at different times. However, since chloroform was the dominant cancer risk driver at most of the soil gas and shallow groundwater sample locations (except for a few locations with cancer risks lower than 10^{-6}), contributing over 90% of the total cancer risks, the total cancer risks were determined mainly by chloroform, and the impacts from other COPCs were negligible. Therefore, using the maximum detected concentrations at each sample location instead of in each sample in the risk calculation does not have a significant impact on the overall risk evaluation.

As discussed in Section 5.2.2 for EPCs in outdoor air, the 95% UCL on the VOC concentrations average over the commercial/industrial areas in the entire Operations Area were developed using the R codes provided by NDEP's consultant, Neptune. The inputs for the UCL calculations were developed by multiplying VOC concentrations in soil gas and groundwater with the medium-specific outdoor air transfer factors estimated from the fate and transport modeling. The UCLs represent the predicted air EPCs in outdoor air (unless a 95% UCL could not be calculated due to a limited number of detections, in which case the maximum detected concentrations over the entire Operations Area were used). This assumption is representative for a RME estimate.

The maximum model-predicted outdoor air concentrations for the VOCs at each sampling location were used as inputs to calculate the 95% UCLs to be conservative and accommodate the issue of potential temporal overweighting. In addition, the proposed soil gas and groundwater samplings were designed to focus more on the areas within the VOC plumes in the OU-1 BHRA Area; the sample density within the VOC plumes is much higher than the sample density outside the VOC plumes (i.e., more samples were collected from the areas with higher VOC concentrations than from the areas with lower VOC concentrations). Therefore, the EPCs developed using these data sets tend to overestimate the exposures and risks. It is very unlikely that an outdoor commercial/industrial worker would be exposed to COPCs in soil gas and shallow groundwater at concentrations higher than the 95% UCLs over an extended period of time.

The EPCs used in the BHRA are estimated based solely on the predicted vapor migration of a COPC from the subsurface to indoor air. The models do not consider other sources of exposure, either the impact of existing chemical concentrations in indoor air or other potential ambient sources on indoor air concentrations. Chemical concentrations in indoor air can originate from both outdoor air and sources indoors, such as building materials, furniture, garages, heating and cooking systems, paints and solvents, and human activities.

Benzene may be present in construction materials, floorings, particleboard furniture, plywood, fiberglass, flooring adhesives, paints, wood paneling, caulking, and paint remover. Attached garages are a potential source of gasoline vapor owing to evaporation and exhaust emissions. Fuels used for heating and cooking, such as coal, wood, gas, kerosene, and natural gas, may also contain benzene. Human activities such as cleaning, painting, the use of consumer products and mosquito repellents, photocopying and printing, the storage and use of solvents, and smoking tobacco can result in exposure to benzene and other chemicals. (Harrison et al. 2010)

6.2.2.3 Fate and Transport Modeling

Fate-and-transport models were used to estimate indoor, outdoor, and trench air concentrations from measured soil gas or shallow groundwater concentrations. For indoor air, the USEPA Johnson and Ettinger model spreadsheet (USEPA 2017) was used. The Johnson and Ettinger model has numerous assumptions and limitations, each of which may over- or underestimate the predicted indoor air concentration. In this BHRA, soil physical parameters in the Operations Area were used in the modeling, which should reduce the uncertainty in the model estimates. For outdoor air, an approach analogous to that used by USEPA to estimate outdoor air concentrations from chemicals in soil was used. Similarly, this approach also has assumptions that may over- or underestimate the predicted outdoor air concentrations.

The soil properties in the Operations Area used for the Johnson and Ettinger model (Table 5-4) were based on mean soil property measurements collected from 9-10 feet bgs in the Qal. Additionally, the one soil sample collected from below 10 feet bgs was not used in the evaluation due to extraordinarily wet soil properties measured at that location. The assumption that the entire unsaturated zone in the Operations Area of OU-1 is Qal is conservative, because for areas where the UMCf is part of the unsaturated zone, the finer-grained UMCf would act to reduce vapor transport of COPCs. If default soil properties for loamy sand recommended by USEPA (2017) were used in the evaluation, the risk results would increase by approximately a factor of two to three. Currently, the maximum estimated excess lifetime cancer risks were 1×10^{-4} for both soil gas and shallow groundwater, and the maximum estimated noncancer HIs were 0.1 for soil gas and 0.4 for shallow groundwater (Tables 5-12 and 5-16). The use of default soil properties for loamy sand would raise the maximum estimated excess lifetime cancer risks to 3×10^{-4} for soil gas and 2×10^{-4} for shallow groundwater, which are above the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}. The use of default soil properties for loamy sand would raise the maximum estimated noncancer HIs to 0.3 for soil gas and 0.7 for shallow groundwater, which are below the NDEP target HI of greater than one.

Data from soil gas samples collected slightly shallower than 15 feet bgs (i.e., 12.4 feet bgs at RISG-22 and 14 feet bgs at RISG-81, RISG-85, and RISG-86) were compared to the soil gas RBTCs modeled at 15 feet bgs. The transfer factors at a shallower depth (12.4 or 14 feet bgs) would be higher (more conservative) than those at a deeper depth (15 feet bgs) due to shorter diffusion up through the vadose zone, resulting in increased risks by a factor of approximately up to 1.2. Therefore, the modeled depth is not expected to have a significant impact on the overall risk results.

Depth to groundwater was selected to be conservative considering both current and historical data for OU-1. Therefore, the vapor intrusion risks from shallow groundwater would be overestimated.

For indoor commercial/industrial workers (slab-on-grade), a conservative default slab-on-grade commercial building (with building characteristics shown on Table 5-3) was assumed for modeling. The default floor space area used in the modeling might be different from the commercial buildings within the Operations Area. However, the size of building footprint is expected to have little impact on the modeling of transfer factors, because when the size of building footprint changes, the air flow into the building changes accordingly, which would offset the effects. A conservative (lower) building height of three meters was assumed, which would result in higher transfer factors, although many commercial buildings have higher first floor ceilings.

For indoor commercial/industrial workers (basement scenario), the same conservative default commercial building was assumed for the modeling as in the slab-on-grade scenario. However, to represent a basement located 10 feet below the ground level, the bottom of building was assumed to be located 10 feet closer to the groundwater and 15-feet bgs soil gas samples. The mixing height was conservatively assumed to be representative of a single-story basement (i.e., 3 meters), even though some mixing between the basement and first floor would be expected to occur. Although the modeling represents an indoor commercial/industrial worker present in the basement, the RBTCs were conservatively applied to evaluate workers present anywhere in the building during the exposure period.

For indoor commercial/industrial workers (trailer scenario), it was conservatively assumed that there is no slab or other barrier between the ground and the trailer floor, although some trailers may have a barrier. Assuming there is no barrier increases the flow of soil gas into the building, making the model more conservative. However, the transport of chemicals in soil gas into the trailer is limited by diffusion of chemicals through the vadose zone. Therefore, the overall results are very similar to the modeling results with a building foundation (i.e., slab-on-grade scenario). For the outdoor air scenario, the 95% UCLs on the mean COPC concentrations in soil gas or shallow groundwater samples over the entire Operations Area were used as EPCs, which would offset the impacts of conservatively using the full size of the Operations Area as the source area in the modeling.

When evaluating the construction trench scenario, it was conservatively assumed that air containing VOCs would be migrating from the walls of the construction trench in addition to the base to maximize exposure potential. A box model was used to simulate dispersion, and the air flow through the construction trench was controlled by a windspeed in the Operations Area that was reduced by a factor of 10 to ensure it would be conservative for a construction trench scenario where the breathing zone may be a few feet bgs. This is especially conservative because many construction trenches include a fan to increase air flow through the construction trench or are shallower than 10 feet, potentially increasing the breathing zone to above the ground surface.

For BioVapor modeling, which as previously discussed was limited to benzene, the default building parameters from the Johnson and Ettinger model (USEPA 2017) were used instead of the default BioVapor building parameters for consistency with the transfer factor

modeling. The BioVapor model is very sensitive to the air flow through the building foundation, and the default building parameters from the Johnson and Ettinger model corresponded to a lower air flow through the building foundation. This resulted in a lower transfer factor with biodegradation for benzene by two to three orders of magnitude when compared to the default BioVapor building parameters. However, since the risk contributions from benzene were extremely low when considering biodegradation (see Appendix G), the use of default building parameters from the Johnson and Ettinger model is not expected to have a significant impact on the overall risk evaluation. In addition, the biodegradation ratios for indoor air scenarios were used as the surrogates for outdoor and trench scenarios at the corresponding depths. This is a conservative approach because there are likely more oxygen and biological activities available when no slab/building is present, and higher biodegradation (lower transfer factors with biodegradation for benzene) is expected for outdoor and trench scenarios. There are also additional sources of benzene (i.e. automobiles and trucks) which may be present at the Site. These sources may cause benzene to be detected in both indoor and outdoor situations not as a result of vapor intrusion.

6.2.3 Toxicity Assessment

One of the largest sources of uncertainty in any risk assessment is the limited understanding of toxicity to humans who are exposed to lower concentrations generally encountered in the environment than those used in toxicity studies. The majority of the available toxicity data are from animal studies; these data are extrapolated using mathematical models or multiple uncertainty factors to predict what might occur in humans. Sources of uncertainty and/or conservatism in the toxicity criteria used in this BHRA include:

- The use of conservative methods and assumptions to extrapolate from high-dose animal studies to predict the possible response in humans at exposure levels far below those administered to animals;
- The assumption that chemicals considered to be carcinogens do not have thresholds (i.e., for all doses greater than zero, some risk is assumed to be present); and
- The fact that epidemiological studies (i.e., human exposure studies) are limited and are not generally considered in a quantitative manner in deriving toxicity values.

Chemical-specific uncertainties in toxicity criteria are provided below for major cancer risk drivers (chloroform, carbon tetrachloride, and 1.4-dichlorobenzene) with soil gas and/or shallow groundwater cancer risks above 10^{-6} as well as for chemicals with noncancer toxicity criteria obtained from Provisional Peer Reviewed Toxicity Values (PPRTV) appendices (bromochloromethane, 2-chlorotoluene, dibromomethane, dichlorodifluoromethane, n-propylbenzene, and 1,1,2-trichloroethane), followed by a discussion regarding soil gas and groundwater analytes for which surrogate criteria were used.

Chloroform

The IUR for chloroform is obtained from IRIS based primarily on a mouse gavage study (USEPA 2023d). The tumor type considered in the derivation of IUR was hepatocellular carcinoma, and USEPA used a linearized multistage procedure to extrapolate metabolism-dependent carcinogenic responses from mice to humans. The IUR was derived by taking a

geometric mean of the slope factors and assuming 100% for low doses of chloroform in air. Adequate numbers of animals were treated and observed, and the risks estimates derived are generally supported by male rat kidney tumor data from other studies. Therefore, the uncertainty associated with the IUR for chloroform is expected to be low. In summary, the uncertainty associated with the IUR for chloroform is not expected to have a significant impact on the overall risk evaluation.

Carbon Tetrachloride

The IUR for carbon tetrachloride is obtained from IRIS based primarily on a mouse inhalation study (USEPA 2023d). The tumor type considered in the derivation of IUR was pheochromocytoma. In the absence of information on mode of action for carbon tetrachloride-induced tumors, USEPA used a log-probit model with a linear low-dose extrapolation and a physiologically based pharmacokinetic (PBPK) model to estimate human carcinogenic risk. This bioassay was well-designed with adequate numbers of animals and adequate data for dose-response modeling, and no issues were identified with this bioassay that might have contributed to uncertainty in the cancer assessment. The available experimental evidence supports a conclusion that mouse pheochromocytomas are relevant to humans, and availability of a PBPK model generally reduces the pharmacokinetic component of uncertainty associated with animal to human extrapolation. The primary uncertainty in the IUR derivation for carbon tetrachloride is related to the lack of information on the mode of action for carbon tetrachloride-induced tumors; such information would inform the approach to linear low-dose extrapolation and reduce the uncertainty associated with the magnitude of risk from exposure to this chemical. Therefore, the uncertainty associated with the IUR for carbon tetrachloride is expected to be low to moderate. In summary, the uncertainty associated with the IUR for carbon tetrachloride is not expected to have a significant impact on the overall risk evaluation.

1.4-Dichlorobenzene

The IUR for 1,4-dichlorobenzene is obtained from the OEHHA Toxicity Criteria Database based primarily on a mouse chronic oral study (Cal/EPA 2009). The tumor types considered in the derivation of IUR were hepatocarcinoma and adenoma. Cal/EPA used a linearized multistage procedure to estimate the oral cancer potency of 1,4-dichlorobenzene and the IUR was derived based on route-to-route extrapolation. This bioassay was well-designed with adequate numbers of animals and adequate data for dose-response modeling, and no issues were identified with this bioassay that might have contributed to uncertainty in the cancer assessment. Therefore, the uncertainty associated with the IUR for 1,4-diochlorobenzene is expected to be low. In summary, the uncertainty associated with the IUR for 1,4-dichlorobenzene is not expected to have a significant impact on the overall risk evaluation.

Bromochloromethane

The inhalation chronic RfC for bromochloromethane is a screening toxicity value taken from an appendix of a PPRTV assessment based on an inhalation subchronic study of rats (USEPA 2009b). Chronic inhalation toxicity testing of bromochloromethane has not been conducted. The critical effect considered in the derivation of the inhalation chronic RfC is increased relative liver weight in rats. USEPA applied a large composite uncertainty factor of 10,000 to the lowest-observed-adverse-effect level (LOAEL) to account for interspecies extrapolation, intraspecies differences for extrapolation to sensitive humans, database

uncertainty (the key study is very old and incompletely reported; there are no developmental or reproductive toxicity data), the use of a LOAEL as the point of departure, and using data from a subchronic study to assess chronic exposures. USEPA concluded that due to a lack of chronic toxicity testing and large uncertainties associated with the subchronic studies, derivation of a provisional chronic RfC for bromochloromethane is not feasible, and there are considerably more uncertainties associated with the appendix screening chronic RfC. Bromochloromethane was not an analyte in soil gas (Appendix D) and was never detected in shallow groundwater (Appendix E); therefore, it did not contribute to any risks. As indicated in Table 4-6, the maximum SQL of bromochloromethane was well below the 0.1xRBTC for shallow groundwater. In summary, the uncertainty associated with the inhalation chronic RfC for bromochloromethane is not expected to have a significant impact on the overall risk evaluation.

2-Chlorotoluene

The inhalation subchronic RfC for 2-chlorotoluene is a screening toxicity value taken from an appendix of a PPRTV assessment based primarily on a rat developmental study (USEPA 2010a). The critical effects considered in the derivation of the subchronic RfC were slight ataxia (coordination issues), decreased body-weight gains and food consumption, and increased water consumption. USEPA applied a composite uncertainty factor of 300 to the no-observed-adverse-effect level (NOAEL) to account for animal to human extrapolation, intraspecies differences for potentially susceptible individuals, and database uncertainty (no acceptable two-generation reproduction or neurotoxicity studies). USEPA concluded that insufficient data were available to derive provisional toxicity values for 2-chlorotoluene, and there is considerably more uncertainty associated with the appendix screening subchronic RfC. Additionally, a screening chronic RfC was not derived due to the short duration of developmental studies (14−23 days) and lack of longer-term studies to detect more sensitive respiratory or systemic effects. The inhalation chronic RfC for chlorobenzene was used as a surrogate for 2-chlorotoluene. 2-Chlorotoluene was not an analyte in soil gas (Appendix D), was not a driver for noncancer HI in groundwater for construction workers (Appendix G, Table G-14), and the maximum SQL was well below the 0.1xRBTC for shallow groundwater (Table 4-6). In summary, the uncertainty associated with the inhalation subchronic RfC for 2-chlorotoluene is not expected to have a significant impact on the overall risk evaluation.

Dibromomethane

The inhalation chronic and subchronic RfC values for dibromomethane are screening toxicity values taken from an appendix of a PPRTV assessment based on an unpublished subchronic inhalation study in rats and dogs (USEPA 2009c). This study is the only adequate evaluation on the inhalation toxicity of dibromomethane; no chronic inhalation toxicity studies were located. The critical effect considered in the derivation of the RfCs is increased blood carboxyhemoglobin levels in rats, which was the only effect observed in the study. Benchmark dose modeling was conducted to derive a lower bound benchmark human equivalent concentration used as the point of departure. To derive the screening subchronic RfC, USEPA applied a composite uncertainty factor of 300 to the point of departure to account for interspecies extrapolation, protection of sensitive human subpopulations, and database deficiencies (no developmental or reproductive toxicity studies); for the screening chronic RfC, an additional uncertainty factor of 10 was also applied to account for using a subchronic study to approximate chronic exposures. USEPA concluded that insufficient data

were available to derive provisional toxicity values for dibromomethane, and there is considerably more uncertainty associated with the appendix screening RfC values. Dibromomethane was not an analyte in soil gas (Appendix D) and was never detected in shallow groundwater (Appendix E); therefore, it did not contribute to any risks. As indicated in Table 4-6, the maximum SQL of dibromomethane was well below the 0.1xRBTC for shallow groundwater. In summary, the uncertainty associated with the inhalation chronic and subchronic RfCs for dibromomethane is not expected to have a significant impact on the overall risk evaluation.

Dichlorodifluoromethane

The inhalation chronic RfC for dichlorodifluoromethane is a screening toxicity value taken from an appendix of a PPRTV assessment based on a six-week intermittent inhalation study in guinea pigs, rabbits, dogs, and monkeys (USEPA 2010b). There are a few existing subchronic human inhalation studies, but they all have significant limitations. The only chronic inhalation toxicity studies available are two experiments in rats and mice, designed as cancer bioassays, but there are no dose-response data available for non-tumor related effects in animals following chronic inhalation exposure. The critical effect considered in the derivation of the inhalation chronic RfC is reduced body-weight gain. USEPA applied a composite uncertainty factor of 10,000 to the LOAEL to account for interspecies extrapolation, intraspecies differences for potentially susceptible individuals, extrapolation from a LOAEL to a NOAEL, using data from a subchronic study to assess chronic exposures, and database inadequacies (i.e., limited reproductive and developmental toxicity studies via the inhalation route). USEPA concluded that insufficient data were available to derive a provisional chronic toxicity value, and there is considerably more uncertainty associated with the appendix screening chronic RfC. Dichlorodifluoromethane was not a driver for noncancer HI in soil gas for commercial/industrial workers (Appendix G, Tables G-1 through G-10), was never detected in shallow groundwater (Appendix E), and the maximum SQLs were below the 0.1xRBTC for both soil gas and shallow groundwater (Tables 4-4 through 4-6). In summary, the uncertainty associated with the inhalation chronic RfC for dichlorodifluoromethane is not expected to have a significant impact on the overall risk evaluation.

n-Propylbenzene

The inhalation chronic and subchronic RfC values for n-propylbenzene are screening toxicity values taken from an appendix of a PPRTV assessment based on using developmental toxicity studies in rats and rabbits for ethylbenzene as a surrogate (USEPA 2009d). The ototoxicity of ethylbenzene in a subchronic oral study of rats was shown to be qualitatively similar to that shown by n-propylbenzene following short-term oral exposure; therefore, the resulting assumption is that inhalation exposures of the two compounds would likely have similar results. In deriving the screening chronic and subchronic RfCs, USEPA applied a composite uncertainty factor of 300 to the NOAEL to account for intra- and interspecies extrapolation and database deficiencies (lack of multigenerational reproductive and chronic studies). USEPA concluded that insufficient data were available to derive provisional toxicity values for n-propylbenzene, and there is considerably more uncertainty associated with the appendix screening RfC values. n-Propylbenzene was not a driver for noncancer HI in soil gas for commercial/industrial workers and construction workers (Appendix G, Tables G-1 through G-10), was never detected in shallow groundwater (Appendix E), and the maximum SQLs were well below the 0.1xRBTC for both soil gas and shallow groundwater (Tables 4-4

through 4-6). In summary, the uncertainty associated with the inhalation chronic and subchronic RfCs for n-propylbenzene is not expected to have a significant impact on the overall risk evaluation.

1,1,2-Trichloroethane

The inhalation chronic value for 1,1,2-trichloroethane is a screening toxicity value taken from an appendix of a PPRTV assessment based on a subchronic inhalation study with rats (USEPA 2011b). The critical effect considered in the derivation of the RfC values was nasal lesions, which are not necessarily adverse effects but were considered to be "probably degenerative" by the study authors. Benchmark dose modeling was conducted on the nasal lesions data sets, and the benchmark dose lower bound 95% confidence interval (BMDL) value for a response of 10% was derived. For the screening chronic RfC, USEPA applied a composite uncertainty factor of 3,000 to the BMDL (converted to human equivalent concentration) to account for interspecies extrapolation, intraspecies differences for potentially susceptible individuals, database uncertainty, and using a subchronic study to approximate chronic exposures. Confidence in the principal study is medium, and confidence in the database is low due to the lack of reproductive and developmental toxicity testing and the absence of supporting subchronic- or chronic-duration systemic toxicity studies. USEPA concluded that insufficient data were available to derive a provisional toxicity value for 1,1,2-trichloroethane, and there is considerably more uncertainty associated with the appendix screening RfC value. 1,1,2-Trichloroethane was not a driver for noncancer HI in soil gas for commercial/industrial workers (Appendix G, Tables G-1 through G-10), was never detected in shallow groundwater (Appendix E), and the maximum SQLs were below the 0.1xRBTC for both soil gas and shallow groundwater except for one soil gas sample at 15 feet bgs (Tables 4-4 through 4-6). In summary, the uncertainty associated with the chronic inhalation RfC for 1,1,2-trichloroethane is not expected to have a significant impact on the overall risk evaluation.

Surrogate Criteria

As identified in Table 5-8, surrogate toxicity criteria (i.e., inhalation RfC) were used for 29 of the 108 soil gas and shallow groundwater analytes. Of these chemicals, 19 surrogates are those identified by NDEP (2023a). Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane) was specified as a surrogate for Freon 114 (1,2-dichloro-1,1,2,2-tetrafluoroethane) in NDEP Response to Revised Technical Memorandum: Screening-Level Indoor Air Health Assessment for the 2008 Tronox Parcels A/B Soil Gas Investigation (NDEP 2010d). The surrogates used for the nine remaining analytes are as follows:

Analyte	Surrogate
tert-Amyl methyl ether	Methyl tert butyl ether
4-Chlorotoluene	Chlorobenzene
2,2-Dichloropropane	1,2-Dichloropropane
1,1-Dichloropropene	1,3-Dichloropropene
Ethyl tert-butyl ether	Methyl tert butyl ether
1-Methylnaphthalene	Naphthalene
2-Methylnaphthalene	Naphthalene
n-Octane	n-Nonane
1,2,3-Trichlorobenzene	1,2,4-Trichlorobenzene

Among the 29 analytes using surrogate RfCs, 17 analytes were identified as soil gas and/or shallow groundwater COPCs. Depending on how similar the surrogate is to the analyte, the use of surrogate RfCs for evaluating soil gas and groundwater COPCs may introduce uncertainties and either overestimate or underestimate the potential for noncancer health effects. However, recognizing the very low noncancer HQs estimated for these COPCs (less than 0.002), use of surrogate RfCs is not expected to have a significant impact on the noncancer hazard evaluation or conclusions. Further, among the 29 analytes using surrogate RfCs, the maximum SQLs were below the 0.1xRBTC for both soil gas and shallow groundwater, except for bromodichloromethane in three soil gas samples and eight shallow groundwater samples as well as 2,2-dichloropropane in four shallow groundwater samples. As discussed in Section 6.1.2, these exceedances would correspond to the estimated cancer risks below the lower end of the target cancer risk range of 1×10^{-6} 1 x to 10^{-4} and to the estimated noncancer HQs below the NDEP target HQ of greater than one. Therefore, use of surrogate RfCs is not expected to have a significant impact on the overall risk evaluation.

6.2.4 Risk Characterization

Because the risk characterization combines the site characterization, selection of chemicals quantitatively evaluated, exposure assumptions, and toxicity assessment, the uncertainties and conservativeness discussed above are carried over into the risk characterization. In this BHRA, potential health risks were quantified for indoor commercial/industrial workers (slab-on-grade, basement, and trailer scenarios), outdoor commercial/ industrial workers, and construction workers associated with inhalation of soil gas and shallow groundwater vapor migrating to indoor, outdoor, and trench air in the Operations Area. Given the highly conservative nature of the exposure parameters used to characterize these pathways, especially for the RME scenario, it is highly unlikely that the same receptor would be exposed at that level over the entire duration of exposure. These conservative estimates of exposure were then combined with even more conservative estimates of toxicity values to estimate the magnitude (noncancer) or likelihood (cancer) of potential effects. Because of all the conservative assumptions built into each component of the risk assessment to address uncertainty, this methodology is believed to not underestimate the true risk but likely overestimate the true risk by a considerable degree, and the true risk could be as low as zero.

One source of uncertainty that is unique to risk characterization is the assumption that the total risk associated with exposure to multiple chemicals is equal to the sum of the individual risks for each chemical (i.e., the risks are additive). Other possible interactions include synergism, where the total risk is higher than the sum of the individual risks, and antagonism, where the total risk is lower than the sum of the individual risks. Relatively few data are available regarding potential chemical interactions following environmental exposure to chemical mixtures. Some studies have been carried out in rodents that were given simultaneous doses of multiple chemicals. The results of these studies indicated that no interactive effects were observed for mixtures of chemicals that affect different target organs (i.e., each chemical acted independently), whereas antagonism was observed for mixtures of chemicals that affect the same target organ, but by different mechanisms (Risk Commission 1997). While there are no data on chemical interactions in humans exposed to chemical mixtures at the dose levels typically observed in environmental exposures, animal studies suggest that synergistic effects will not occur at levels of exposure below their individual effect levels (Seed et al. 1995). As exposure levels approach the individual effect levels, a variety of interactions may occur, including additive, synergistic, and antagonistic interactions (Seed et al. 1995).

USEPA guidance for risk assessment of chemical mixtures (USEPA 1986) recommends assuming an additive effect following exposure to multiple chemicals. Subsequent recommendations by other parties, such as the National Research Council (NRC 1988) and the Presidential/Congressional Commission on Risk Assessment and Risk Management (Risk Commission 1997), have also advocated a default assumption of additivity. In this BHRA, risk assessments of chemical mixtures summed cancer risks regardless of tumor type, and summed noncancer HQs regardless of toxic endpoint or mode of action. Given the available experimental data, this approach likely overestimates potential risks associated with simultaneous exposure to multiple chemicals.

For four soil gas and shallow groundwater COPCs (dibromochloromethane, cis-1,2-dichloroethene, trans-1,2-dichloroethene, and trichlorofluoromethane, all of which are noncarcinogens), chronic toxicity values are not available. Also, an inhalation subchronic RfC is not available for dibromochloromethane. In the absence of toxicity values, these COPCs were not evaluated quantitatively for the corresponding noncancer effects in the BHRA. The impacts of these COPCs on the overall risk estimates were evaluated using the RfC values developed by Cal/EPA (2019), which are derived based on route-to-route extrapolation from oral reference dose (RfD) values developed by the IRIS assuming an inhalation rate of 20 m^3 per day and a body weight of 70 kilograms. Use of these Cal/EPA RfCs would result in very low noncancer HQs estimated for these COPCs (less than 0.001). Therefore, the exclusion of these COPCs from quantitative risk assessment is not expected to have a significant impact on the risk estimates or overall conclusions of the BHRA.

In summary, assumptions used in each step of the risk assessment contribute to the overall uncertainty in the BHRA results. However, given that the largest sources of uncertainty generally cause overestimates of exposure or risk, the results presented in this BHRA are considered to represent conservative estimates of the carcinogenic and noncarcinogenic risks, if any, posed by volatile chemicals in soil gas and shallow groundwater in the Operations Area of OU-1 through the vapor intrusion pathway. In other words, the

methodology of this BHRA is designed to not underestimate the true risk but likely overestimate the true risk by a considerable degree, and the true risk could be as low as zero.

7. DATA QUALITY ASSESSMENT

Data quality assessment is an analysis that is performed after the risk assessment is complete to determine whether enough data have been collected to support the risk-based decisions that are recommended by the risk assessment. The results of the data quality assessment for soil gas and shallow groundwater data are discussed below.

7.1 Soil Gas Data

For soil gas, the evaluation of the indoor commercial/industrial worker and construction worker scenarios was based on the maximum detected concentration, while the evaluation of the outdoor commercial/industrial worker scenario was based on the 95% UCL which is a measure of mean concentration.

7.1.1 Indoor Commercial/Industrial Worker and Construction Worker Scenarios

For indoor commercial/industrial workers (slab-on-grade, basement, and trailer scenarios) and construction workers, the data quality assessment was conceptualized as a statistical test of the proportion of the soil gas sample locations that are associated with an unacceptable risk. As summarized in Table 5-12, the maximum total estimated excess lifetime cancer risks for each exposed population are all at or below the higher end of the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}, and the total noncancer HIs do not exceed the target HI of greater than one. Therefore, the proportion of sample locations with an unacceptable risk is zero out of the total number of sample locations for each scenario, or 0%. The sample size, which is the number of sample locations from the RI, is summarized in Table 7-1.

In a hypothesis testing framework, a binomial test of proportions was used to evaluate the possibility that there is a greater-than-zero proportion of sample locations with an unacceptable risk. The null hypothesis is that the proportion of sample locations with an unacceptable risk is zero ($P_1=0$). The alternative hypothesis is that the proportion of sample locations with an unacceptable risk is greater than P_2, which is P_1 plus an appropriate effect size (i.e., population proportion) that the test should be able to detect.

For the purposes of evaluating if a sufficient number of sample locations were collected to support the risk assessment, the number of sample locations required for each scenario was determined using the Exact – Generic binomial test in the software program G*Power version 3.1.9 (Faul 2009). A null hypothesis with a P_1 of zero indicates that the false rejection error rate (α) is zero and independent of the sample size and other parameters. Thus, the number of samples required depends on false acceptance rate (β), P_1, and P_2. The number of sample locations required for β at 15%, 20% to 25% was tested for all scenarios in Table 7-1.

As a starting point, an effect size of one over the total number of sample locations was considered, which would be equivalent to one sample location having an unacceptable risk. Under this assumption, the null hypothesis would be rejected if one or more sample locations with an unacceptable risk were observed. As shown in Table 7-1, the number of sample locations required is larger than the corresponding sample size for indoor commercial/industrial workers (slab-on-grade), construction workers, and indoor commercial/industrial workers (basement scenario) with β as large as 25%, and for indoor

commercial/industrial workers (trailer scenario) with β as large as 20%. Therefore, for the above scenarios, the null hypothesis that no soil gas sample locations would have an unacceptable risk is rejected, and the current sample size is not sufficient to guarantee that no sample location over the entire Operations Area, over the entire area of the Unit Buildings, or near the Trust and Envirogen's trailers would have an unacceptable risk. For the indoor commercial/industrial worker (trailer scenario) with β as 25%, the number of sample locations required is the same as the sample size. Therefore, for this scenario, the null hypothesis that no soil gas sample locations would have an unacceptable risk is accepted, and the current sample size is sufficient to guarantee that no sample location near the Trust and Envirogen's trailers would have an unacceptable risk.

Further, for the scenarios where the null hypothesis is rejected with an effect size of one over the total number of sample locations, an effect size of two over the total number of sample locations was considered, which would be equivalent to two sample locations having an unacceptable risk. Under this assumption, the null hypothesis would be rejected if two or more sample locations with an unacceptable risk were observed. As shown in Table 7-1, this test cannot be conducted for indoor commercial/industrial workers (trailer scenario) because its sample size is two. For indoor commercial/industrial workers (slab-on-grade), construction workers, and indoor commercial/industrial workers (basement scenario), the number of sample locations required is smaller than the corresponding sample size, and the null hypothesis that no soil gas samples would have an unacceptable risk is accepted with β as small as 15%. Therefore, the current sample size is sufficient to guarantee that no more than one sample location over the entire Operations Area or the entire area of the Unit Buildings would have an unacceptable risk.

7.1.2 Outdoor Commercial/Industrial Worker Scenario

For outdoor commercial/industrial workers, the data quality assessment was conceptualized as a statistical test of comparing the mean of the population total cancer risk or noncancer HI with the target cancer risk or noncancer HI. In a hypothesis testing framework, a t-test can be used to evaluate the possibility that the mean of the population total cancer risk or noncancer HI is greater than or smaller than the target cancer risk or noncancer HI. The null hypothesis is that the mean of the population total estimated excess lifetime cancer risk or noncancer HI is the same as the total estimated excess lifetime cancer risk or noncancer HI based on the 95% UCL of sample results ($Mean_0$). The alternative hypothesis is that the mean of the population total estimated excess lifetime cancer risk or noncancer HI is greater than the target cancer risk or noncancer HI ($Mean_1$).

As shown in Table 5-12, the total estimated excess lifetime cancer risks and noncancer HIs for outdoor commercial/industrial workers are all significantly lower than the higher end of the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4} and the target HI of greater than one. Chloroform was analyzed at all sample locations and was the only cancer risk and noncancer HI driver for outdoor commercial/industrial worker scenarios based on Tables G-3 and G-4. The sample size of chloroform, which is the number of sample locations from the RI (as shown in Table 7-2), was tested to evaluate if a sufficient number of sample locations were collected using the t-tests - "Means: difference from constant (one sample case) test" in the software program G*Power version 3.1.9 (Faul 2009).

The number of sample locations required to support the risk assessment depends on false rejection error rate (α), false acceptance rate (β), $Mean_0$, $Mean_1$, and standard deviation of cancer risk or noncancer HQ from the driver chemical. A value of 5% was used for both α and β. $Mean_0$ was defined as the total cancer risk or noncancer HI based on the 95% UCL of sample results. The standard deviation of the total estimated excess lifetime cancer risk or noncancer HI was assumed to be equal to the standard deviation of cancer risk or noncancer HQ from the driver chemical. In the G*Power program, the target cancer risk ($Mean_1$) was set to 1.49×10^{-4}, which can be rounded to 1×10^{-4}, and the target HI ($Mean_1$) was set to 1.49, which can be rounded to 1.

As shown in Table 7-2, the number of soil gas sample locations required to support the risk assessment for outdoor commercial/industrial worker scenarios is smaller than the sample size. With α and β equal to 5%, the null hypothesis that the mean of the population total estimated excess lifetime cancer risk or noncancer HI is the same as the total estimated excess lifetime cancer risk or noncancer HI based on the 95% UCL of sample results is not rejected. Since the total estimated excess lifetime cancer risks and noncancer HIs based on the 95% UCL of sample results were below the targets, the mean of the population total estimated excess lifetime cancer risk and the noncancer HI are also expected to be below the targets. Based on this analysis, the number of soil gas sample locations collected over the Operations Area of OU-1 during the RI is sufficient for the purpose of risk characterization.

7.2 Shallow Groundwater Data

For shallow groundwater, the evaluation of the indoor commercial/industrial worker and construction worker scenarios was based on the maximum detected concentration, while the evaluation of the outdoor commercial/industrial worker scenario was based on the 95% UCL which is a measure of mean concentration.

7.2.1 Indoor Commercial/Industrial Worker and Construction Worker Scenarios

For indoor commercial/industrial workers (slab-on-grade, basement, and trailer scenarios) and construction workers, the data quality assessment was conceptualized as a statistical test of the proportion of the shallow groundwater sample locations that are associated with an unacceptable risk. As summarized in Table 5-16, the maximum total estimated excess lifetime cancer risk for each exposed population are all at or below the higher end of the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}, and the total noncancer HIs do not exceed the target HI of greater than one. Therefore, the proportion of sample locations with an unacceptable risk is zero out of the total number of sample locations for each scenario, or 0%. The sample size, which is the number of sample locations, is summarized in Table 7-3.

In a hypothesis testing framework, a binomial test of proportions was used to evaluate the possibility that there is a greater-than-zero proportion of sample locations with an unacceptable risk. The null hypothesis is that the proportion of sample locations with an unacceptable risk is zero ($P_1=0$). The alternative hypothesis is that the proportion of sample locations with an unacceptable risk is greater than P_2, which is P_1 plus an appropriate effect size (i.e., population proportion) that the test should be able to detect.

For the purposes of evaluating if a sufficient number of sample locations were collected to support the risk assessment, the number of sample locations required for each scenario was determined using the Exact – Generic binomial test in the software program G*Power version 3.1.9 (Faul 2009). A null hypothesis with a P_1 of zero indicates that the false rejection error rate (α) is zero and independent of the sample size and other parameters. Thus, the number of samples required depends on false acceptance rate (β), P_1, and P_2. The number of sample locations required for β at 15%, 20%, and 25% was tested for all scenarios in Table 7-3.

As a starting point, an effect size of one over the total number of sample locations was considered, which would be equivalent to one sample location having an unacceptable risk. Under this assumption, the null hypothesis would be rejected if one or more sample locations with an unacceptable risk were observed. As shown in Table 7-3, the number of sample locations required is larger than the corresponding sample size for indoor commercial/industrial workers (slab-on-grade), construction workers, and indoor commercial/industrial workers (basement scenario) with β as large as 25%, and for indoor commercial/industrial workers (trailer scenario) with β as large as 20%. Therefore, for the above scenarios, the null hypothesis that no shallow groundwater sample locations would have an unacceptable risk is rejected, and the current sample size is not sufficient to guarantee that no sample location over the entire Operations Area of OU-1, over the entire area of the Unit Buildings, or near the Trust and Envirogen's trailers would have an unacceptable risk. For indoor commercial/industrial workers (trailer scenario) with β as 25%, the number of sample locations required is the same as the sample size. Therefore, for this scenario, the null hypothesis that no shallow groundwater sample locations would have an unacceptable risk is accepted, and the current sample size is sufficient to guarantee that no sample location near the Trust and Envirogen's trailers would have an unacceptable risk.

Further, for the scenarios where the null hypothesis is rejected with an effect size of one over the total number of sample locations, an effect size of two over the total number of sample locations was considered, which would be equivalent to two sample locations having an unacceptable risk. Under this assumption, the null hypothesis would be rejected if two or more sample locations with an unacceptable risk were observed. As shown in Table 7-3, this test cannot be conducted for indoor commercial/industrial workers (trailer scenario) because its sample size is two. For indoor commercial/industrial workers (slab-on-grade), construction workers, and indoor commercial/industrial workers (basement scenario), the number of sample locations required is smaller than the corresponding sample size, and the null hypothesis that no shallow groundwater samples would have an unacceptable risk is accepted with β as small as 15%. Therefore, the current sample size is sufficient to guarantee that no more than one sample location over the entire Operations Area of OU-1 or the entire area of the Unit Buildings would have an unacceptable risk.

7.2.2 Outdoor Commercial/Industrial Worker Scenario

For outdoor commercial/industrial workers, the data quality assessment was conceptualized as a statistical test of comparing the mean of the population total estimated excess lifetime cancer risk or noncancer HI with the target cancer risk or noncancer HI. In a hypothesis testing framework, a t-test can be used to evaluate the possibility that the mean of the population total estimated excess lifetime cancer risk or noncancer HI is greater than or

smaller than the target cancer risk or noncancer HI. The null hypothesis is that the mean of the population total estimated excess lifetime cancer risk or noncancer HI is the same as the total estimated excess lifetime cancer risk or noncancer HI based on the 95% UCL of sample results ($Mean_0$). The alternative hypothesis is that the mean of the population total estimated excess lifetime cancer risk or noncancer HI is greater than the target cancer risk or noncancer HI ($Mean_1$).

As shown in Table 5-16, the total estimated excess lifetime cancer risks and noncancer HIs for outdoor commercial/industrial workers are all significantly lower than the higher end of the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4} and the target HI of greater than one. Chloroform and chlorobenzene were analyzed at all sample locations and were the cancer risk and noncancer HI drivers, respectively for outdoor commercial/industrial worker scenarios based on Table G-13. The sample size of chloroform and chlorobenzene, which is the number of sample locations (as shown in Table 7-4), was tested to evaluate if a sufficient number of sample locations were collected using the t-tests - "Means: difference from constant (one sample case) test" in the software program G*Power version 3.1.9 (Faul 2009).

The number of sample locations required to support the risk assessment depends on false rejection error rate (α), false acceptance rate (β), $Mean_0$, $Mean_1$, and standard deviation of cancer risk or noncancer HQ from the driver chemical. A value of 5% was used for both α and β. $Mean_0$ was defined as the total estimated excess lifetime cancer risk or noncancer HI based on the 95% UCL of sample results. The standard deviation of the total estimated excess lifetime cancer risk or noncancer HI was assumed to be equal to the standard deviation of cancer risk or noncancer HQ from the driver chemical. In the G*Power program, the target cancer risk ($Mean_1$) was set to 1.49×10^{-4}, which can be rounded to 1×10^{-4}, and the target HI ($Mean_1$) was set to 1.49, which can be rounded to 1.

As shown in Table 7-4, the number of shallow groundwater sample locations required to support the risk assessment for the outdoor commercial/industrial worker scenario is smaller than the sample size. With α and β equal to 5%, the null hypothesis that the mean of the population total estimated excess lifetime cancer risk or noncancer HI is the same as the total estimated excess lifetime cancer risk or noncancer HI based on the 95% UCL of sample results is not rejected. Since the total estimated excess lifetime cancer risks and noncancer HIs based on the 95% UCL of sample results were below the targets, the mean of the population total estimated excess lifetime cancer risk and the noncancer HI are also expected to be below the targets. Based on this analysis, the number of shallow groundwater sample locations collected over the Operations Area is sufficient for the purpose of risk characterization.

8. SUMMARY AND CONCLUSIONS

This BHRA was conducted to evaluate potential risks to workers associated with the vapor intrusion pathway from soil gas and shallow groundwater in the Operations Area. The BHRA followed the procedures outlined in USEPA's risk assessment guidance, applicable NDEP guidance, and approved work plans (ENVIRON 2014a; Ramboll 2018a). This BHRA Report has been prepared consistent with the methodology described in the BHRA Work Plan for OU-1 and OU-2 Soil Gas and Groundwater, Revision 1 (Ramboll 2018a), submitted to the NDEP on December 19, 2018 and approved by NDEP on January 24, 2019.

The initial version of the BHRA Report for OU-1 Soil Gas and Groundwater was submitted to NDEP on September 29, 2021 (Ramboll 2021a), and NDEP comments were received on March 9, 2022. The annotated response to the NDEP comment letter on this report was submitted to NDEP on June 24, 2022; NDEP's responses on the annotated response to comment letter were received on November 3, 2022. As requested by NDEP, this revised version was prepared consistent with the November 3, 2022 letter, addresses pertinent comments on other BHRAs being revised, and to address changes associated with the passage of time. Furthermore, and as directed by NDEP, the revised BHRA Report includes spatial plots consistent with Neptune's draft technical memorandum "NERT Spatial Plot Recommendations" dated February 18, 2022 (Neptune 2022).

Subsequent to the initial version of the BHRA Report submitted in 2021, NDEP released updated BCL tables (NDEP 2020a and NDEP 2023a) and User's Guide and Background Technical Documents (NDEP 2020b and NDEP 2023b), with the latest updates issued in June 2023. In the updates, extensive modifications were made to the soil BCLs, and some toxicity values and methodology used to derive the BCLs were also updated. In addition, the USEPA updated toxicity values in recent RSL tables released in May 2023 (USEPA 2023a). The relevant updates from NDEP and USEPA as described above have been incorporated into this revised BHRA Report. NDEP cites the NCP (40 CFR § 300) as the basis for NDEP's establishment of the target cancer risk range (NDEP 2023b). According to the NCP, lifetime incremental cancer risks posed by a site should be less than or within the cancer risk management range of 1×10^{-6} to 1×10^{-4}. According to the NCP and NDEP (2023b), noncarcinogenic chemicals should not be present at levels expected to cause adverse health effects (i.e., an HI greater than one). It should be noted that the cancer risk and noncancer hazard estimated in this BHRA do not represent absolute estimates in the Operations Area, since generic and conservative assumptions were used when values specific to the Operations Area were not available, which are likely to overestimate actual exposures and calculated risks.

Analytical results of soil gas and shallow groundwater samples collected within the Operations Area were assessed through data processing and DUE steps (see Section 4.1), and data representative of current conditions in the Operations Area were selected for purposes of the BHRA. Consistent with USEPA guidance (2015), soil gas data collected within the Operations Area during the NERT RI were used to evaluate potential exposure for workers via inhalation of vapors migrating from the subsurface to indoor air, outdoor air, and trench air. The soil gas data used in this BHRA were specifically collected to evaluate the vapor intrusion pathway. Soil gas data collected within the Operations Area were used to evaluate potential exposure for workers via inhalation of vapors migrating from the

subsurface to indoor air, outdoor air, and trench air. Soil gas data is generally the preferred line of evidence for assessing vapor intrusion risks as opposed to groundwater or soil data primarily due to higher uncertainties associated with vapor intrusion modeling based on groundwater or soil data (i.e., uncertainties in predicting contaminant partitioning from groundwater or soil moisture to soil gas and in predicting transport through the capillary fringe). Shallow groundwater data were incorporated in this BHRA to provide a secondary line of evidence for the vapor intrusion risk analysis and to check consistency between soil gas and groundwater results. As described in the uncertainty analysis, the methodology of this BHRA is designed to not underestimate the true risk but likely overestimate the true risk by a considerable degree, and the true risk could be as low as zero.

The COPCs, CSM, and estimated cancer risks and noncancer HIs are summarized as follows:

- All volatile compounds detected in one or more soil gas or shallow groundwater samples in the BHRA data sets were selected as COPCs (Table 5-1). A total of 66 COPCs were identified for soil gas collected at 5 feet bgs and a total of 60 COPCs were identified for soil gas collected at or around 15 feet bgs. A total of 34 COPCs were identified for shallow groundwater. Of the soil gas and shallow groundwater COPCs, six COPCs (benzene, carbon tetrachloride, chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene) are primarily associated with the trespassing OSSM plume (Ramboll 2023b).
- Based on the refined CSM developed by NERT for the Operations Area in OU-1, potential exposure to soil gas and shallow groundwater was evaluated for indoor commercial/industrial workers (slab-on-grade), outdoor commercial/industrial workers, and construction workers via inhalation of vapors migrating from soil gas and shallow groundwater to indoor air, outdoor air, and trench air. In addition, a basement scenario was evaluated for indoor commercial/industrial workers present at locations within the area of the Unit Buildings, and a trailer scenario was evaluated for indoor commercial/industrial workers present at locations within the area of office trailers used by the Trust and Envirogen. To be conservative, construction workers were assumed to be exposed to vapors migrating from soil gas/shallow groundwater while standing in a 10-foot trench in the unsaturated zone, placing them closer to the potential source.
- Excess lifetime cancer risks and noncancer HIs associated with inhalation of vapors migrating from soil gas and shallow groundwater were estimated based on the maximum detected concentrations at each individual sample location for indoor air and trench air scenarios, and based on the 95% UCLs on the mean concentrations over the entire Operations Area (or the maximum detected concentrations over the entire Operations Area if 95% UCLs could not be calculated due to limited detections) for outdoor air scenarios.
- The risk results based on soil gas data, which is the preferred line of evidence for assessing vapor intrusion risks, are summarized below:
    - The estimated excess lifetime cancer risks for indoor commercial/industrial workers (slab-on-grade) ranged from 3×10^{-9} to 3×10^{-5} for soil gas at 5 feet bgs and from 3×10^{-9} to 1×10^{-4} for soil gas at or around 15 feet bgs (see Table 5-12). As shown in Figures 5-2 and 5-3, the highest estimated total

excess lifetime cancer risks for soil gas both at 5 and 15 feet bgs were associated with the trespassing OSSM plume. Within the area associated with the trespassing OSSM plume, for indoor commercial/industrial workers (slab-on-grade), only the maximum total excess lifetime cancer risks at RISG-10 were above 1 x 10^{-5}, while there were several other locations with total cancer risks above 1 x 10^{-6} but at or below 1 x 10^{-5}.

- The maximum estimated total excess lifetime cancer risk for indoor commercial/industrial workers (slab-on-grade) exposed to soil gas at 5 feet bgs was 3 x 10^{-5} at RISG-10 associated with the trespassing OSSM plume, which was within or below the NDEP and USEPA cancer risk management range of 1 x 10^{-6} to 1 x 10^{-4}. The maximum estimated total excess lifetime cancer risk for indoor commercial/industrial workers (slab-on-grade) exposed to soil gas at or around 15 feet bgs was 1 x 10^{-4} at RISG-10, which was within or below the NDEP and USEPA cancer risk management range of 1 x 10^{-6} to 1 x 10^{-4}.
- The cancer risk driver at most of the soil gas sample locations (except for a few locations with cancer risks lower than 1 x 10^{-6}) was chloroform, contributing over 90% of the total estimated cancer risk.
- The maximum estimated total excess lifetime cancer risks for indoor commercial/industrial workers (basement scenario) exposed to soil gas at 5 and 15 feet bgs were 1 x 10^{-5} and 8 x 10^{-5}, respectively, located in the Unit 4 Building area.
- The estimated total excess lifetime cancer risks near the Trust trailer were 5 x 10^{-6} at both 5 and 15 feet bgs for indoor commercial/industrial workers (trailer scenario). The total excess lifetime cancer risks near Envirogen's trailer were 1 x 10^{-6} at both 5 and 15 feet bgs.
- The estimated total excess lifetime cancer risks for outdoor commercial/ industrial workers and construction workers in a trench exposed to soil gas at 5 feet bgs and at or around 15 feet bgs were below the lower end of the NDEP and USEPA cancer risk management range of 1 x 10^{-6} to 1 x 10^{-4}.
- The estimated total noncancer HIs for all soil gas scenarios were below the NDEP target HI of greater than one.

As discussed above, shallow groundwater data were incorporated in this BHRA to provide a secondary line of evidence for the vapor intrusion risk analysis and to check consistency between soil gas and groundwater results. Groundwater data for volatile compounds collected from shallow monitoring wells (with top of well screens less than 60 feet bgs) from 2015 to 2020 within the Operations Area were included in this BHRA. Similar to soil gas, the shallow groundwater cancer risks were above 10^{-6} in the area of the trespassing OSSM plume for indoor air scenarios, with a maximum estimated total excess lifetime cancer risk of 1 x 10^{-4} at M-126 (co-located with the soil gas location with the maximum cancer risk, RISG-10), which is within or below the NDEP and USEPA cancer risk management range of 1 x 10^{-6} to 1 x 10^{-4}. The cancer risk driver at most of the shallow groundwater sample locations (except for a few locations with cancer risks lower than 1 x 10^{-6}) was chloroform, contributing over 90% of the total cancer risk.

For shallow groundwater, total excess lifetime cancer risks above 1×10^{-6} but at or below 1×10^{-5} for indoor commercial/industrial workers (slab-on-grade) were observed in and adjacent to the NERT chloroform plume downgradient of the former Beta Ditch (see Figure 3-2 as well as discussion in Section 4.2.5), but the cancer risks predicted from soil gas in this area for indoor commercial/industrial workers (slab-on-grade) were below 1×10^{-6}. Near or underneath the Unit 4 Building, soil gas cancer risks above 1×10^{-6} for indoor commercial/ industrial workers (basement scenario) were also observed, but the cancer risks estimated from shallow groundwater in this area for indoor commercial/industrial workers (basement scenario) were below 1×10^{-6}.

The estimated total excess lifetime cancer risks for outdoor commercial/industrial workers and construction workers in a trench exposed to shallow groundwater through inhalation were below the lower end of the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4}. The estimated total noncancer HIs for all the shallow groundwater scenarios were below the NDEP target HI of greater than one.

The results and conclusions of the shallow groundwater risk evaluation are generally consistent with the results and conclusions of the soil gas risk evaluations, supporting the OU-1 CSM presented in the RI Report for OU-1 and OU-2 (Ramboll 2023b) which identifies that groundwater is the main source of VOCs detected in soil gas in OU-1.

In summary, in the Operations Area of OU-1 exposure to VOCs in soil gas and shallow groundwater in the OU-1 BHRA Area through the vapor intrusion pathway do not exceed the NDEP and USEPA cancer risk management range of 1×10^{-6} to 1×10^{-4} to indoor or outdoor commercial/industrial workers and construction workers under the conditions and assumptions evaluated and the target HI of greater than one for noncarcinogenic health impacts, under the conditions and assumptions evaluated. Therefore, additional assessment is not warranted based on the risk characterization results for the OU-1 Operations Area.

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TABLES

TABLE ES-1. Summary of Soil Gas and Shallow Groundwater COPCs
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	Soil Gas		Shallow Groundwater	Uniquely Associated with Trespassing OSSM Plume? [1]
	at 5 ft bgs	at or around 15 ft bgs		
Acetone	X	X		
Acrylonitrile	X	X		
tert-Amyl methyl ether	X			
Benzene	X	X	X	X
Benzyl chloride	X	X		
Bromobenzene			X	
Bromodichloromethane	X	X	X	
Bromoform	X	X	X	
Bromomethane	X	X		
2-Butanone	X	X	X	
tert-Butyl alcohol	X	X		
n-Butylbenzene	X	X		
sec-Butylbenzene	X	X		
tert-Butylbenzene	X			
Carbon disulfide	X	X		
Carbon tetrachloride	X	X	X	X
3-Chloro-1-propene	X			
Chlorobenzene	X	X	X	X
Chloroethane	X	X		
Chloroform	X	X	X	
Chloromethane	X	X		
2-Chlorotoluene			X	
4-Chlorotoluene			X	
Cumene	X	X		
Cyclohexane	X	X		
p-Cymene	X	X		
Dibromochloromethane	X	X	X	
1,2-Dichlorobenzene	X	X	X	X
1,3-Dichlorobenzene	X	X	X	X
1,4-Dichlorobenzene	X	X	X	X
Dichlorodifluoromethane	X	X		
1,1-Dichloroethane	X	X	X	
1,2-Dichloroethane	X	X	X	
1,1-Dichloroethene	X	X	X	
cis-1,2-Dichloroethene	X	X		
trans-1,2-Dichloroethene	X	X		
1,2-Dichloropropane	X	X		
1,3-Dichloropropane			X	
1,4-Dioxane	X	X	X	
Ethanol	X	X		
Ethylbenzene	X	X		
4-Ethyltoluene	X	X		
Freon 114	X	X		

TABLE ES-1. Summary of Soil Gas and Shallow Groundwater COPCs
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	Soil Gas		Shallow Groundwater	Uniquely Associated with Trespassing OSSM Plume? [1]
	at 5 ft bgs	at or around 15 ft bgs		
n-Heptane	X	X		
Hexachlorobutadiene	X	X	X	
n-Hexane	X			
2-Hexanone	X	X		
alpha-Methyl styrene	X	X		
Methyl tert-butyl ether	X	X		
4-Methyl-2-pentanone	X	X		
Methylene chloride	X	X	X	
Methylmethacrylate		X		
Naphthalene	X	X	X	
n-Octane	X	X		
n-Propylbenzene	X	X		
Styrene	X	X		
1,1,2,2-Tetrachloroethane	X		X	
Tetrachloroethene	X	X	X	
Tetrahydrofuran	X	X		
Toluene	X	X	X	
1,2,3-Trichlorobenzene			X	
1,2,4-Trichlorobenzene	X	X	X	
1,1,1-Trichloroethane	X	X		
1,1,2-Trichloroethane	X			
Trichloroethene	X	X	X	
Trichlorofluoromethane	X	X	X	
1,2,3-Trichloropropane			X	
1,1,2-Trichloro-1,2,2-trifluoroethane	X	X		
1,2,4-Trimethylbenzene	X	X	X	
1,3,5-Trimethylbenzene	X	X	X	
Vinyl acetate	X	X		
Vinyl chloride	X		X	
Xylenes (total)	X	X	X	

Notes:

bgs = below ground surface

ft = feet

COPC = Chemical of potential concern

OSSM = Olin Chlor Alkali/Stauffer/Syngenta/Montrose

OU = Operable Unit

[1] Please refer to Section 7.5.2.4 in the Remedial Investigation Report for OU-1 and OU-2, Revision 1 (Ramboll 2023) for more deta

Source:

Ramboll. 2023. Remedial Investigation Report for OU-1 and OU-2, Revision 1, Nevada Environmental Response Trust Site, Henderson, Nevada. August 15.

TABLE ES-2. Summary of Estimated Soil Gas Cancer Risks and Noncancer Hazard Indices
Nevada Environmental Response Trust Site
Henderson, Nevada

Scenario[1]	Depth (ft bgs)	Total Cancer Risk	Total Noncancer HI
Indoor Commercial/Industrial Worker (Slab-on-grade)	5	3E-09 - 3E-05	0.0001 - 0.03
	at or around 15	3E-09 - 1E-04	0.00002 - 0.1
Outdoor Commercial/Industrial Worker	5	2E-09	0.000003
	at or around 15	5E-09	0.000008
Construction Worker	5	1E-14 - 1E-10	0.000000006 - 0.000002
	at or around 15	2E-14 - 1E-09	0.000000003 - 0.00002
Indoor Commercial/Industrial Worker (Basement Scenario)	5	8E-09 - 1E-05	0.0003 - 0.02
	at or around 15	2E-08 - 8E-05	0.0009 - 0.1
Indoor Commercial/Industrial Worker (Trailer Scenario)	5	1E-06 - 5E-06	0.006
	at or around 15	1E-06 - 5E-06	0.005 - 0.007

Notes:
bgs = below ground surface
ft = feet
HI = Hazard index
OU = Operable unit
UCL = Upper confidence limit

[1] The cancer risk and non-cancer chronic HI estimates for the indoor commercial/industrial workers and construction workers were based on the maximum by sample risk/HI results for each scenario.

[2] The cancer risk and non-cancer chronic HI for the outdoor commercial/industrial workers were estimated based on the 95% UCLs calculated using the soil gas VOC data collected over the entire Operations Area of OU-1.

TABLE 4-1. Data Usability Evaluation- Soil Gas

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
I. Reports to the Risk Assessor *List all reports and dates and confirm that report(s) relied upon are complete and appropriate for use in the BHRA*	The work plans, reports, and DVSRs[1] for soil gas investigations completed within the Operations Area are reported in the following documents. **Historical Investigations** *Phase B Soil Gas Investigation (between May 7 and May 29, 2008)* • *Phase B Source Area Investigation Soil Gas Survey Work Plan* (ENSR 2008a, approved by NDEP on March 26, 2008) • (A Phase B Soil Gas Investigation results report was not identified.) • *DVSR, Phase B Source Area Investigation Soil Gas Survey, Tronox LLC Facility* (ENSR 2008c, approved by NDEP on October 20, 2008) **Remedial Investigations** *Phase 2 RI Modification No. 11 (between March 6, 2019 and March 22, 2019), and Phase 3 RI Modification No. 9 (between November 4, 2019 and January 21, 2020)* • *Phase 2 RI Modification No. 11, Recommended Soil Gas Sampling Locations* (Ramboll 2018b, approved by NDEP on June 21, 2018) • *Phase 3 RI Modification No. 9, Proposed Soil Gas Sampling in OU-1 and OU-2* (Ramboll 2019b, approved by NDEP on October 14, 2019) • *Technical Memorandum, Soil Gas Sampling Results for OU-1 and OU-2* (Ramboll 2020b, commented by NDEP on January 28, 2021) • *OU-1 and OU-2 Remedial Investigation Report* (Ramboll 2023b)

[1] DVSRs are provided in Appendix B.

TABLE 4-1. Data Usability Evaluation- Soil Gas

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
	• *DVSR, Phase 2 Remedial Investigation, March 2018 through March 2019* (Ramboll 2020c, approved by NDEP on April 9, 2020) • *DVSR, Phase 3 Remedial Investigation, February 2019 through January 2020* (Ramboll 2021e, approved by NDEP on January 27, 2021) Overall, the available reports, and the accompanying laboratory reports and DVSRs, are considered complete for BHRA purposes.
II. Documentation *Confirm that each analytical result is associated with a specific sample location and that the appropriate sampling procedure is documented.*	For this step, Ramboll reviewed the soil gas samples collected and reported in the documents listed under Criterion I and/or in the NERT project database. The following steps were then completed (presented in chronological order): • Identification of "removed" samples: Following the 2010-2011 soil removal actions, 2008 soil gas samples that had been collected within an excavated area were tagged in the NERT project database as "removed." These samples were excluded from the BHRA data set. • Confirmation of sample locations: The geographic location of each sample was confirmed relative to the current boundaries of the Operations Area and sale parcels. Samples located outside the Operations Area were removed from the BHRA data set. • Confirmation of sampling procedures: As discussed in the work plans listed under Criterion I, all sample collection and handling procedures were consistent with the NDEP-approved QAPPs (ENSR 2008b, Ramboll Environ 2017a, Ramboll 2019a). Ramboll reviewed the chain-of-custody forms prepared in the field and compared them with the analytical data results provided by the laboratories to ensure completeness of the data set. The available information is adequate to relate each analytical result retained in the risk assessment dataset to a geographic location, depth interval, and sampling procedure.

TABLE 4-1. Data Usability Evaluation- Soil Gas

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
III. Data Sources *Confirmation that source areas are adequately sampled and that analytical methods are appropriate to identify COPCs and estimate EPCs.*	**Historical Investigations** Soil gas samples from the Phase B Investigation were: 1) located near or within LOUs where VOCs may have been used in past operations; 2) located in areas overlying trespassing (western Site boundary) groundwater plumes; 3) co-located with existing groundwater monitoring wells; and (4) located randomly throughout the Site to obtain spatial coverage. Analyses with standard USEPA analytical methods (listed under Criterion IV) were conducted by NDEP-certified laboratories. **Remedial Investigations** As part of the ongoing RI/FS (Ramboll 2018b, 2019b, 2023b), soil gas samples were collected in the Operations Area during the Phase 2 RI and Phase 3 RI to delineate the horizontal and vertical extent of VOCs in soil gas and to address data gaps in the Phase B Soil Gas Investigation identified through the further evaluation of VOC data in shallow groundwater, i.e., to obtain VOC data at a deeper depth (15 feet bgs) and in areas where high chloroform concentrations were detected in the previous soil gas and/or groundwater sampling. The specific analysis conducted for VOCs was identified based on the review of the historical sampling results; Analyses with standard USEPA analytical methods (listed under Criterion IV) were conducted by NDEP-certified laboratories. In summary, the review of sampling coverage from the BHRA data set is based on the distribution of sample locations from both historical investigations and RI. Sample coverage is considered adequate for purposes of the BHRA. The USEPA analytical methods are adequate for characterizing potential contaminants in soil gas and provide quantitative analytical results that are of adequate quality for deriving EPCs.

TABLE 4-1. Data Usability Evaluation- Soil Gas

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
IV. Analytical Methods and Detection Limits *Confirm that analytical methods appropriately identify the chemical form or species and that the SQL is at or below a concentration appropriate for the BHRA.*	Standard analytical methods were used for all analyses as listed below. **Historical Investigations** • USEPA Method TO-15 (VOCs) **Remedial Investigations** • USEPA Method TO-15 (VOCs) The above method is adequate to characterize a broad spectrum of VOCs in soil gas. The SQLs were evaluated to confirm that they were sufficiently low for risk characterization (i.e., below 0.1xRBTC, as derived in Section 5.4.1). As shown in Tables 4-4 and 4-5, maximum SQLs were less than 0.1xRBTC, with the following exceptions: *For soil gas at 5 feet bgs:* • For five analytes (acrylonitrile, benzyl chloride, bromodichloromethane, hexachlorobutadiene, and 1,1,2,2-tetrachloroethane), the SQLs exceeded 0.1xRBTC in 0.90 to 8.3% of the samples reported as nondetects, with no SQLs exceeding the RBTCs. • 1,2-Dibromoethane was reported as less than detection limits in all samples; the SQLs exceeded 0.1xRBTC in 5.3% of the nondetected samples (six out of 113 samples), including the SQL of one sample exceeding the RBTC. • 1,2-Dibromo-3-chloropropane was reported as less than detection limits in all samples; the SQLs exceeded 0.1xRBTC in 50% of the nondetected samples (50 out of 100 samples) and exceeded the RBTC in 26% of the nondetected samples (26 out of 100 samples). *For soil gas at or around 15 feet bgs:* • For nine analytes (benzyl chloride, bromodichloromethane, 1,4-dichlorobenzene, 1,2-dichloroethane, 1,2-dichloropropane, hexachlorobutadiene, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, and 1,2,3-

TABLE 4-1. Data Usability Evaluation- Soil Gas

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
	trichloropropane), the SQLs exceeded 0.1xRBTC in 1.8 to 14% of the samples reported as nondetects, with no SQLs exceeding the RBTCs. • For acrylonitrile, the SQLs exceeded 0.1xRBTC in seven out of 33 samples reported as nondetects (21%), while the detection frequency was 5.7%. No SQLs exceeded the RBTC. • 1,2-Dibromoethane was reported as less than detection limits in all samples; the SQLs exceeded 0.1xRBTC in 20% of the nondetected samples (11 out of 55 samples), including the SQLs of three samples exceeding the RBTC. • 1,2-Dibromo-3-chloropropane was reported as less than detection limits in all samples; the SQLs exceeded 0.1xRBTC in 83% of samples (29 out of 35 samples) and exceeded the RBTC in 57% of the nondetected samples (20 out of 35 samples). Overall, the SQLs were sufficiently low for risk characterization. The impacts of the few exceptions with elevated SQLs on the overall risk evaluation are further discussed in Section 6.1.2.
V. Data Review *Confirm that the quality of the analytical data is assessed by professionals knowledgeable in field collection procedures and analytical chemistry and that data quality is adequate to estimate EPCs.*	The laboratory results from historical investigations and the RI were subjected to formal data validation consistent with USEPA guidelines (USEPA 1999, 2001, 2004, 2005a,b, 2008, 2009e), the *BMI Plant Site Specific Supplemental Guidance on Data Validation* (NDEP 2009d), and *Basic Remediation Company (BRC) Standard Operating Procedure (SOP) 40 and Data Review/Validation* (BRC 2009). The USEPA guidelines, which were prepared for Contract Laboratory Program data, were adapted to reflect the analytical methods and measurement quality objectives established for the individual sampling events and NDEP guidance. The NDEP-approved DVSRs listed in Criterion I for soil gas data included in the BHRA data set are provided in Appendix B, in which the names and qualifications of the reviewers, the specific data validation procedures, and the qualification findings are presented. Each DVSR includes the following tabular summaries of the data qualifications: • Summary of data qualified due to holding time exceedances

TABLE 4-1. Data Usability Evaluation- Soil Gas

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
	• Summary of data qualified due to detection below quantitation limit • Summary of data qualified due to laboratory blank contamination • Summary of data qualified due to field blank contamination • Summary of data qualified due to matrix spike (MS)/matrix spike duplicate (MSD) recovery exceedances • Summary of data qualified due to laboratory control spike (LCS) recovery exceedances • Summary of data qualified due to field/laboratory duplicate • Summary of data qualified due to surrogate recovery exceedances • Summary of data qualified due to calibration violations • Summary of data qualified due to calibration range exceedances • Summary of data qualified due to internal standard recovery exceedances • Summary of data qualified due to serial dilutions • Summary of qualified data results • Summary of rejected data results These data qualifications are further discussed below as a component of Criterion VI.
VI. Data Quality Indicators *Document that sampling and analysis DQIs are evaluated using criteria*	<u>Completeness</u> Completeness is defined as the percentage of acceptable sample results compared to the total number of sample results, which is evaluated to determine if an acceptable amount of usable data were obtained so that a valid scientific site assessment can be completed. The completeness goal stated in the QAPPs is 90% or greater.

TABLE 4-1. Data Usability Evaluation- Soil Gas

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
specific to the risk assessment.	Completeness was reviewed as reported in the DVSR prepared for each individual investigation contributing to the soil gas BHRA data set, and no data were rejected. Therefore, completeness for the soil gas BHRA data set for the Operations Area (Appendix D) was 100%, which meets the completeness goal of 90% established in the QAPPs. <u>Comparability</u> Comparability is a qualitative characteristic expressing the confidence with which one data set can be combined with another for purposes of estimating exposure. More specifically, comparability is a qualitative expression of the measure of confidence that two or more data sets may contribute to a common analysis. In general, comparability of data is maximized by using standard methods for sampling and analysis, reporting data, and data validation. Soil gas samples identified for the BHRA were collected by different entities and analyzed by different analytical laboratories; overall, the investigations from which data are being used span a period of approximately 12 years. In the Phase B Soil Gas Investigation in 2008, the Phase 2 RI Modification No. 11 in 2019, and the Phase 3 RI Modification No. 9 in 2019-2020, helium was used as the tracer gas for leak checking during sample collection; helium was analyzed in the soil gas samples collected in the 2008 Phase B Investigation and the 2019-2020 Phase 3 RI Modification No. 9. USEPA Method TO-15 was used as the analytical method for samples collected from all three investigations, and the sampling results were all reported in µg/m^3. Additionally, all three investigations used the same sample preservation, extraction, and preparation techniques. Different reporting limits for the same analyte may also impact the comparability of the data sets. The ranges of the SQLs for each analyte where the detection frequency was less than 100% are presented in Tables 4-4 and 4-5. For most of the analytes, the SQLs are well below 0.1xRBTC; therefore, different reporting limits for the same analyte would not affect the overall risk evaluation. There are a few analytes with SQLs exceeding 0.1xRBTC, and their impacts on the overall risk evaluation are further discussed in Section 6.1.2.

TABLE 4-1. Data Usability Evaluation- Soil Gas

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
	Temporal factors were also considered in the comparability evaluation. Soil gas concentrations would be expected to follow trends of groundwater concentrations, in cases where groundwater is the source of VOCs. The temporal trends of VOCs in soil gas and groundwater are further discussed in Section 4.2.3. <u>Representativeness</u> Representativeness is the degree to which data accurately and precisely represent a characteristic of the population at a sampling point or an environmental condition. There is no standard method or formula for evaluating representativeness, which is a qualitative term. Spatial representativeness is achieved through selection of sampling locations that are appropriate relative to the objective of the specific investigation, and by collection of an adequate number of samples from locations identified in relation to the investigation objectives. Concentration representativeness is achieved by obtaining analytical results of sufficient quality, as specified in the QAPPs. Spatial representativeness was discussed previously under Criterion III. As noted, soil gas locations were selected based on the former chemical usage at the individual LOUs and the the presence of several VOCs in the soil and groundwater samples within the Operations Area, ensuring that the data provide a conservative representation of current conditions within the Operations Area in the context of the CSM. The objectives of the sampling programs were met, considering the approach used to delineate contaminated areas. As presented in the DVSRs listed under Criterion I, standard methods for sampling and analysis were used for all the investigations, which confirmed that the analytical data are representative of the soil gas concentrations at the locations sampled. Entrainment of contaminants and dilution with surface air can impact the representativeness of analytical results. Therefore, the extent of concentration representativeness was further evaluated by reviewing the helium leak check results from the 2008 Phase B Investigation, the 2019 Phase 2 RI Modification No. 11, and the 2019-2020 Phase 3 RI Modification No. 9. For the 2008 Phase B Investigation, all samples with average leak percentages of helium between 1% and 10% were qualified as estimated (J) based on possible contamination and dilution by surface air. This rule was based on a conservative interpretation of the *Technical and Regulatory Guidance, Vapor Intrusion*

TABLE 4-1. Data Usability Evaluation- Soil Gas

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
	Pathway: A Practical Guideline (ITRC 2007) and *Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (New York State Department of Health 2006). The analytical results of samples SG60B-05 and SG94B-05 were J-qualified due to this criterion, with average leak percentages of helium as 1.4% and 2.6%, respectively (see Table C-8 in ENSR 2008c). The average leak percentages for these two samples were less than the QAPP criterion of 5%. Therefore, the results for these samples were not corrected. For the 2019 Phase 2 RI Modification No. 11, helium concentrations in shrouds were monitored for leak check purposes during sampling and no helium leak was noted. Helium concentrations in the soil gas samples were not analyzed by the laboratory and helium leak percentages were not calculated for the soil gas samples collected from this investigation. The analytical results from this soil gas investigation were not corrected. For the 2019-2020 Phase 3 RI Modification No. 9, helium concentrations in shrouds were monitored for leak check purposes during sampling and helium concentrations in the soil gas samples were also analyzed by the laboratory. Helium was detected in 15-foot samples collected at RISG-25 and RISG-87, with leak percentages as 1.6% and 1.8%, respectively (see Ramboll 2021e). The average leak percentages for these two samples were less than the QAPP criterion of 5%. Therefore, the results for these samples were not corrected. <u>Precision</u> Precision is a measure of the degree of agreement between replicate measurements of the same source (field precision) or sample (analytical precision). Field precision is evaluated by calculating the RPD between the primary field sample and its field duplicate. Laboratory precision is quantitated for each laboratory data batch by calculating the RPD using data for the LCS/laboratory control spike duplicate (LCSD) and/or data for the MS/MSD. The field precision goal established in the QAPPs is a RPD of less than or equal to 50%, except for the case in which one (or both) of the primary or duplicate result is less than five times the PQL. For the latter case, the acceptance criterion is the PQL (i.e., the absolute value of the difference between the

	primary and duplicate result is less than or equal to the PQL). Laboratory precision goals are defined for specific analytical methods, as indicated in the QAPP (see Table 2 of ENVIRON [2014c]). Field precision for the Operations Area samples was assessed by evaluating the field duplicate results in accordance with the *Statistical Analysis Recommendations for Field Duplicates and Field Splits* (NDEP 2008c), where the primary sample and field duplicate are independent samples. A total of 14 pairs of primary and field duplicate results were qualified due to RPD or PQL criterion exceedance (see Appendix B, Table B-1). For laboratory duplicates, there were no data points qualified due to RPD or PQL criterion exceedance (see DVSR tables in Appendix B). All data with precision exceedances were qualified as "J/Estimated" or "UJ/Estimated non-detected" and are determined to be usable for purposes of the BHRA, and the effects of these qualified data on the overall risk evaluation are further discussed in Sections 6.1.5 and 6.1.6. <u>Accuracy</u> Accuracy measures the level of bias that an analytical method or measurement exhibits. Both field accuracy and laboratory accuracy are evaluated under this DQI. Accuracy in the field is assessed through the use of trip and equipment blanks and through adherence to all sample handling, preservation, and holding time requirements. As specified in the QAPPs, the objective for trip and equipment blanks is for no analyte to be present at levels greater than the PQL. Accuracy in the laboratory analytical data is a measure of the overestimation or underestimation of reported concentrations. Several QC parameters are used to evaluate the accuracy of reported analytical results, including: • Holding times; • Field and laboratory blanks; • MS/MSD percent recovery; • Surrogate spike recovery; and • LCS percent recovery. All qualified results (i.e., U, J, J-, and J+ qualified data) for the soil gas analytes are presented in Appendix D along with the reason codes for these qualified results. Although laboratory limits were exceeded for certain compounds or analyses, as identified by the laboratory (and confirmed during data validation), there does not appear to be a systematic or widespread impact on the quality of the analytical results. Furthermore, based on a review of the laboratory narratives (provided in the laboratory reports in each DVSR), the laboratory does not believe that the observed exceedances of laboratory criteria are cause for concern. Therefore, the qualified data are determined to be usable and valid for purposes of the BHRA and

TABLE 4-1. Data Usability Evaluation- Soil Gas

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
	are included in the BHRA data set. The impacts of qualified data on the overall risk evaluation are further discussed in Section 6.1.6. Data collected from the 2008 Phase B Soil Gas Investigation and associated with field and laboratory blank contamination were originally qualified as nondetects based on the NDEP guidance at that time. As requested by NDEP and in accordance with the most recent guidance (NDEP 2012) for evaluating data associated with blank contamination, if there were detections between the SQL and PQL for samples with blank contamination, these data were changed from nondetected values (U qualified) to detected values (J qualified) at reported concentrations. The revisions of censored data for blank contamination are summarized in Appendix B, Table B-2, and the impacts on the overall risk evaluation are further discussed in Section 6.1.6. In summary, all data are acceptable through the DQI evaluation and deemed to be usable for risk assessment purposes.

TABLE 4-2. Data Usability Evaluation – Shallow Groundwater

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
I. Reports to the Risk Assessor *List all reports and dates and confirm that report(s) relied upon are complete and appropriate for use in the BHRA*	The work plans, reports, and DVSRs[1] for shallow groundwater investigations completed within the Operations Area are reported in the following documents. **Remedial Investigations** *Phase 1 RI (between January 19 and May 7, 2015) and Phase 2 RI (between May 2, 2017 and March 12, 2019)* • *Remedial Investigation and Feasibility Study Work Plan* (ENVIRON 2014a, approved by NDEP on July 2, 2014) • *Remedial Investigation Data Evaluation Technical Memorandum* (Ramboll Environ 2016a, approved by NDEP on July 13, 2016) • *RI Phase 2 Modification No. 1* (Ramboll Environ 2017d, approved by NDEP on May 1, 2017) • *RI Phase 2 Modification No. 9* (Ramboll Environ 2017e, approved by NDEP on November 3, 2017) • *OU-1 and OU-2 Remedial Investigation Report* (Ramboll 2023b) • *DVSR, Groundwater Data Collected as Part of the NERT Phase 1 Remedial Investigation* (Ramboll 2018d, approved by NDEP on August 14, 2018) • *DVSR, Phase 2 Remedial Investigation, February through June 2017* (Ramboll 2019d, approved by NDEP on July 10, 2019) • *DVSR, Phase 2 Remedial Investigation, July through November 2017* (Ramboll 2019e, approved by NDEP on June 3, 2019) • *DVSR, Phase 2 Remedial Investigation, March 2018 through March 2019* (Ramboll 2020c, approved by NDEP on April 9, 2020)

[1] DVSRs are provided in Appendix C.

TABLE 4-2. Data Usability Evaluation – Shallow Groundwater

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
	Unit 4 and 5 Buildings Investigation (between November 13 and November 14, 2017 for the third mobilization) • *Unit 4 and 5 Buildings Investigation Work Plan* (Tetra Tech 2015, approved by NDEP on April 13, 2015) • *Unit 4 and 5 Buildings Investigation Source Area Characterization Report* (Tetra Tech 2020, approved by NDEP on January 13, 2020) • *DVSR, Unit 4 and 5 Buildings Investigation* (Tetra Tech 2019, approved by NDEP on February 21, 2019) **Annual Groundwater Monitoring** *2016 (between February 10 and September 14, 2016), 2017 (between May 9 and May 15, 2017), 2018 (between May 11 and May 30, 2018), 2019 (between May 10 and May 16, 2019), and 2020 (between May 11 and May 18, 2020)* • *2016 Groundwater Monitoring Optimization Plan* (Ramboll Environ 2016c, approved by NDEP on June 24, 2016) • *2016 Annual Remedial Performance Report for Chromium and Perchlorate* (Ramboll Environ 2016d, approved by NDEP on December 6, 2016) • *DVSR, 2016 Annual Remedial Performance Sampling* (Ramboll 2018e, approved by NDEP on July 10, 2018) • *DVSR, 2016 Semi-Annual Remedial Performance Sampling* (Ramboll Environ 2017g, approved by NDEP on August 17, 2017) • *2017 Annual Remedial Performance Report for Chromium and Perchlorate* (Ramboll Environ 2017f, approved by NDEP on February 6, 2018) • *DVSR, 2017 Annual Remedial Performance Report* (Ramboll 2018f, approved by NDEP on March 5, 2018)

TABLE 4-2. Data Usability Evaluation – Shallow Groundwater

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
	• *2018 Annual Remedial Performance Report for Chromium and Perchlorate* (Ramboll 2018c, approved by NDEP on January 18, 2019) • *DVSR, 2018 Annual Remedial Performance Report* (Ramboll 2019f, approved by NDEP on May 14, 2019) • *2019 Annual Remedial Performance Report for Chromium and Perchlorate* (Ramboll 2019c, approved by NDEP on April 30, 2020) • *DVSR, 2019 Annual Remedial Performance Report* (Ramboll 2019g, approved by NDEP on January 13, 2020) • *2020 Annual Groundwater Monitoring and GWETS Performance Report* (Ramboll 2021d, approved by NDEP on May 6, 2021) • *DVSR, 2020 Annual Remedial Performance Report* (Ramboll 2021f, commented by NDEP on September 16, 2021) Overall, the available reports, and the accompanying laboratory reports and DVSRs, are considered complete for BHRA purposes.
II. Documentation *Confirm that each analytical result is associated with a specific sample location and that the appropriate sampling procedure is documented.*	For this step, Ramboll reviewed the shallow groundwater samples collected and reported in the documents listed under Criterion I and/or in the NERT project database. The following steps were then completed (presented in chronological order): • Confirmation of sample locations: The geographic location of each sample was confirmed relative to the current boundaries of the Operations Area and sale parcels. Samples located outside the Operations Area were removed from the BHRA data set. • Confirmation of sampling procedures: As discussed in the work plans listed under Criterion I, all sample collection and handling procedures were consistent with the NDEP-approved QAPPs (ENVIRON 2014c, Ramboll Environ 2017a, Ramboll 2019a). Ramboll reviewed the chain-of-custody forms prepared in the

TABLE 4-2. Data Usability Evaluation – Shallow Groundwater

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
	field and compared them with the analytical data results provided by the laboratories to ensure completeness of the data set. The available information is adequate to relate each analytical result retained in the risk assessment dataset to a geographic location, depth interval, and sampling procedure.
III. Data Sources *Confirmation that source areas are adequately sampled and that analytical methods are appropriate to identify COPCs and estimate EPCs.*	**Remedial Investigations** As part of the ongoing RI/FS (ENVIRON 2014a; Ramboll Environ 2016a; Ramboll 2023b), shallow groundwater samples were collected in the Operations Area during Phase 1 and Phase 2 RI to address spatial data gaps identified through the review of available historical groundwater data. In addition, the Unit 4 and 5 Buildings Investigation was conducted to provide scale-appropriate data density to characterize the vertical and horizontal extent of impacted groundwater underneath the Unit 4 and 5 Buildings and the nearby area. Review of the analytical results indicates that these spatial data gaps have been addressed. The specific analyses conducted for volatile compounds (i.e., VOCs, SVOCs, and PAHs) were identified based on the review of the historical sampling results; Analyses with standard USEPA analytical methods (listed under Criterion IV) were conducted by NDEP-certified laboratories. **Annual Groundwater Monitoring** As directed by NDEP, VOCs were first added to the groundwater monitoring program as part of the 2016 *Groundwater Monitoring Optimization Plan* (Ramboll Environ 2016c) after initial evaluations of Phase 1 RI data suggested that these chemicals were present at detectable levels throughout the Operations Area (Ramboll Environ 2016a). Comprehensive groundwater sampling for volatile compounds throughout the Operations Area has been conducted on an annual basis (usually in May every year) as part of the annual groundwater sampling event since 2017.

TABLE 4-2. Data Usability Evaluation – Shallow Groundwater

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
	The specific analysis conducted for VOCs was identified based on the review of the Phase 1 RI sampling results; Analyses with standard USEPA analytical methods (listed under Criterion IV) were conducted by NDEP-certified laboratories. In summary, the review of sampling coverage from the BHRA data set is based on the distribution of sample locations from recent shallow groundwater investigations. Sample coverage is considered adequate for purposes of the BHRA. The USEPA analytical methods are adequate for characterizing potential contaminants in shallow groundwater and provide quantitative analytical results that are of adequate quality for deriving EPCs.
IV. Analytical Methods and Detection Limits *Confirm that analytical methods appropriately identify the chemical form or species and that the SQL is at or below a concentration appropriate for the BHRA.*	Standard analytical methods were used for all analyses as listed below. **Remedial Investigations** • USEPA Method 8260 or 8260 selective ion monitoring (SIM) (VOCs) • USEPA Method 8270 (SVOCs) • USEPA Method 8270 SIM (PAHs) • USEPA Method 8315 (formaldehyde) **Annual Groundwater Monitoring** • USEPA Method 8260 or 8260 SIM (VOCs) The above methods are adequate to characterize the corresponding chemical groups in shallow groundwater. The SQLs were evaluated to confirm that they were sufficiently low for risk characterization (i.e., below 0.1xRBTC, as derived in Section 5.4.2). As shown in Table 4-6, maximum SQLs were less than 0.1xRBTC, with the following exceptions:

TABLE 4-2. Data Usability Evaluation – Shallow Groundwater

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
	• For eight analytes (bromodichloromethane, carbon tetrachloride, 1,2-dichloroethane, 1,2-dichloropropane, 2,2-dichloropropane, hexachlorobutadiene, naphthalene, and trichloroethene), the SQLs exceeded 0.1xRBTC in 0.84 to 2.7% of the samples reported as nondetects, with no SQLs exceeding the RBTCs. • For vinyl chloride, the SQLs exceeded 0.1xRBTC in 4.4% of the nondetected samples (21 out of 477 samples), including the SQLs of three samples exceeding the RBTC. • 1,2-Dibromoethane was reported as less than detection limits in all samples; the SQLs exceeded 0.1xRBTC in 4.6% of the nondetected samples (22 out of 479 samples), including the SQLs of four samples exceeding the RBTC. • 1,2-Dibromo-3-chloropropane was reported as less than detection limits in all samples; the SQLs exceeded 0.1xRBTC in 14% of the nondetected samples (68 out of 479 samples) and exceeded the RBTC in 3.5% of the nondetected samples (17 out of 479 samples). Overall, the SQLs were sufficiently low for risk characterization. The impacts of the few exceptions with elevated SQLs on the overall risk evaluation are further discussed in Section 6.1.2.
V. Data Review *Confirm that the quality of the analytical data is assessed by professionals knowledgeable in field collection procedures and analytical chemistry and that data quality is adequate to estimate EPCs.*	The laboratory results from the RI and the Annual Groundwater Monitoring were subjected to formal data validation consistent with USEPA guidelines (USEPA 1999, 2001, 2004, 2005a,b, 2008, 2009e), the BMI Plant Site Specific Supplemental Guidance on Data Validation (NDEP 2009), and BRC SOP 40 and Data Review/Validation (BRC 2009). The USEPA guidelines, which were prepared for Contract Laboratory Program data, were adapted to reflect the analytical methods and measurement quality objectives established for the individual sampling events and NDEP guidance. The NDEP-approved DVSRs listed in Criterion I for shallow groundwater data included in the BHRA data set are provided in Appendix C, in which the names and qualifications of the reviewers, the specific data validation procedures, and the qualification findings are presented. Each DVSR includes the following tabular summaries of the data qualifications:

TABLE 4-2. Data Usability Evaluation – Shallow Groundwater

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
	• Summary of data qualified due to holding time exceedances • Summary of data qualified due to detection below quantitation limit • Summary of data qualified due to laboratory blank contamination • Summary of data qualified due to field blank contamination • Summary of data qualified due to MS/MSD recovery exceedances • Summary of data qualified due to LCS recovery exceedances • Summary of data qualified due to field/laboratory duplicate • Summary of data qualified due to surrogate recovery exceedances • Summary of data qualified due to calibration violations • Summary of data qualified due to calibration range exceedances • Summary of data qualified due to internal standard recovery exceedances • Summary of data qualified due to serial dilutions • Summary of qualified data results • Summary of rejected data results These data qualifications are further discussed below as a component of Criterion VI.
VI. Data Quality Indicators *Document that sampling and analysis DQIs are evaluated using criteria*	<u>Completeness</u> Completeness is defined as the percentage of acceptable sample results compared to the total number of sample results, which is evaluated to determine if an acceptable amount of usable data were obtained so that

TABLE 4-2. Data Usability Evaluation – Shallow Groundwater

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
specific to the risk assessment.	a valid scientific site assessment can be completed. The completeness goal stated in the QAPPs is 90% or greater. First, completeness was reviewed as reported in the DVSR prepared for each individual investigation contributing to the shallow groundwater BHRA data set. Depending on the specific DVSR, 98% to 100% completeness was archived based on validated data, with 0% to 2% of the data qualified as rejected ("R" qualified). Rejected ("R" qualified) data associated with shallow groundwater samples in the Operations Area are summarized in Appendix C, Table C-2. Completeness for the shallow groundwater BHRA data set for the Operations Area (Appendix E) was calculated as 99.9%. In summary, the completeness for the shallow groundwater BHRA data meet the completeness goal of 90% established in the QAPPs. Rejected data are excluded from the shallow groundwater BHRA data set, and a discussion of how these rejected data occurrences potentially affect the overall risk evaluation are further discussed in Section 6.1.3. <u>Comparability</u> Comparability is a qualitative characteristic expressing the confidence with which one data set can be combined with another for purposes of estimating exposure. More specifically, comparability is a qualitative expression of the measure of confidence that two or more data sets may contribute to a common analysis. In general, comparability of data is maximized by using standard methods for sampling and analysis, reporting data, and data validation. Shallow groundwater samples identified for the BHRA were collected by different entities and analyzed by different analytical laboratories; overall, the investigations from which data are being used span a period of approximately six years. The same analytical methods were used across most investigations; specifically, USEPA Method 8260 for VOCs and USEPA Method 8270 for SVOCs. In some investigations, the more

TABLE 4-2. Data Usability Evaluation – Shallow Groundwater

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
	sensitive USEPA Method 8260 SIM was used for VOCs and USEPA Method 8270 SIM was used for PAHs. All groundwater sampling results were reported in µg/L. Different reporting limits for the same analyte may also impact the comparability of the data sets. The ranges of the SQLs for each analyte where the detection frequency was less than 100% are presented in Table 4-6. For most of the analytes, the SQLs are well below 0.1xRTBC; therefore, different reporting limits for the same analyte would not affect the overall risk evaluation. There are a few analytes with SQLs exceeding 0.1xRBTC, and their impacts on the overall risk evaluation are further discussed in Section 6.1.2. Temporal factors were also considered in the comparability evaluation. The temporal trends of VOCs in groundwater are further discussed in Section 4.2.3. <u>Representativeness</u> Representativeness is the degree to which data accurately and precisely represent a characteristic of the population at a sampling point or an environmental condition. There is no standard method or formula for evaluating representativeness, which is a qualitative term. Spatial representativeness is achieved through selection of sampling locations that are appropriate relative to the objective of the specific investigation, and by collection of an adequate number of samples from locations identified in relation to the investigation objectives. Concentration representativeness is achieved by obtaining analytical results of sufficient quality, as specified in the QAPPs. Spatial representativeness was discussed previously under Criterion III. As noted, shallow groundwater sample locations were identified based on the review of available historical groundwater data and in areas associated with historical Site activities to characterize the vertical and horizontal extent of impacted groundwater, ensuring that the data provide a conservative representation of current conditions within the Operations Area in the context of the CSM. The objectives of the sampling programs were met, considering the phased approach used to delineate contaminated areas.

TABLE 4-2. Data Usability Evaluation – Shallow Groundwater

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
	As presented in the DVSRs listed under Criterion I, standard methods for sampling and analysis were used for all the investigations, which confirmed that the analytical data are representative of the shallow groundwater concentrations at the locations sampled. <u>Precision</u> Precision is a measure of the degree of agreement between replicate measurements of the same source (field precision) or sample (analytical precision). Field precision is evaluated by calculating the RPD between the primary field sample and its field duplicate. Laboratory precision is quantitated for each laboratory data batch by calculating the RPD using data for the LCS/LCSD and/or data for the MS/MSD. The field precision goal established in the QAPPs is a RPD of less than or equal to 30%, except for the case in which one (or both) of the primary or duplicate result is less than five times the PQL. For the latter case, the acceptance criterion is the PQL (i.e., the absolute value of the difference between the primary and duplicate result is less than or equal to the PQL). Laboratory precision goals are defined for specific analytical methods, as indicated in the QAPP (see Table 2 of ENVIRON [2014c]). Field precision for the Operations Area samples was assessed by evaluating the field duplicate results in accordance with the *Statistical Analysis Recommendations for Field Duplicates and Field Splits* (NDEP 2008c), where the primary sample and field duplicate are independent samples. Only one pair of primary and field duplicate results was qualified due to RPD criterion exceedance, and no primary and field duplicate results were qualified due to PQL criterion exceedance (see Appendix C, Table C-3). For laboratory duplicates, there were two sample results qualified due to RPD or PQL criterion exceedance (see DVSR tables in Appendix C). All data with precision exceedances were qualified as "J/Estimated" and are determined to be usable for purposes of the BHRA, and the effects of these qualified data on the overall risk evaluation are further discussed in Sections 6.1.5 and 6.1.6. <u>Accuracy</u> Accuracy measures the level of bias that an analytical method or measurement exhibits. Both field accuracy and laboratory accuracy are evaluated under this DQI. Accuracy in the field is assessed through the use of

TABLE 4-2. Data Usability Evaluation – Shallow Groundwater

Nevada Environmental Response Trust Site

Henderson, Nevada

Data Usability Criterion *(description of criterion)*	**Evaluation Result**
	trip and equipment blanks and through adherence to all sample handling, preservation, and holding time requirements. As specified in the QAPPs, the objective for trip and equipment blanks is for no analyte to be present at levels greater than the PQL. Accuracy in the laboratory analytical data is a measure of the overestimation or underestimation of reported concentrations. Several QC parameters are used to evaluate the accuracy of reported analytical results, including: • Holding times; • Field and laboratory blanks; • MS/MSD percent recovery; • Surrogate spike recovery; and • LCS percent recovery. All qualified results (i.e., U, J, J-, and J+ qualified data) for the shallow groundwater analytes are presented in Appendix E along with the reason codes for these qualified results. Although laboratory limits were exceeded for certain compounds or analyses, as identified by the laboratory (and confirmed during data validation), there does not appear to be a systematic or widespread impact on the quality of the analytical results. Furthermore, based on a review of the laboratory narratives (provided in the laboratory reports in each DVSR), the laboratory does not believe that the observed exceedances of laboratory criteria are cause for concern. Therefore, the qualified data are determined to be usable and valid for purposes of the BHRA and are included in the BHRA data set. The impacts of qualified data on the overall risk evaluation are further discussed in Section 6.1.6. In summary, with the exception of the rejected data listed in Appendix C, Table C-2, all data are acceptable through the DQI evaluation and deemed to be usable for risk assessment purposes.

Table 4-3a. Soil Gas Samples Included in the BHRA Data Set
Nevada Environmental Response Trust Site
Henderson, Nevada

Sample ID	Depth (ft bgs) Start	End	Investigation
Used in BHRA and DUE			
RISG-10	5	5	Phase 2 Remedial Investigation - March 2019
RISG-10	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-10	15	15	Phase 2 Remedial Investigation - March 2019
RISG-10	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-11	5	5	Phase 2 Remedial Investigation - March 2019
RISG-11	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-11	15	15	Phase 2 Remedial Investigation - March 2019
RISG-11	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-12	5	5	Phase 2 Remedial Investigation - March 2019
RISG-12	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-12	15	15	Phase 2 Remedial Investigation - March 2019
RISG-12	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-13	5	5	Phase 2 Remedial Investigation - March 2019
RISG-13	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-13	15	15	Phase 2 Remedial Investigation - March 2019
RISG-13	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-14	5	5	Phase 2 Remedial Investigation - March 2019
RISG-14	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-14	15	15	Phase 2 Remedial Investigation - March 2019
RISG-14	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-15	5	5	Phase 2 Remedial Investigation - March 2019
RISG-15	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-15	15	15	Phase 2 Remedial Investigation - March 2019
RISG-15	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-16	15	15	Phase 2 Remedial Investigation - March 2019
RISG-16	15	15	Phase 3 Remedial Investigation - November/December 2019
RISG-17	15	15	Phase 2 Remedial Investigation - March 2019
RISG-17	15	15	Phase 3 Remedial Investigation - November/December 2019
RISG-18	15	15	Phase 2 Remedial Investigation - March 2019
RISG-18	15	15	Phase 3 Remedial Investigation - November/December 2019
RISG-19	15	15	Phase 2 Remedial Investigation - March 2019
RISG-19	15	15	Phase 3 Remedial Investigation - November/December 2019
RISG-20	5	5	Phase 2 Remedial Investigation - March 2019
RISG-20	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-20	15	15	Phase 2 Remedial Investigation - March 2019
RISG-20	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-21	5	5	Phase 2 Remedial Investigation - March 2019
RISG-21	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-21	15	15	Phase 2 Remedial Investigation - March 2019
RISG-21	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-22	5	5	Phase 2 Remedial Investigation - March 2019
RISG-22	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-22	12.4	12.9	Phase 3 Remedial Investigation - November/December 2019
RISG-22	15	15	Phase 2 Remedial Investigation - March 2019
RISG-23	5	5	Phase 2 Remedial Investigation - March 2019
RISG-23	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-23	15	15	Phase 2 Remedial Investigation - March 2019
RISG-23	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-24	5	5	Phase 2 Remedial Investigation - March 2019

Table 4-3a. Soil Gas Samples Included in the BHRA Data Set
Nevada Environmental Response Trust Site
Henderson, Nevada

Sample ID	Depth (ft bgs) Start	End	Investigation
RISG-24	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-24	15	15	Phase 2 Remedial Investigation - March 2019
RISG-24	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-25	5	5	Phase 2 Remedial Investigation - March 2019
RISG-25	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-25	15	15	Phase 2 Remedial Investigation - March 2019
RISG-25	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-26	5	5	Phase 2 Remedial Investigation - March 2019
RISG-26	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-26	15	15	Phase 2 Remedial Investigation - March 2019
RISG-26	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-79	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-79	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-80	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-80	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-81	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-81	14	14.5	Phase 3 Remedial Investigation - November/December 2019
RISG-82	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-82	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-83	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-83	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-84	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-84	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-85	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-85	14	14.5	Phase 3 Remedial Investigation - November/December 2019
RISG-86	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-86	14	14.5	Phase 3 Remedial Investigation - November/December 2019
RISG-87	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-87	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-88	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-88	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-89	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-89	15	15.5	Phase 3 Remedial Investigation - November/December 2019
RISG-90	5	5.5	Phase 3 Remedial Investigation - November/December 2019
RISG-90	15	15.5	Phase 3 Remedial Investigation - November/December 2019
Used only in DUE			
SG19	5	5	Phase B Source Area Investigation - 2008
SG20	5	5	Phase B Source Area Investigation - 2008
SG21	5	5	Phase B Source Area Investigation - 2008
SG22	5	5	Phase B Source Area Investigation - 2008
SG23	5	5	Phase B Source Area Investigation - 2008
SG24	5	5	Phase B Source Area Investigation - 2008
SG25	5	5	Phase B Source Area Investigation - 2008
SG26	5	5	Phase B Source Area Investigation - 2008
SG27	5	5	Phase B Source Area Investigation - 2008
SG28	5	5	Phase B Source Area Investigation - 2008
SG29	5	5	Phase B Source Area Investigation - 2008
SG30	5	5	Phase B Source Area Investigation - 2008
SG31	5	5	Phase B Source Area Investigation - 2008
SG32	5	5	Phase B Source Area Investigation - 2008

Table 4-3a. Soil Gas Samples Included in the BHRA Data Set
Nevada Environmental Response Trust Site
Henderson, Nevada

Sample ID	Depth (ft bgs) Start	End	Investigation
SG33	5	5	Phase B Source Area Investigation - 2008
SG36	20	21.5	Phase B Source Area Investigation - 2008
SG37	20	21.5	Phase B Source Area Investigation - 2008
SG38	20	21.5	Phase B Source Area Investigation - 2008
SG40	5	5	Phase B Source Area Investigation - 2008
SG41	20	21.5	Phase B Source Area Investigation - 2008
SG43	5	5	Phase B Source Area Investigation - 2008
SG44	5	5	Phase B Source Area Investigation - 2008
SG45	5	5	Phase B Source Area Investigation - 2008
SG46	5	5	Phase B Source Area Investigation - 2008
SG47	5	5	Phase B Source Area Investigation - 2008
SG48	5	5	Phase B Source Area Investigation - 2008
SG52	5	5	Phase B Source Area Investigation - 2008
SG54	5	5	Phase B Source Area Investigation - 2008
SG55	5	5	Phase B Source Area Investigation - 2008
SG56	5	5	Phase B Source Area Investigation - 2008
SG57	5	5	Phase B Source Area Investigation - 2008
SG58	5	5	Phase B Source Area Investigation - 2008
SG59	5	5	Phase B Source Area Investigation - 2008
SG60	5	5	Phase B Source Area Investigation - 2008
SG60	5	5	Phase B Source Area Investigation - 2008
SG61	5	5	Phase B Source Area Investigation - 2008
SG62	5	5	Phase B Source Area Investigation - 2008
SG63	5	5	Phase B Source Area Investigation - 2008
SG64	5	5	Phase B Source Area Investigation - 2008
SG65	5	5	Phase B Source Area Investigation - 2008
SG65	5	5	Phase B Source Area Investigation - 2008
SG66	5	5	Phase B Source Area Investigation - 2008
SG67	5	5	Phase B Source Area Investigation - 2008
SG68	5	5	Phase B Source Area Investigation - 2008
SG69	5	5	Phase B Source Area Investigation - 2008
SG70	5	5	Phase B Source Area Investigation - 2008
SG71	5	5	Phase B Source Area Investigation - 2008
SG74	5	5	Phase B Source Area Investigation - 2008
SG75	5	5	Phase B Source Area Investigation - 2008
SG76	5	5	Phase B Source Area Investigation - 2008
SG77	5	5	Phase B Source Area Investigation - 2008
SG78	5	5	Phase B Source Area Investigation - 2008
SG79	5	5	Phase B Source Area Investigation - 2008
SG80	5	5	Phase B Source Area Investigation - 2008
SG81	5	5	Phase B Source Area Investigation - 2008
SG82	5	5	Phase B Source Area Investigation - 2008
SG83	5	5	Phase B Source Area Investigation - 2008
SG83	5	5	Phase B Source Area Investigation - 2008
SG83	5	5	Phase B Source Area Investigation - 2008
SG83	5	5	Phase B Source Area Investigation - 2008
SG84	5	5	Phase B Source Area Investigation - 2008
SG86	5	5	Phase B Source Area Investigation - 2008
SG87	5	5	Phase B Source Area Investigation - 2008
SG88	5	5	Phase B Source Area Investigation - 2008

Table 4-3a. Soil Gas Samples Included in the BHRA Data Set
Nevada Environmental Response Trust Site
Henderson, Nevada

Sample ID	Depth (ft bgs) Start	End	Investigation
SG89	5	5	Phase B Source Area Investigation - 2008
SG90	5	5	Phase B Source Area Investigation - 2008
SG91	5	5	Phase B Source Area Investigation - 2008
SG92	5	5	Phase B Source Area Investigation - 2008
SG93	5	5	Phase B Source Area Investigation - 2008
SG94	5	5	Phase B Source Area Investigation - 2008
SG94	5	5	Phase B Source Area Investigation - 2008

Notes:

bgs = below ground surface
ft = feet
BHRA = Baseline health risk assessment
DUE = Data usability evaluation

TABLE 4-3b. Shallow Groundwater Wells Included in the BHRA Data Set
Nevada Environmental Response Trust Site
Henderson, Nevada

Well ID	Screen Top Depth (ft bgs)	Screen Bottom Depth (ft bgs)	Minimum Depth to Groundwater (ft bgs)	Maximum Depth to Groundwater (ft bgs)	Water Bearing Zone	Well Type	Well Owner	Investigations for VOC Sampling	Note
DFW-03	39	44	22.2	31.4	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring	Top screen depth - water table > 5 ft
DFW-04	44	49	31.5	33.2	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring	Top screen depth - water table > 5 ft
DFW-05	44	49	31.3	32.3	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring	Top screen depth - water table > 5 ft
DFW-06	44	49	35	35.8	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring	Top screen depth - water table > 5 ft
M-2A	36.8	45.78	38.2	42.2	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-5A	40	50	36.6	38.5	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-6A	26.8	41.5	38.0	40.2	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-7B	25.5	50.5	32.2	36.9	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	Saturated screen thickness > 10 ft
M-10	43	63	49.7	54.1	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-11	33	53	42.7	45.9	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-12A	40	50	41	43	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-13	28	48	42.4	45.8	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-14A	20	40	29.4	33.1	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-19	14.5	34.5	33.8	36.1	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, 2016 Annual Groundwater Monitoring Q2	--
M-21D	40	55	37.3	37.3	Shallow	Monitoring	NERT	RI Phase 2	Saturated screen thickness > 10 ft
M-22A	16	36	29	31.6	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-22D	55	65	29.4	29.5	Shallow	Monitoring	NERT	RI Phase 2	Top screen depth - water table > 5 ft
M-25	24	39	31	35	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-31A	35	55	33.3	47.4	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-32	30	45	38.8	46.4	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-33	30	45	39.6	46.1	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-35	25	40	29.7	33.9	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-36D	55	65	32.1	32.1	Shallow	Monitoring	NERT	RI Phase 2	Top screen depth - water table > 5 ft
M-37	20	35	28.9	34.7	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-38	20	35	30.2	31.8	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-52	34.5	44.5	39.5	45.4	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-55	14.6	44.6	25.6	30.5	Shallow	Monitoring	NERT	RI Phase 2	Saturated screen thickness > 10 ft

TABLE 4-3b. Shallow Groundwater Wells Included in the BHRA Data Set
Nevada Environmental Response Trust Site
Henderson, Nevada

Well ID	Screen Top Depth (ft bgs)	Screen Bottom Depth (ft bgs)	Minimum Depth to Groundwater (ft bgs)	Maximum Depth to Groundwater (ft bgs)	Water Bearing Zone	Well Type	Well Owner	Investigations for VOC Sampling	Note
M-56	15	40	26.8	32.5	Shallow	Monitoring	NERT	RI Phase 2	--
M-57A	20	40	27.5	30.1	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-58	15	45	27.1	30.5	Shallow	Monitoring	NERT	RI Phase 1, RI Phase 2	Saturated screen thickness > 10 ft
M-60	17.8	42.8	26.9	38	Shallow	Monitoring	NERT	RI Phase 2	--
M-64	12.7	37.3	26.4	30	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-65	14.4	39	25.3	34	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-66	17.5	42.3	28.7	32.1	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	Saturated screen thickness > 10 ft
M-67	7.8	37.8	20.7	23.5	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	Saturated screen thickness > 10 ft
M-68	11.2	39.8	26	26.8	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	Saturated screen thickness > 10 ft
M-69	19.9	39.3	31.6	34.6	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-70	15.3	40	31.3	36.2	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-71	17.5	42	32	36.6	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-72	10.1	34.8	31.2	32.7	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-73	11	35.8	26.9	30.7	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-74	9.2	38.8	27.5	28.9	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-75	34.6	49.3	40.2	47.9	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-76	34.6	49.3	38	42.4	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-77	29	43.8	36.7	46.6	Shallow	Monitoring	NERT	2017 Annual Groundwater Monitoring, RI Phase 1	--
M-77R	30	45	35.0	35.0	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring	--
M-78	21.5	41.5	27.6	40.1	Shallow	Monitoring	NERT	RI Phase 2	--
M-79	10.8	35.4	28.5	32	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-80	11.5	41.5	35.0	37.9	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-81A	30	40	33.7	36.3	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-83	10.8	40.3	28.6	32.3	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-97	35	45	18.8	40.1	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-115	35	45	34.8	38.2	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-123	36	51	35.4	43.4	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-124	34	49	34.1	37	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	Saturated screen thickness > 10 ft

TABLE 4-3b. Shallow Groundwater Wells Included in the BHRA Data Set
Nevada Environmental Response Trust Site
Henderson, Nevada

Well ID	Screen Top Depth (ft bgs)	Screen Bottom Depth (ft bgs)	Minimum Depth to Groundwater (ft bgs)	Maximum Depth to Groundwater (ft bgs)	Water Bearing Zone	Well Type	Well Owner	Investigations for VOC Sampling	Note
M-125	35	50	32.7	38.7	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	Saturated screen thickness > 10 ft
M-126	19.7	39.7	31.9	35.1	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-128	40	55	36	41.8	Shallow	Monitoring	NERT	RI Phase 1	Saturated screen thickness > 10 ft
M-131	28.7	38.7	32.7	34.5	Shallow	Monitoring	NERT	RI Phase 2	--
M-133	59.7	69.7	25.8	27.4	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	Top screen depth - water table > 5 ft
M-134	59.7	69.7	33	35.3	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	Top screen depth - water table > 5 ft
M-135	28.7	38.7	33	35	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-137	52	72	57	59.6	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	Saturated screen thickness > 10 ft
M-138	50.5	65.5	56.2	58.9	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-139	45	60	36.1	38	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	Top screen depth - water table > 5 ft
M-140	24.1	43.9	30.9	35.8	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-141	39.5	49.5	38	43.5	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-142	30	45	26.6	31.2	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	Saturated screen thickness > 10 ft
M-144	35	45	36.1	38.8	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-145	45	60	38.4	39.9	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, 2016 Annual Groundwater Monitoring Q3, 2016 Annual Groundwater Monitoring Q2, 2016 Annual Groundwater Monitoring Q1	Top screen depth - water table > 5 ft
M-146	40	50	35.8	36.2	Shallow	Monitoring	NERT	RI Phase 1	--
M-147	25	40	33	36.4	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
M-148A	39.7	49.7	44.4	47.8	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, 2016 Annual Groundwater Monitoring Q3, 2016 Annual Groundwater Monitoring Q2, 2016 Annual Groundwater Monitoring Q1, RI Phase 1	--
M-160	39.7	49.7	31.5	31.7	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, RI Phase 2	Top screen depth - water table > 5 ft
M-164	59.7	69.7	33.4	35.1	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	Top screen depth - water table > 5 ft
M-166	21.7	31.7	26	31.2	Shallow	Monitoring	NERT	RI Phase 2	--
M-167	19.7	29.7	21.3	30	Shallow	Monitoring	NERT	RI Phase 2	--
M-168	21.7	31.7	24.7	27.7	Shallow	Monitoring	NERT	RI Phase 2	--
M-169	24.7	34.7	26.2	30.1	Shallow	Monitoring	NERT	RI Phase 2	--
M-170	24.7	34.7	25.4	30.3	Shallow	Monitoring	NERT	RI Phase 2	--
M-172	26.7	36.7	26.8	33.6	Shallow	Monitoring	NERT	RI Phase 2	--
M-173	24.7	39.7	25.5	29.7	Shallow	Monitoring	NERT	RI Phase 2	Saturated screen thickness > 10 ft
M-174	17.7	27.7	18.5	28	Shallow	Monitoring	NERT	RI Phase 2	--

TABLE 4-3b. Shallow Groundwater Wells Included in the BHRA Data Set
Nevada Environmental Response Trust Site
Henderson, Nevada

Well ID	Screen Top Depth (ft bgs)	Screen Bottom Depth (ft bgs)	Minimum Depth to Groundwater (ft bgs)	Maximum Depth to Groundwater (ft bgs)	Water Bearing Zone	Well Type	Well Owner	Investigations for VOC Sampling	Note
M-175	18.7	28.7	20.0	21.8	Shallow	Monitoring	NERT	RI Phase 2	--
M-176	19.7	29.7	23.3	24.3	Shallow	Monitoring	NERT	RI Phase 2	--
M-177	19.7	29.7	20.8	21.9	Shallow	Monitoring	NERT	RI Phase 2	--
M-189	35	50	33.7	35.9	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, 2016 Annual Groundwater Monitoring Q2, 2016 Annual Groundwater Monitoring Q1, RI Phase 1	Saturated screen thickness > 10 ft
M-190	35	50	34.8	36.8	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, 2016 Annual Groundwater Monitoring Q3, 2016 Annual Groundwater Monitoring Q2, 2016 Annual Groundwater Monitoring Q1, RI Phase 1	Saturated screen thickness > 10 ft
M-191	35	50	37	38.8	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, 2016 Annual Groundwater Monitoring Q3, 2016 Annual Groundwater Monitoring Q2, 2016 Annual Groundwater Monitoring Q1, RI Phase 1	Saturated screen thickness > 10 ft
M-192	35	50	36.5	38.7	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, 2016 Annual Groundwater Monitoring Q3, 2016 Annual Groundwater Monitoring Q2, 2016 Annual Groundwater Monitoring Q1, RI Phase 1	Saturated screen thickness > 10 ft
M-193	35	50	37.9	39.7	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, 2016 Annual Groundwater Monitoring Q3, 2016 Annual Groundwater Monitoring Q2, 2016 Annual Groundwater Monitoring Q1, RI Phase 1	Saturated screen thickness > 10 ft
M-202	40	55	33.3	33.3	Shallow	Monitoring	NERT	RI Phase 2	Top screen depth - water table > 5 ft
M-203	30	50	23	23	Shallow	Monitoring	NERT	RI Phase 2	Top screen depth - water table > 5 ft
M-205	30	50	32	32	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, RI Phase 2	Saturated screen thickness > 10 ft
M-206	30	50	32	32	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, RI Phase 2	Saturated screen thickness > 10 ft
M-207	25	45	33	34	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, RI Phase 2	Saturated screen thickness > 10 ft
M-208	25	45	33	34	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, RI Phase 2	Saturated screen thickness > 10 ft
M-209	50	60	33	35	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, RI Phase 2	Top screen depth - water table > 5 ft
M-211	25	45	36.6	37.2	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, RI Phase 2	--
M-214	30	50	43.9	44.5	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, RI Phase 2	--
M-215	25	45	28.8	29.8	Shallow	Monitoring	NERT	RI Phase 2	Saturated screen thickness > 10 ft
M-216	25	45	27.7	27.7	Shallow	Monitoring	NERT	RI Phase 2	Saturated screen thickness > 10 ft
M-217	55	65	27.4	27.4	Shallow	Monitoring	NERT	RI Phase 2	Top screen depth - water table > 5 ft
M-219	25	45	27.9	27.9	Shallow	Monitoring	NERT	RI Phase 2	Saturated screen thickness > 10 ft
M-223	40	55	33.8	33.8	Shallow	Monitoring	NERT	RI Phase 2	Top screen depth - water table > 5 ft
M-226	40	55	30.9	30.9	Shallow	Monitoring	NERT	RI Phase 2	Top screen depth - water table > 5 ft
M-229	40	55	20.5	20.5	Shallow	Monitoring	NERT	RI Phase 2	Top screen depth - water table > 5 ft
M-237	45	60	46.3	46.3	Shallow	Monitoring	NERT	RI Phase 2	Saturated screen thickness > 10 ft
M-242	38	53	28.2	28.2	Shallow	Monitoring	NERT	RI Phase 2	Top screen depth - water table > 5 ft
M-245	35	50	24.4	24.4	Shallow	Monitoring	NERT	RI Phase 2	Top screen depth - water table > 5 ft
M-249-60	59.5	69.5	39.6	39.6	Shallow	Monitoring	NERT	Unit 4 and 5 Buildings Investigation	Top screen depth - water table > 5 ft
M-251-60	52.3	62.3	34.9	34.9	Shallow	Monitoring	NERT	Unit 4 and 5 Buildings Investigation	Top screen depth - water table > 5 ft

TABLE 4-3b. Shallow Groundwater Wells Included in the BHRA Data Set
Nevada Environmental Response Trust Site
Henderson, Nevada

Well ID	Screen Top Depth (ft bgs)	Screen Bottom Depth (ft bgs)	Minimum Depth to Groundwater (ft bgs)	Maximum Depth to Groundwater (ft bgs)	Water Bearing Zone	Well Type	Well Owner	Investigations for VOC Sampling	Note
MW-16(NERT)	24.7	39.7	32.7	36.7	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring, 2017 Annual Groundwater Monitoring, RI Phase 1	--
UFMW-01D	44	49	31.3	32.4	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring	Top screen depth - water table > 5 ft
UFMW-02D	44	49	31.5	32.9	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring	Top screen depth - water table > 5 ft
UFMW-03D	45	50	28.7	31	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring	Top screen depth - water table > 5 ft
UFMW-04D	44	49	29.6	31.1	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring	Top screen depth - water table > 5 ft
UFMW-05D	45	50	29.7	31.2	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring	Top screen depth - water table > 5 ft
UFMW-06D	45	50	29.5	31.1	Shallow	Monitoring	NERT	2020 Annual Groundwater Monitoring, 2019 Annual Groundwater Monitoring, 2018 Annual Groundwater Monitoring	Top screen depth - water table > 5 ft

Notes:

-- = Not applicable
bgs = below ground surface
ft = feet
BHRA = Baseline health risk assessment
NERT = Nevada Environmental Response Trust
Q = Quarter
RI = Remediation investigation
VOC = Volatile organic compound

TABLE 4-3c. Soil Gas Sample Locations Matched for Temporal Trend Evaluation

Nevada Environmental Response Trust Site
Henderson, Nevada

Sample ID	Depth (ft bgs) Start	Depth (ft bgs) End	Sample Date	Sample Type	Concentration µg/m^3	Plume	Notes
SG54	5	5	May-08	N	19,000	OSSM	Phase B
RISG-10	5	5	Mar-19	N	75,000	OSSM	Phase 2 RI Mod 11
RISG-10	5	5.5	Nov-19	N	18,000	OSSM	RI Phase 3 RI Mod 9
SG31	5	5	May-08	N	4,000	OSSM	Phase B
RISG-11	5	5	Mar-19	N	18,000	OSSM	Phase 2 RI Mod 11
RISG-11	5	5.5	Nov-19	N	18,000	OSSM	RI Phase 3 RI Mod 9
SG83	5	5	May-08	N	54,000	OSSM	Phase B
SG83	5	5	May-08	FD	52,000	OSSM	Phase B
RISG-12	5	5	Mar-19	N	25,000	OSSM	Phase 2 RI Mod 11
RISG-12	5	5.5	Nov-19	N	17,000	OSSM	RI Phase 3 RI Mod 9
SG89	5	5	May-08	N	130,000	NERT Related	Phase B
RISG-13	5	5	Mar-19	N	3,500	NERT Related	Phase 2 RI Mod 11
RISG-13	5	5.5	Nov-19	N	2,200	NERT Related	RI Phase 3 RI Mod 9
SG69	5	5	May-08	N	130,000	NERT Related	Phase B
RISG-14	5	5	Mar-19	N	35,000	NERT Related	Phase 2 RI Mod 11
RISG-14	5	5.5	Nov-19	N	33,000	NERT Related	RI Phase 3 RI Mod 9
SG71	5	5	May-08	N	120,000	NERT Related	Phase B
RISG-15	5	5	Mar-19	N	8,600	NERT Related	Phase 2 RI Mod 11
RISG-15	5	5.5	Nov-19	N	7,200	NERT Related	RI Phase 3 RI Mod 9
SG84	5	5	May-08	N	4,400	NERT Related	Phase B
RISG-20	5	5	Mar-19	N	2,800	NERT Related	Phase 2 RI Mod 11
RISG-20	5	5.5	Jan-20	N	3,000	NERT Related	RI Phase 3 RI Mod 9
SG28	5	5	May-08	N	7,800	NERT Related	Phase B
SG28	5	5	May-08	FD	5,900	NERT Related	Phase B
RISG-22	5	5	Mar-19	N	4,800	NERT Related	Phase 2 RI Mod 11
RISG-22	5	5.5	Nov-19	N	3,700	NERT Related	RI Phase 3 RI Mod 9
SG23	5	5	May-08	N	3,300	NERT Related	Phase B
RISG-82	5	5.5	Nov-19	N	4,400	NERT Related	RI Phase 3 RI Mod 9
SG61	5	5	May-08	N	93,000	OSSM	Phase B
RISG-84	5	5.5	Nov-19	N	23,000	OSSM	RI Phase 3 RI Mod 9
SG46	5	5	May-08	N	25	Outside Plumes	Phase B
RISG-90	5	5.5	Dec-19	N	3	Outside Plumes	RI Phase 3 RI Mod 9

Wells within 100 feet grouped.
ft - feet; bgs - below ground surface; N - normal; FD - field duplicate

TABLE 4-4. Evaluation of Sample Quantitation Limits – Soil Gas at 5 feet bgs
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Screening Levels [1]	Screening Level Scenario(s)	Unit	No. of Samples	No. of Detects	% Detects	Nondetects			
							Minimum SQL	Maximum SQL	No. of Samples Above Screen	No. of Samples Above 10% Screen
Acetone	512,000,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	96	85	3.5	230	0	0
Acrolein	321	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	8	0	0	4.4	20	0	0
Acrylonitrile	651	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	100	4	4.0	0.10	140	0	8
tert-Amyl methyl ether	79,800,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	75	1	1.3	0.073	33	0	0
Benzene	1.75E+17	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	77	68	0.83	140	0	0
Benzyl chloride	1,560	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	3	2.7	0.13	470	0	1
Bromodichloromethane	2,320	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	52	46	0.077	240	0	1
Bromoform	120,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	13	12	0.11	400	0	0
Bromomethane	89,100	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	88	11	13	0.073	720	0	0
2-Butanone	95,400,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	68	60	1.4	320	0	0
tert-Butyl alcohol	90,900,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	75	40	53	0.72	48	0	0
n-Butylbenzene	13,100,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	75	33	44	0.073	33	0	0
sec-Butylbenzene	13,000,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	75	9	12	0.085	38	0	0
tert-Butylbenzene	13,000,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	75	4	5.3	0.073	33	0	0
Carbon disulfide	11,800,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	64	57	1.2	130	0	0
Carbon tetrachloride	14,100	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	99	88	3.6	220	0	0
3-Chloro-1-propene	8,880	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	75	2	2.7	0.073	33	0	0
Chlorobenzene	1,210,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	33	29	0.074	160	0	0
Chloroethane	173,000,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	35	31	0.039	450	0	0
Chloromethane	1,330,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	18	16	0.073	230	0	0
Cumene	11,500,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	75	20	27	0.082	37	0	0
Cyclohexane	132,000,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	25	3	12	0.38	12	0	0
p-Cymene	9,360,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	75	31	41	0.20	42	0	0
1,2-Dibromo-3-chloropropane	24	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	100	0	0	0.11	440	26	50
Dibromochloromethane	N/A	--	µg/m^3	113	17	15	0.10	370	--	--
1,2-Dibromoethane	184	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	0	0	0.030	320	1	6
1,2-Dichlorobenzene	6,140,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	19	17	0.098	430	0	0
1,3-Dichlorobenzene	5,060,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	25	22	0.091	370	0	0
1,4-Dichlorobenzene	7,970	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	61	54	0.24	500	0	0
Dichlorodifluoromethane	2,310,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	70	62	1.7	400	0	0
1,1-Dichloroethane	37,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	43	38	0.073	160	0	0
1,2-Dichloroethane	2,220	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	19	17	0.048	200	0	0
1,1-Dichloroethene	4,100,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	50	44	0.075	160	0	0
cis-1,2-Dichloroethene	802,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	7	6.2	0.0090	200	0	0
trans-1,2-Dichloroethene	809,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	3	2.7	0.0098	220	0	0
1,2-Dichloropropane	18,100	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	15	13	0.073	610	0	0
1,3-Dichloropropene	16,100	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	88	0	0	0.092	260	0	0
Diisopropyl ether	18,600,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	75	0	0	0.086	38	0	0
1,4-Dioxane	8,970	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	100	17	17	0.090	66	0	0
Ethanol	1.28E+09	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	100	68	68	1.7	54	0	0
Ethyl tert-butyl ether	931,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	75	0	0	0.074	33	0	0
Ethyl acetate	1,490,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	25	0	0	2.4	230	0	0
Ethylbenzene	28,500	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	53	47	0.097	150	0	0

TABLE 4-4. Evaluation of Sample Quantitation Limits – Soil Gas at 5 feet bgs
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Screening Levels [1]	Screening Level Scenario(s)	Unit	No. of Samples	No. of Detects	% Detects	Nondetects			
							Minimum SQL	Maximum SQL	No. of Samples Above Screen	No. of Samples Above 10% Screen
4-Ethyltoluene	9,360,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	41	36	0.093	510	0	0
Freon 114	226,000,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	88	20	23	0.082	600	0	0
n-Heptane	11,300,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	100	28	28	0.10	42	0	0
Hexachlorobutadiene	8,010	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	32	28	0.13	2,500	0	2
n-Hexane	16,800,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	25	1	4.0	0.67	12	0	0
2-Hexanone	735,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	41	36	0.31	200	0	0
alpha-Methyl styrene	27,600,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	75	10	13	0.11	48	0	0
Methyl tert-butyl ether	251,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	75	7	9.3	0.074	33	0	0
4-Methyl-2-pentanone	74,400,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	37	33	0.058	310	0	0
Methylene Chloride	5,020,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	75	66	0.079	140	0	0
Methylmethacrylate	16,300,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	100	0	0	0.11	640	0	0
Naphthalene	2,350	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	100	54	54	0.12	48	0	0
n-Octane	563,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	75	35	47	0.080	33	0	0
n-Propylbenzene	28,800,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	75	32	43	0.085	34	0	0
Styrene	24,600,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	22	19	0.11	140	0	0
1,1,1,2-Tetrachloroethane	13,500	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	25	0	0	0.30	430	0	0
1,1,2,2-Tetrachloroethane	1,680	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	2	1.8	0.062	260	0	1
Tetrachloroethene	367,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	111	98	1.7	190	0	0
Tetrahydrofuran	35,500,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	25	2	8.0	0.58	17	0	0
Toluene	113,000,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	82	73	0.41	110	0	0
1,2,4-Trichlorobenzene	85,800	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	16	14	0.11	1,800	0	0
1,1,1-Trichloroethane	134,000,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	88	13	15	0.073	200	0	0
1,1,2-Trichloroethane	4,550	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	4	3.5	0.019	200	0	0
Trichloroethene	17,400	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	83	73	0.081	310	0	0
Trichlorofluoromethane	6.89E+12	Construction worker scenario	µg/m^3	113	79	70	1.3	190	0	0
1,2,3-Trichloropropane	8,980	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	25	0	0	1.9	380	0	0
1,1,2-Trichloro-1,2,2-trifluoroethane	226,000,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	40	35	0.54	690	0	0
1,2,4-Trimethylbenzene	1,710,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	49	43	0.072	440	0	0
1,3,5-Trimethylbenzene	1,730,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	38	34	0.098	340	0	0
Vinyl acetate	4,160,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	44	39	0.24	280	0	0
Vinyl chloride	10,700	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	7	6.2	0.020	170	0	0
Xylenes (total)	2,550,000	Indoor commercial/industrial worker (slab-on-grade and basement scenario)	µg/m^3	113	73	65	0.15	240	0	0

Notes:

-- = Not applicable
N/A = No screening level available
bgs = below ground surface
RBTC = Risk-based target concentration
µg/m^3 = microgram per cubic meter
SQL = Sample quantitation limit
[1] Screening levels are the lowest RBTCs among indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers.

TABLE 4-5. Evaluation of Sample Quantitation Limits – Soil Gas at or around 15 feet bgs
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Screening Levels [1]	Screening Level Scenario(s) [1]	Unit	No. of Samples	No. of Detects	% Detects	Nondetects			
							Minimum SQL	Maximum SQL	No. of Samples Above Screen [2]	No. of Samples Above 10% Screen [2]
Acetone	512,000,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	34	62	11	2,100	0	0
Acrolein	321	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	5	0	0	2.1	19	0	0
Acrylonitrile	651 / 2,010	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/m^3	35	2	5.7	0.11	340	0 / 0	6 / 1
tert-Amyl methyl ether	79,800,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	5	0	0	0.078	1.6	0	0
Benzene	1.75E+17	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	15	27	1.3	1,200	0	0
Benzyl chloride	1,560 / 4,960	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/m^3	55	1	1.8	0.13	4,200	0 / 0	5 / 1
Bromodichloromethane	2,320 / 7,410	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/m^3	55	21	38	0.45	2,200	0 / 0	1 / 1
Bromoform	120,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	5	9.1	0.12	3,600	0	0
Bromomethane	89,100	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	25	1	4.0	0.078	6,400	0	0
2-Butanone	95,400,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	15	27	2.7	2,900	0	0
tert-Butyl alcohol	90,900,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	5	4	80	2.3	2.3	0	0
n-Butylbenzene	13,100,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	5	4	80	1.6	1.6	0	0
sec-Butylbenzene	13,000,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	5	2	40	0.090	1.8	0	0
tert-Butylbenzene	13,000,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	5	0	0	0.078	1.6	0	0
Carbon disulfide	11,800,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	15	27	0.65	1,200	0	0
Carbon tetrachloride	14,100 / 45,000	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/m^3	55	35	64	2.0	2,000	0 / 0	0 / 0
3-Chloro-1-propene	8,880	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	5	0	0	0.078	1.6	0	0
Chlorobenzene	1,210,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	7	13	0.080	1,500	0	0
Chloroethane	173,000,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	9	16	0.078	4,000	0	0
Chloromethane	1,330,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	3	5.5	0.078	2,000	0	0
Cumene	11,500,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	5	3	60	0.18	1.7	0	0
Cyclohexane	132,000,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	30	3	10	0.23	30	0	0
p-Cymene	9,360,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	5	4	80	2.0	2.0	0	0
1,2-Dibromo-3-chloropropane	24 / 78	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/m^3	35	0	0	0.12	1,500	9 / 11	10 / 19
Dibromochloromethane	N/A	--	µg/m^3	55	8	15	0.11	3,300	N/A	N/A
1,2-Dibromoethane	184 / 593	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/m^3	55	0	0	0.059	2,900	2 / 1	10 / 1
1,2-Dichlorobenzene	6,140,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	4	7.3	0.10	3,900	0	0
1,3-Dichlorobenzene	5,060,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	9	16	0.097	3,300	0	0
1,4-Dichlorobenzene	7,970 / 25,500	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/m^3	55	7	13	0.26	4,400	0 / 0	1 / 1
Dichlorodifluoromethane	2,310,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	14	25	2.4	3,500	0	0
1,1-Dichloroethane	37,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	15	27	0.078	330	0	0
1,2-Dichloroethane	2,220 / 6,970	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/m^3	55	9	16	0.020	1,800	0 / 0	1 / 1
1,1-Dichloroethene	4,100,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	22	40	0.020	1,400	0	0
cis-1,2-Dichloroethene	802,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	3	5.5	0.024	1,700	0	0
trans-1,2-Dichloroethene	809,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	2	3.6	0.019	2,000	0	0
1,2-Dichloropropane	18,100 / 57,100	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/m^3	55	3	5.5	0.078	5,500	0 / 0	1 / 0
1,3-Dichloropropene	16,100 / 50,900	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/m^3	25	0	0	0.098	2,300	0 / 0	0 / 0
Diisopropyl ether	18,600,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	5	0	0	0.092	1.8	0	0
1,4-Dioxane	8,970	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	35	1	2.9	0.095	150	0	0
Ethanol	1.28E+09	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	35	13	37	3.3	150	0	0

TABLE 4-5. Evaluation of Sample Quantitation Limits – Soil Gas at or around 15 feet bgs
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Screening Levels [1]	Screening Level Scenario(s) [1]	Unit	No. of Samples	No. of Detects	% Detects	Nondetects			
							Minimum SQL	Maximum SQL	No. of Samples Above Screen [2]	No. of Samples Above 10% Screen [2]
Ethyl tert-butyl ether	931,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	5	0	0	0.080	1.6	0	0
Ethyl acetate	1,490,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	30	0	0	2.8	560	0	0
Ethylbenzene	28,500	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	10	18	0.19	1,400	0	0
4-Ethyltoluene	9,360,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	7	13	0.24	4,600	0	0
Freon 114	226,000,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	25	3	12	0.16	5,400	0	0
n-Heptane	11,300,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	35	3	8.6	0.20	54	0	0
Hexachlorobutadiene	8,010 / 26,000	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/m^3	55	5	9.1	0.14	23,000	0 / 0	6 / 1
n-Hexane	16,800,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	30	0	0	0.40	34	0	0
2-Hexanone	735,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	4	7.3	0.13	1,800	0	0
alpha-Methyl styrene	27,600,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	5	3	60	0.23	2.3	0	0
Methyl tert-butyl ether	251,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	5	2	40	0.078	1.6	0	0
4-Methyl-2-pentanone	74,400,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	6	11	0.11	2,700	0	0
Methylene Chloride	5,020,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	14	25	1.1	1,200	0	0
Methylmethacrylate	16,300,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	35	2	5.7	0.12	630	0	0
Naphthalene	2,350	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	35	8	23	0.058	62	0	0
n-Octane	563,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	5	3	60	0.16	1.6	0	0
n-Propylbenzene	28,800,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	5	3	60	0.16	1.6	0	0
Styrene	24,600,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	3	5.5	0.11	1,200	0	0
1,1,1,2-Tetrachloroethane	13,500	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	30	0	0	0.18	1,100	0	0
1,1,2,2-Tetrachloroethane	1,680 / 5,400	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/m^3	55	0	0	0.039	2,300	0 / 0	2 / 1
Tetrachloroethene	367,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	54	98	1,700	1,700	0	0
Tetrahydrofuran	35,500,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	30	5	17	0.35	40	0	0
Toluene	113,000,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	18	33	1.4	950	0	0
1,2,4-Trichlorobenzene	85,800 / 277,000	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/m^3	55	2	3.6	0.12	16,000	0 / 0	0 / 0
1,1,1-Trichloroethane	134,000,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	25	2	8.0	0.078	1,800	0	0
1,1,2-Trichloroethane	4,550 / 14,400	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/m^3	55	0	0	0.037	1,800	0 / 0	0 / 1
Trichloroethene	17,400 / 55,000	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/m^3	55	28	51	1.9	2,800	0 / 0	0 / 0
Trichlorofluoromethane	6.89E+12	Construction worker scenario	µg/m^3	55	20	36	1.6	1,200	0	0
1,2,3-Trichloropropane	8,980 / 28,600	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/m^3	30	0	0	2.2	930	0 / 0	1 / 0
1,1,2-Trichloro-1,2,2-trifluoroethane	226,000,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	5	9.1	0.73	6,200	0	0
1,2,4-Trimethylbenzene	1,710,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	10	18	0.26	3,900	0	0
1,3,5-Trimethylbenzene	1,730,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	6	11	0.22	3,000	0	0
Vinyl acetate	4,160,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	4	7.3	0.29	2,500	0	0
Vinyl chloride	10,700 / 33,200	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/m^3	55	0	0	0.012	1,500	0 / 0	0 / 0
Xylenes (total)	2,550,000	Indoor commercial/industrial worker: (basement scenario)	µg/m^3	55	15	27	1.8	2,100	0	0

TABLE 4-5. Evaluation of Sample Quantitation Limits – Soil Gas at or around 15 feet bgs
Nevada Environmental Response Trust Site
Henderson, Nevada

Notes:

-- = Not applicable
bgs = below ground surface
$\mu g/m^3$ = microgram per cubic meter
N/A = No screening level available
RBTC = Risk-based target concentration
SQL = Sample quantitation limit

[1] The SQLs were initially screened by comparing against the lowest RBTCs among indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers (the single values in the cells or the values on the left side of the "/" sign). Then, for those analytes with exceedances and the lowest RBTCs are the basement indoor worker RBTCs, the SQLs for samples collected outside the Unit Buildings area were further screened by comparing against the second lowest RBTCs (the values on the right side of the "/" sign).

[2] For those analytes with exceedances from the lowest RBTCs during the initial screen, the values on the left side of the "/" sign are the numbers of samples collected within the Unit Buildings area with exceedances from the lowest RBTCs (the basement indoor worker RBTCs); the values on the right side of the "/" sign are the numbers of samples collected outside the Unit Buildings area with exceedances from the second lowest RBTCs (the indoor worker RBTCs).

TABLE 4-6. Evaluation of Sample Quantitation Limits - Shallow Groundwater
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Screening Levels [1]	Screening Level Scenario(s) [1]	Unit	No. of Samples	No. of Detects	% Detects	Nondetects			
							Minimum SQL	Maximum SQL	No. of Samples Above Screen [2]	No. of Samples Above 10% Screen [2]
Acenaphthene	106,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	11	0	0	0.19	0.22	0	0
Acenaphthylene	85,100	Indoor commercial/industrial worker: (basement scenario)	µg/L	13	0	0	0.10	0.22	0	0
Anthracene	409,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	11	0	0	0.19	0.22	0	0
Benzene	4.68E+16	Indoor commercial/industrial worker: (basement scenario)	µg/L	481	41	8.5	0.20	25	0	0
Benzo(a)anthracene	35,900	Indoor commercial/industrial worker: (basement scenario)	µg/L	13	0	0	0.10	2.2	0	0
Bis(2-chloro-1-methylethyl) ether	N/A	--	µg/L	12	0	0	0.19	0.22	--	--
Bis(2-chloroethyl) ether	1,920	Indoor commercial/industrial worker: (basement scenario)	µg/L	12	0	0	0.19	0.22	0	0
Bromobenzene	185,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	1	0.21	0.21	100	0	0
Bromochloromethane	113,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	0	0	0.15	100	0	0
Bromodichloromethane	215 / 300	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/L	479	69	14	0.17	100	0 / 0	0 / 8
Bromoform	39,700	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	46	9.6	0.29	160	0	0
Bromomethane	2,150	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	0	0	0.25	100	0	0
4-Bromophenyl-phenyl ether	N/A	--	µg/L	12	0	0	0.47	0.55	--	--
2-Butanone	209,000,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	481	1	0.21	2.5	1,000	0	0
n-Butylbenzene	230,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	0	0	0.24	160	0	0
sec-Butylbenzene	203,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	0	0	0.17	100	0	0
tert-Butylbenzene	267,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	0	0	0.17	100	0	0
Carbon tetrachloride	105 / 143	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/L	481	149	31	0.18	100	0 / 0	0 / 9
Chlorobenzene	83,100	Indoor commercial/industrial worker: (basement scenario)	µg/L	481	54	11	0.18	25	0	0
Chloroethane	2,810,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	0	0	0.36	160	0	0
Chloroform	146	Indoor commercial/industrial worker: (basement scenario)	µg/L	481	474	99	0.23	13	0	0
Chloromethane	25,300	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	0	0	0.25	100	0	0
2-Chloronaphthalene	23,500	Indoor commercial/industrial worker: (basement scenario)	µg/L	12	0	0	0.19	0.22	0	0
2-Chlorophenol	13,000,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	5	0	0	0.49	0.51	0	0
4-Chlorophenyl-phenyl ether	N/A	--	µg/L	12	0	0	0.19	0.22	--	--
2-Chlorotoluene	91,900	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	1	0.21	0.18	100	0	0
4-Chlorotoluene	76,900	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	1	0.21	0.17	100	0	0
Cumene	252,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	0	0	0.25	100	0	0
p-Cymene	1,130	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	0	0	0.17	100	0	0
Dibenzofuran	N/A	--	µg/L	12	0	0	0.19	0.22	--	--
1,2-Dibromo-3-chloropropane	25 / 40	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/L	479	0	0	0.50	200	0 / 17	0 / 68
Dibromochloromethane	N/A	--	µg/L	479	8	1.7	0.25	100	--	--
1,2-Dibromoethane	51 / 75	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/L	479	0	0	0.21	100	0 / 4	0 / 22
Dibromomethane	26,900	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	0	0	0.25	100	0	0
1,2-Dichlorobenzene	720,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	481	107	22	0.19	100	0	0
1,3-Dichlorobenzene	372,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	68	14	0.18	100	0	0

TABLE 4-6. Evaluation of Sample Quantitation Limits - Shallow Groundwater
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Screening Levels [1]	Screening Level Scenario(s) [1]	Unit	No. of Samples	No. of Detects	% Detects	Nondetects			
							Minimum SQL	Maximum SQL	No. of Samples Above Screen [2]	No. of Samples Above 10% Screen [2]
1,4-Dichlorobenzene	743 / 1,030	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/L	481	100	21	0.17	100	0 / 0	0 / 0
Dichlorodifluoromethane	1,390 / 1,900	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/L	479	0	0	0.17	160	0 / 0	0 / 0
1,1-Dichloroethane	1,270	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	46	9.6	0.24	100	0	0
1,2-Dichloroethane	355 / 497	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/L	481	32	6.7	0.20	100	0 / 0	0 / 8
1,1-Dichloroethene	29,500	Indoor commercial/industrial worker: (basement scenario)	µg/L	481	84	17	0.25	100	0	0
cis-1,2-Dichloroethene	38,100	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	0	0	0.21	100	0	0
trans-1,2-Dichloroethene	16,700	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	0	0	0.23	100	0	0
1,2-Dichloropropane	1,290	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	0	0	0.25	100	0	0
1,3-Dichloropropane	18,900	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	3	0.63	0.19	100	0	0
2,2-Dichloropropane	858 / 1,170	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/L	479	0	0	0.16	160	0 / 0	0 / 4
1,1-Dichloropropene	1,330	Indoor commercial/industrial worker: (basement scenario)	µg/L	481	0	0	0.20	100	0	0
1,3-Dichloropropene	943 / 1,300	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/L	479	0	0	0.17	100	0 / 0	0 / 0
1,4-Dioxane	212,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	475	181	38	0.50	100	0	0
Ethyl tert-butyl ether	79,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	481	0	0	0.21	100	0	0
Ethylbenzene	808 / 1,110	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/L	479	0	0	0.19	100	0 / 0	0 / 0
Fluorene	209,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	12	0	0	0.19	0.22	0	0
Formaldehyde	184,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	2	0	0	5.0	5.0	0	0
Hexachlorobenzene	52	Indoor commercial/industrial worker: (basement scenario)	µg/L	14	0	0	0.47	5.0	0	0
Hexachlorobutadiene	200 / 275	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/L	479	6	1.3	0.25	100	0 / 0	0 / 11
Hexachlorocyclopentadiene	780	Indoor commercial/industrial worker: (basement scenario)	µg/L	12	0	0	1.9	2.2	0	0
Hexachloroethane	889	Indoor commercial/industrial worker: (basement scenario)	µg/L	12	0	0	0.47	0.55	0	0
Methylene Chloride	286,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	481	39	8.1	0.88	350	0	0
1-Methylnaphthalene	46,600	Indoor commercial/industrial worker: (basement scenario)	µg/L	14	0	0	3.3	3.8	0	0
2-Methylnaphthalene	44,300	Indoor commercial/industrial worker: (basement scenario)	µg/L	13	0	0	0.49	5.0	0	0
Naphthalene	1,080 / 1,580	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/L	479	3	0.63	0.21	160	0 / 0	0 / 4
Nitrobenzene	9,880	Indoor commercial/industrial worker: (basement scenario)	µg/L	12	0	0	0.47	0.55	0	0
2-Nitrophenol	6,660,000	Construction worker scenario	µg/L	5	0	0	0.97	1.0	0	0
Octachlorostyrene	N/A	--	µg/L	14	0	0	6.2	7.1	--	--
Phenanthrene	406,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	14	0	0	0.10	0.22	0	0
n-Propylbenzene	653,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	0	0	0.17	100	0	0
Pyrene	2,130,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	12	0	0	0.19	0.22	0	0
Styrene	1,960,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	478	0	0	0.25	100	0	0
1,1,1,2-Tetrachloroethane	1,210	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	0	0	0.15	100	0	0
1,1,2,2-Tetrachloroethane	783 / 1,170	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/L	479	1	0.21	0.19	100	0 / 0	0 / 0
Tetrachloroethene	4,580	Indoor commercial/industrial worker: (basement scenario)	µg/L	481	116	24	0.14	100	0	0
Toluene	3,600,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	17	3.6	0.17	100	0	0

TABLE 4-6. Evaluation of Sample Quantitation Limits - Shallow Groundwater
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Screening Levels [1]	Screening Level Scenario(s) [1]	Unit	No. of Samples	No. of Detects	% Detects	Nondetects			
							Minimum SQL	Maximum SQL	No. of Samples Above Screen [2]	No. of Samples Above 10% Screen [2]
1,2,3-Trichlorobenzene	17,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	481	2	0.42	0.23	160	0	0
1,2,4-Trichlorobenzene	13,900	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	5	1.0	0.20	160	0	0
1,1,1-Trichloroethane	1,580,000	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	0	0	0.19	100	0	0
1,1,2-Trichloroethane	1,050	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	0	0	0.19	100	0	0
Trichloroethene	366 / 500	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/L	481	177	37	0.20	100	0 / 0	0 / 5
Trichlorofluoromethane	4,070,000	Construction worker scenario	µg/L	479	6	1.3	0.21	100	0	0
1,2,3-Trichloropropane	4,610	Indoor commercial/industrial worker: (basement scenario)	µg/L	482	398	83	0.0025	0.25	0	0
1,2,4-Trimethylbenzene	66,500	Indoor commercial/industrial worker: (basement scenario)	µg/L	481	2	0.42	0.17	100	0	0
1,3,5-Trimethylbenzene	47,400	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	1	0.21	0.17	100	0	0
Vinyl chloride	67 / 91	Indoor commercial/industrial worker: (basement scenario) / (slab-on-grade)	µg/L	479	2	0.42	0.18	100	0 / 3	0 / 21
Xylenes (total)	85,800	Indoor commercial/industrial worker: (basement scenario)	µg/L	479	1	0.21	0.38	200	0	0

Notes:

-- = No value

µg/L = microgram per liter

N/A = No screening level available

RBTC = Risk-based target concentration

SQL = Sample quantitation limit

[1] The SQLs were initially screened by comparing against the lowest RBTCs among indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers (the single values in the cells or the values on the left side of the "/" sign). Then, for those analytes with exceedances and the lowest RBTCs are the basement indoor worker RBTCs, the SQLs for samples collected outside the Unit Buildings area were further screened by comparing against the second lowest RBTCs (the values on the right side of the "/" sign).

[2] For those analytes with exceedances from the lowest RBTCs during the initial screen, the values on the left side of the "/" sign are the numbers of samples collected within the Unit Buildings area with exceedances from the lowest RBTCs (the basement indoor worker RBTCs); the values on the right side of the "/" sign are the numbers of samples collected outside the Unit Buildings area with exceedances from the second lowest RBTCs (the indoor worker RBTCs).

TABLE 4-7. Summary Statistics for Volatile Compounds in Soil Gas at 5 feet bgs
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
					Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
Acetone	µg/m^3	113	96	85	3.5	230	4.0	410	23	45	64	1.4	SG60
Acrolein	µg/m^3	8	0	0	4.4	20	--	--	--	--	--	--	--
Acrylonitrile	µg/m^3	100	4	4.0	0.10	140	0.11	0.34	0.16	0.19	0.10	0.53	SG79
tert-Amyl methyl ether	µg/m^3	75	1	1.3	0.073	33	0.10	0.10	0.10	0.10	--	--	SG46
Benzene	µg/m^3	113	77	68	0.83	140	0.27	100	3.5	10	23	2.2	SG83
Benzyl chloride	µg/m^3	113	3	2.7	0.13	470	0.17	0.29	0.22	0.23	0.060	0.27	SG33
Bromodichloromethane	µg/m^3	113	52	46	0.077	240	0.14	200	1.8	13	35	2.6	SG89
Bromoform	µg/m^3	113	13	12	0.11	400	0.14	140	0.35	22	39	1.8	SG89
Bromomethane	µg/m^3	88	11	13	0.073	720	0.080	1.8	0.24	0.41	0.51	1.3	SG79
2-Butanone	µg/m^3	113	68	60	1.4	320	1.6	62	5.9	9.1	10	1.1	SG84
tert-Butyl alcohol	µg/m^3	75	40	53	0.72	48	0.20	17	0.51	1.3	2.9	2.2	SG66
n-Butylbenzene	µg/m^3	75	33	44	0.073	33	0.17	1.5	0.38	0.48	0.33	0.70	SG88
sec-Butylbenzene	µg/m^3	75	9	12	0.085	38	0.11	0.80	0.20	0.28	0.22	0.79	SG67
tert-Butylbenzene	µg/m^3	75	4	5.3	0.073	33	0.35	1.0	0.46	0.56	0.30	0.53	SG67
Carbon disulfide	µg/m^3	113	64	57	1.2	130	0.41	270	4.8	14	35	2.5	SG60
Carbon tetrachloride	µg/m^3	113	99	88	3.6	220	0.11	18,000	12	1,060	3,420	3.2	SG29
3-Chloro-1-propene	µg/m^3	75	2	2.7	0.073	33	1.0	5.5	3.2	3.2	3.2	0.98	SG40
Chlorobenzene	µg/m^3	113	33	29	0.074	160	0.093	340	1.1	37	89	2.4	SG83
Chloroethane	µg/m^3	113	35	31	0.039	450	0.064	89	0.32	11	22	2.0	RISG-25
Chloroform	µg/m^3	113	113	100	--	--	0.74	160,000	3,900	17,500	32,800	1.9	SG32
Chloromethane	µg/m^3	113	18	16	0.073	230	0.065	2.4	0.17	0.36	0.57	1.6	SG75
Cumene	µg/m^3	75	20	27	0.082	37	0.098	9.7	0.24	0.78	2.1	2.7	SG83
Cyclohexane	µg/m^3	25	3	12	0.38	12	1.3	2.4	1.4	1.7	0.61	0.36	RISG-82
p-Cymene	µg/m^3	75	31	41	0.20	42	0.13	6.7	0.43	0.99	1.4	1.5	SG68
1,2-Dibromo-3-chloropropane	µg/m^3	100	0	0	0.11	440	--	--	--	--	--	--	--
Dibromochloromethane	µg/m^3	113	17	15	0.10	370	0.22	160	1.5	17	39	2.3	SG89
1,2-Dibromoethane	µg/m^3	113	0	0	0.030	320	--	--	--	--	--	--	--
1,2-Dichlorobenzene	µg/m^3	113	19	17	0.098	430	0.12	36	1.1	5.6	9.1	1.6	RISG-11
1,3-Dichlorobenzene	µg/m^3	113	25	22	0.091	370	0.12	49	3.9	6.3	9.9	1.6	RISG-11
1,4-Dichlorobenzene	µg/m^3	113	61	54	0.24	500	0.19	130	12	20	26	1.3	SG21
Dichlorodifluoromethane	µg/m^3	113	70	62	1.7	400	1.6	51	2.1	2.9	5.9	2.0	SG60
1,1-Dichloroethane	µg/m^3	113	43	38	0.073	160	0.10	360	0.84	38	83	2.2	RISG-25
1,2-Dichloroethane	µg/m^3	113	19	17	0.048	200	0.063	71	2.9	9.0	17	1.9	RISG-80

TABLE 4-7. Summary Statistics for Volatile Compounds in Soil Gas at 5 feet bgs
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
					Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
1,1-Dichloroethene	µg/m^3	113	50	44	0.075	160	0.074	4,700	3.0	140	670	4.8	RISG-86
cis-1,2-Dichloroethene	µg/m^3	113	7	6.2	0.0090	200	0.084	1.3	0.18	0.39	0.43	1.1	SG24
trans-1,2-Dichloroethene	µg/m^3	113	3	2.7	0.0098	220	0.087	0.55	0.43	0.36	0.24	0.68	RISG-25
1,2-Dichloropropane	µg/m^3	113	15	13	0.073	610	0.084	1.3	0.36	0.48	0.34	0.72	SG40
1,3-Dichloropropene	µg/m^3	88	0	0	0.092	260	--	--	--	--	--	--	--
Diisopropyl ether	µg/m^3	75	0	0	0.086	38	--	--	--	--	--	--	--
1,4-Dioxane	µg/m^3	100	17	17	0.090	66	0.17	4.2	0.29	0.68	1.1	1.6	SG67
Ethanol	µg/m^3	100	68	68	1.7	54	1.4	180	5.8	13	25	1.9	SG60
Ethyl tert-butyl ether	µg/m^3	75	0	0	0.074	33	--	--	--	--	--	--	--
Ethyl acetate	µg/m^3	25	0	0	2.4	230	--	--	--	--	--	--	--
Ethylbenzene	µg/m^3	113	53	47	0.097	150	0.12	85	1.9	5.9	13	2.1	SG77
4-Ethyltoluene	µg/m^3	113	41	36	0.093	510	0.097	290	0.76	8.9	45	5.1	RISG-81
Freon 114	µg/m^3	88	20	23	0.082	600	0.075	0.14	0.093	0.098	0.015	0.15	SG46
n-Heptane	µg/m^3	100	28	28	0.10	42	0.11	39	0.51	2.4	7.4	3.1	SG77
Hexachlorobutadiene	µg/m^3	113	32	28	0.13	2,500	0.15	300	3.7	35	73	2.0	SG86
n-Hexane	µg/m^3	25	1	4.0	0.67	12	0.92	0.92	0.92	0.92	--	--	RISG-87
2-Hexanone	µg/m^3	113	41	36	0.31	200	0.17	1.8	0.56	0.75	0.44	0.58	SG64
alpha-Methyl styrene	µg/m^3	75	10	13	0.11	48	0.11	0.74	0.20	0.27	0.20	0.76	SG48
Methyl tert-butyl ether	µg/m^3	75	7	9.3	0.074	33	0.099	1.0	0.16	0.27	0.32	1.2	SG76
4-Methyl-2-pentanone	µg/m^3	113	37	33	0.058	310	0.17	8.4	0.53	1.5	2.0	1.3	SG68
Methylene Chloride	µg/m^3	113	75	66	0.079	140	0.089	360	1.7	11	42	3.7	SG60
Methylmethacrylate	µg/m^3	100	0	0	0.11	640	--	--	--	--	--	--	--
Naphthalene	µg/m^3	100	54	54	0.12	48	0.15	73	1.4	4.8	11	2.4	SG60
n-Octane	µg/m^3	75	35	47	0.080	33	0.11	1,000	1.0	46	170	3.7	SG77
n-Propylbenzene	µg/m^3	75	32	43	0.085	34	0.11	14	0.49	1.1	2.5	2.2	SG77
Styrene	µg/m^3	113	22	19	0.11	140	0.13	20	0.31	1.5	4.3	2.9	RISG-11
1,1,1,2-Tetrachloroethane	µg/m^3	25	0	0	0.30	430	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	µg/m^3	113	2	1.8	0.062	260	0.18	32	16	16	23	1.4	RISG-11
Tetrachloroethene	µg/m^3	113	111	98	1.7	190	0.50	630	36	76	99	1.3	SG47
Tetrahydrofuran	µg/m^3	25	2	8.0	0.58	17	1.5	6.8	4.2	4.2	3.7	0.90	RISG-82
Toluene	µg/m^3	113	82	73	0.41	110	0.31	430	8.6	18	49	2.7	SG77
1,2,4-Trichlorobenzene	µg/m^3	113	16	14	0.11	1,800	0.12	42	5.1	6.8	10	1.5	SG60
1,1,1-Trichloroethane	µg/m^3	88	13	15	0.073	200	0.083	14	0.33	2.4	4.3	1.8	SG66

TABLE 4-7. Summary Statistics for Volatile Compounds in Soil Gas at 5 feet bgs
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
					Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
1,1,2-Trichloroethane	µg/m^3	113	4	3.5	0.019	200	0.23	1.1	0.40	0.53	0.41	0.76	SG20
Trichloroethene	µg/m^3	113	83	73	0.081	310	0.11	1,700	10	72	220	3.0	SG47
Trichlorofluoromethane	µg/m^3	113	79	70	1.3	190	0.96	1,700	1.5	200	440	2.2	SG61
1,2,3-Trichloropropane	µg/m^3	25	0	0	1.9	380	--	--	--	--	--	--	--
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/m^3	113	40	35	0.54	690	0.40	1.9	0.50	0.54	0.23	0.42	SG47
1,2,4-Trimethylbenzene	µg/m^3	113	49	43	0.072	440	0.13	570	1.8	15	81	5.4	RISG-81
1,3,5-Trimethylbenzene	µg/m^3	113	38	34	0.098	340	0.21	170	0.94	6.5	27	4.2	RISG-81
Vinyl acetate	µg/m^3	113	44	39	0.24	280	0.74	16	3.5	4.5	3.5	0.78	SG47
Vinyl chloride	µg/m^3	113	7	6.2	0.020	170	0.0098	1.3	0.18	0.37	0.45	1.2	SG66
Xylenes (total)	µg/m^3	113	73	65	0.15	240	0.27	470	7.0	30	63	2.1	SG77

Notes:

-- = No value

bgs = below ground surface

µg/m^3 = microgram per cubic meter

TABLE 4-8. Summary Statistics for Volatile Compounds in Soil Gas at or around 15 feet bgs
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
					Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
Acetone	µg/m^3	55	34	62	11	2,100	7.2	270	34	70	74	1.1	RISG-14
Acrolein	µg/m^3	5	0	0	2.1	19	--	--	--	--	--	--	--
Acrylonitrile	µg/m^3	35	2	5.7	0.11	340	0.25	0.31	0.28	0.28	0.042	0.15	SG41
tert-Amyl methyl ether	µg/m^3	5	0	0	0.078	1.6	--	--	--	--	--	--	--
Benzene	µg/m^3	55	15	27	1.3	1,200	0.15	35	2.1	6.1	10	1.6	SG41
Benzyl chloride	µg/m^3	55	1	1.8	0.13	4,200	20	20	20	20	--	--	RISG-21
Bromodichloromethane	µg/m^3	55	21	38	0.45	2,200	0.83	250	14	36	56	1.5	RISG-17
Bromoform	µg/m^3	55	5	9.1	0.12	3,600	18	67	38	41	20	0.50	RISG-17
Bromomethane	µg/m^3	25	1	4.0	0.078	6,400	0.10	0.10	0.10	0.10	--	--	SG41
2-Butanone	µg/m^3	55	15	27	2.7	2,900	0.97	33	12	14	9.4	0.66	RISG-80
tert-Butyl alcohol	µg/m^3	5	4	80	2.3	2.3	0.26	1.6	0.68	0.80	0.57	0.71	SG37
n-Butylbenzene	µg/m^3	5	4	80	1.6	1.6	0.29	3.0	1.5	1.6	1.5	0.92	SG41
sec-Butylbenzene	µg/m^3	5	2	40	0.090	1.8	0.91	0.93	0.92	0.92	0.014	0.015	SG41
tert-Butylbenzene	µg/m^3	5	0	0	0.078	1.6	--	--	--	--	--	--	--
Carbon disulfide	µg/m^3	55	15	27	0.65	1,200	1.4	78	10	19	24	1.3	RISG-15
Carbon tetrachloride	µg/m^3	55	35	64	2.0	2,000	0.78	7,500	19	810	1,860	2.3	RISG-84
3-Chloro-1-propene	µg/m^3	5	0	0	0.078	1.6	--	--	--	--	--	--	--
Chlorobenzene	µg/m^3	55	7	13	0.080	1,500	0.32	2,000	110	440	720	1.6	RISG-17
Chloroethane	µg/m^3	55	9	16	0.078	4,000	0.042	100	0.22	17	33	2.0	RISG-83
Chloroform	µg/m^3	55	55	100	--	--	8.3	850,000	10,000	45,500	120,000	2.6	RISG-10
Chloromethane	µg/m^3	55	3	5.5	0.078	2,000	0.12	0.20	0.14	0.15	0.042	0.27	RISG-88
Cumene	µg/m^3	5	3	60	0.18	1.7	0.090	3.8	3.7	2.5	2.1	0.84	SG41
Cyclohexane	µg/m^3	30	3	10	0.23	30	0.65	18	0.90	6.5	9.9	1.5	RISG-11
p-Cymene	µg/m^3	5	4	80	2.0	2.0	0.20	6.9	3.0	3.3	3.6	1.1	SG41
1,2-Dibromo-3-chloropropane	µg/m^3	35	0	0	0.12	1,500	--	--	--	--	--	--	--
Dibromochloromethane	µg/m^3	55	8	15	0.11	3,300	0.12	96	23	37	36	0.99	RISG-17
1,2-Dibromoethane	µg/m^3	55	0	0	0.059	2,900	--	--	--	--	--	--	--
1,2-Dichlorobenzene	µg/m^3	55	4	7.3	0.10	3,900	0.11	57	1.4	15	28	1.9	RISG-26
1,3-Dichlorobenzene	µg/m^3	55	9	16	0.097	3,300	2.0	34	9.2	13	12	0.93	RISG-23
1,4-Dichlorobenzene	µg/m^3	55	7	13	0.26	4,400	0.60	65	31	28	27	0.97	SG36
Dichlorodifluoromethane	µg/m^3	55	14	25	2.4	3,500	1.6	3.8	2.2	2.3	0.70	0.31	RISG-25
1,1-Dichloroethane	µg/m^3	55	15	27	0.078	330	0.11	1,600	2.0	130	410	3.1	RISG-10
1,2-Dichloroethane	µg/m^3	55	9	16	0.020	1,800	0.046	60	0.21	13	22	1.6	RISG-83
1,1-Dichloroethene	µg/m^3	55	22	40	0.020	1,400	0.42	1,500	32	280	480	1.7	RISG-86
cis-1,2-Dichloroethene	µg/m^3	55	3	5.5	0.024	1,700	0.066	0.15	0.093	0.10	0.043	0.42	SG41
trans-1,2-Dichloroethene	µg/m^3	55	2	3.6	0.019	2,000	0.029	0.064	0.046	0.046	0.025	0.53	RISG-79

TABLE 4-8. Summary Statistics for Volatile Compounds in Soil Gas at or around 15 feet bgs
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
					Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
1,2-Dichloropropane	µg/m^3	55	3	5.5	0.078	5,500	0.23	2.1	0.25	0.86	1.1	1.2	SG36
1,3-Dichloropropene	µg/m^3	25	0	0	0.098	2,300	--	--	--	--	--	--	--
Diisopropyl ether	µg/m^3	5	0	0	0.092	1.8	--	--	--	--	--	--	--
1,4-Dioxane	µg/m^3	35	1	2.9	0.095	150	0.14	0.14	0.14	0.14	--	--	SG41
Ethanol	µg/m^3	35	13	37	3.3	150	0.84	86	7.6	20	27	1.4	RISG-83
Ethyl tert-butyl ether	µg/m^3	5	0	0	0.080	1.6	--	--	--	--	--	--	--
Ethyl acetate	µg/m^3	30	0	0	2.8	560	--	--	--	--	--	--	--
Ethylbenzene	µg/m^3	55	10	18	0.19	1,400	0.072	90	0.42	18	37	2.1	SG41
4-Ethyltoluene	µg/m^3	55	7	13	0.24	4,600	0.24	17	0.97	5.4	7.1	1.3	SG41
Freon 114	µg/m^3	25	3	12	0.16	5,400	0.089	0.10	0.097	0.095	0.0057	0.060	SG38
n-Heptane	µg/m^3	35	3	8.6	0.20	54	0.18	19	10	9.7	9.4	0.97	SG41
Hexachlorobutadiene	µg/m^3	55	5	9.1	0.14	23,000	6.2	56	24	30	22	0.73	SG36
n-Hexane	µg/m^3	30	0	0	0.40	34	--	--	--	--	--	--	--
2-Hexanone	µg/m^3	55	4	7.3	0.13	1,800	0.55	16	2.3	5.3	7.3	1.4	RISG-80
alpha-Methyl styrene	µg/m^3	5	3	60	0.23	2.3	0.22	0.63	0.53	0.46	0.21	0.46	SG41
Methyl tert-butyl ether	µg/m^3	5	2	40	0.078	1.6	0.27	0.30	0.29	0.29	0.021	0.074	SG41
4-Methyl-2-pentanone	µg/m^3	55	6	11	0.11	2,700	0.20	14	5.2	6.2	6.1	0.98	SG41
Methylene Chloride	µg/m^3	55	14	25	1.1	1,200	0.10	110	10	20	30	1.5	RISG-17
Methylmethacrylate	µg/m^3	35	2	5.7	0.12	630	0.18	0.36	0.27	0.27	0.13	0.47	SG41
Naphthalene	µg/m^3	35	8	23	0.058	62	0.26	7.0	1.9	2.8	2.6	0.93	SG41
n-Octane	µg/m^3	5	3	60	0.16	1.6	0.41	53	30	28	26	0.95	SG41
n-Propylbenzene	µg/m^3	5	3	60	0.16	1.6	0.24	9.7	8.8	6.2	5.2	0.84	SG41
Styrene	µg/m^3	55	3	5.5	0.11	1,200	0.25	1.9	1.7	1.3	0.90	0.70	SG41
1,1,1,2-Tetrachloroethane	µg/m^3	30	0	0	0.18	1,100	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	µg/m^3	55	0	0	0.039	2,300	--	--	--	--	--	--	--
Tetrachloroethene	µg/m^3	55	54	98	1,700	1,700	3.8	1,600	90	200	300	1.5	RISG-17
Tetrahydrofuran	µg/m^3	30	5	17	0.35	40	1.5	12	1.9	4.1	4.5	1.1	RISG-80
Toluene	µg/m^3	55	18	33	1.4	950	0.30	240	1.7	29	75	2.6	SG41
1,2,4-Trichlorobenzene	µg/m^3	55	2	3.6	0.12	16,000	0.19	6.9	3.5	3.6	4.7	1.3	RISG-81
1,1,1-Trichloroethane	µg/m^3	25	2	8.0	0.078	1,800	0.23	2.5	1.4	1.4	1.6	1.2	SG36
1,1,2-Trichloroethane	µg/m^3	55	0	0	0.037	1,800	--	--	--	--	--	--	--
Trichloroethene	µg/m^3	55	28	51	1.9	2,800	0.17	610	46	87	140	1.6	RISG-82
Trichlorofluoromethane	µg/m^3	55	20	36	1.6	1,200	1.2	9,800	5.7	820	2,190	2.7	RISG-10
1,2,3-Trichloropropane	µg/m^3	30	0	0	2.2	930	--	--	--	--	--	--	--
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/m^3	55	5	9.1	0.73	6,200	0.51	0.60	0.57	0.56	0.037	0.066	SG38
1,2,4-Trimethylbenzene	µg/m^3	55	10	18	0.26	3,900	0.79	39	4.2	13	16	1.2	SG41

TABLE 4-8. Summary Statistics for Volatile Compounds in Soil Gas at or around 15 feet bgs
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
					Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
1,3,5-Trimethylbenzene	$\mu g/m^3$	55	6	11	0.22	3,000	0.33	53	9.7	15	20	1.3	RISG-17
Vinyl acetate	$\mu g/m^3$	55	4	7.3	0.29	2,500	0.73	14	2.5	5.0	6.1	1.2	SG37
Vinyl chloride	$\mu g/m^3$	55	0	0	0.012	1,500	--	--	--	--	--	--	--
Xylenes (total)	$\mu g/m^3$	55	15	27	1.8	2,100	0.37	530	3.2	80	180	2.2	SG41

Notes:

-- = No value

bgs = below ground surface

$\mu g/m^3$ = microgram per cubic meter

TABLE 4-9. Summary Statistics for Volatile Compounds in Shallow Groundwater
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
					Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
Acenaphthene	µg/L	11	0	0	0.19	0.22	--	--	--	--	--	--	--
Acenaphthylene	µg/L	13	0	0	0.10	0.22	--	--	--	--	--	--	--
Anthracene	µg/L	11	0	0	0.19	0.22	--	--	--	--	--	--	--
Benzene	µg/L	481	41	8.5	0.20	25	0.98	17,000	630	2,630	3,700	1.4	M-123
Benzo(a)anthracene	µg/L	13	0	0	0.10	2.2	--	--	--	--	--	--	--
Bis(2-chloro-1-methylethyl) ether	µg/L	12	0	0	0.19	0.22	--	--	--	--	--	--	--
Bis(2-chloroethyl) ether	µg/L	12	0	0	0.19	0.22	--	--	--	--	--	--	--
Bromobenzene	µg/L	479	1	0.21	0.21	100	54	54	54	54	--	--	M-126
Bromochloromethane	µg/L	479	0	0	0.15	100	--	--	--	--	--	--	--
Bromodichloromethane	µg/L	479	69	14	0.17	100	0.17	1.5	0.37	0.44	0.24	0.54	M-36D
Bromoform	µg/L	479	46	9.6	0.29	160	0.40	3.7	1.4	1.5	0.75	0.49	M-36D
Bromomethane	µg/L	479	0	0	0.25	100	--	--	--	--	--	--	--
4-Bromophenyl-phenyl ether	µg/L	12	0	0	0.47	0.55	--	--	--	--	--	--	--
2-Butanone	µg/L	481	1	0.21	2.5	1,000	13	13	13	13	--	--	M-140
n-Butylbenzene	µg/L	479	0	0	0.24	160	--	--	--	--	--	--	--
sec-Butylbenzene	µg/L	479	0	0	0.17	100	--	--	--	--	--	--	--
tert-Butylbenzene	µg/L	479	0	0	0.17	100	--	--	--	--	--	--	--
Carbon tetrachloride	µg/L	481	149	31	0.18	100	0.25	660	1.8	28	99	3.6	M-123
Chlorobenzene	µg/L	481	54	11	0.18	25	0.27	31,000	1,100	5,260	7,730	1.5	M-123
Chloroethane	µg/L	479	0	0	0.36	160	--	--	--	--	--	--	--
Chloroform	µg/L	481	474	99	0.23	13	0.29	21,000	110	910	3,100	3.4	M-126
Chloromethane	µg/L	479	0	0	0.25	100	--	--	--	--	--	--	--
2-Chloronaphthalene	µg/L	12	0	0	0.19	0.22	--	--	--	--	--	--	--
2-Chlorophenol	µg/L	5	0	0	0.49	0.51	--	--	--	--	--	--	--
4-Chlorophenyl-phenyl ether	µg/L	12	0	0	0.19	0.22	--	--	--	--	--	--	--
2-Chlorotoluene	µg/L	479	1	0.21	0.18	100	60	60	60	60	--	--	M-126
4-Chlorotoluene	µg/L	479	1	0.21	0.17	100	56	56	56	56	--	--	M-126
Cumene	µg/L	479	0	0	0.25	100	--	--	--	--	--	--	--
p-Cymene	µg/L	479	0	0	0.17	100	--	--	--	--	--	--	--
Dibenzofuran	µg/L	12	0	0	0.19	0.22	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane	µg/L	479	0	0	0.50	200	--	--	--	--	--	--	--
Dibromochloromethane	µg/L	479	8	1.7	0.25	100	0.25	54	0.50	7.2	19	2.6	M-126
1,2-Dibromoethane	µg/L	479	0	0	0.21	100	--	--	--	--	--	--	--
Dibromomethane	µg/L	479	0	0	0.25	100	--	--	--	--	--	--	--
1,2-Dichlorobenzene	µg/L	481	107	22	0.19	100	0.29	1,200	2.4	94	240	2.6	M-123

TABLE 4-9. Summary Statistics for Volatile Compounds in Shallow Groundwater
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
					Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
1,3-Dichlorobenzene	µg/L	479	68	14	0.18	100	0.24	95	0.85	7.5	17	2.3	M-126
1,4-Dichlorobenzene	µg/L	481	100	21	0.17	100	0.26	2,100	0.90	160	430	2.7	M-123
Dichlorodifluoromethane	µg/L	479	0	0	0.17	160	--	--	--	--	--	--	--
1,1-Dichloroethane	µg/L	479	46	9.6	0.24	100	0.25	39	1.4	4.6	9.4	2.0	M-5A
1,2-Dichloroethane	µg/L	481	32	6.7	0.20	100	0.27	28	1.1	4.3	7.2	1.7	M-5A
1,1-Dichloroethene	µg/L	481	84	17	0.25	100	0.25	130	1.6	11	27	2.5	M-97
cis-1,2-Dichloroethene	µg/L	479	0	0	0.21	100	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	µg/L	479	0	0	0.23	100	--	--	--	--	--	--	--
1,2-Dichloropropane	µg/L	479	0	0	0.25	100	--	--	--	--	--	--	--
1,3-Dichloropropane	µg/L	479	3	0.63	0.19	100	0.84	0.86	0.85	0.85	0.010	0.012	M-115
2,2-Dichloropropane	µg/L	479	0	0	0.16	160	--	--	--	--	--	--	--
1,1-Dichloropropene	µg/L	481	0	0	0.20	100	--	--	--	--	--	--	--
1,3-Dichloropropene	µg/L	479	0	0	0.17	100	--	--	--	--	--	--	--
1,4-Dioxane	µg/L	475	181	38	0.50	100	0.50	170	0.85	2.6	13	4.9	M-123
Ethyl tert-butyl ether	µg/L	481	0	0	0.21	100	--	--	--	--	--	--	--
Ethylbenzene	µg/L	479	0	0	0.19	100	--	--	--	--	--	--	--
Fluorene	µg/L	12	0	0	0.19	0.22	--	--	--	--	--	--	--
Formaldehyde	µg/L	2	0	0	5.0	5.0	--	--	--	--	--	--	--
Hexachlorobenzene	µg/L	14	0	0	0.47	5.0	--	--	--	--	--	--	--
Hexachlorobutadiene	µg/L	479	6	1.3	0.25	100	0.34	3.4	1.1	1.3	1.1	0.85	M-22A
Hexachlorocyclopentadiene	µg/L	12	0	0	1.9	2.2	--	--	--	--	--	--	--
Hexachloroethane	µg/L	12	0	0	0.47	0.55	--	--	--	--	--	--	--
Methylene Chloride	µg/L	481	39	8.1	0.88	350	0.88	390	2.4	20	70	3.5	M-125
1-Methylnaphthalene	µg/L	14	0	0	3.3	3.8	--	--	--	--	--	--	--
2-Methylnaphthalene	µg/L	13	0	0	0.49	5.0	--	--	--	--	--	--	--
Naphthalene	µg/L	479	3	0.63	0.21	160	0.75	13	1.1	5.0	7.0	1.4	M-73
Nitrobenzene	µg/L	12	0	0	0.47	0.55	--	--	--	--	--	--	--
2-Nitrophenol	µg/L	5	0	0	0.97	1.0	--	--	--	--	--	--	--
Octachlorostyrene	µg/L	14	0	0	6.2	7.1	--	--	--	--	--	--	--
Phenanthrene	µg/L	14	0	0	0.10	0.22	--	--	--	--	--	--	--
n-Propylbenzene	µg/L	479	0	0	0.17	100	--	--	--	--	--	--	--
Pyrene	µg/L	12	0	0	0.19	0.22	--	--	--	--	--	--	--
Styrene	µg/L	478	0	0	0.25	100	--	--	--	--	--	--	--
1,1,1,2-Tetrachloroethane	µg/L	479	0	0	0.15	100	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	µg/L	479	1	0.21	0.19	100	54	54	54	54	--	--	M-126

TABLE 4-9. Summary Statistics for Volatile Compounds in Shallow Groundwater
Nevada Environmental Response Trust Site
Henderson, Nevada

Analyte	Unit	No. of Samples	No. of Detects	% Detects	Nondetects		Detects						
					Minimum	Maximum	Minimum	Maximum	Median	Mean	Standard Deviation	Coefficient of Variation	Location of Maximum
Tetrachloroethene	µg/L	481	116	24	0.14	100	0.17	98	0.42	3.5	16	4.5	M-123
Toluene	µg/L	479	17	3.6	0.17	100	0.17	65	0.44	4.5	16	3.5	M-126
1,2,3-Trichlorobenzene	µg/L	481	2	0.42	0.23	160	0.82	0.82	0.82	0.82	0	0	M-72
1,2,4-Trichlorobenzene	µg/L	479	5	1.0	0.20	160	0.40	0.73	0.41	0.49	0.14	0.29	M-176
1,1,1-Trichloroethane	µg/L	479	0	0	0.19	100	--	--	--	--	--	--	--
1,1,2-Trichloroethane	µg/L	479	0	0	0.19	100	--	--	--	--	--	--	--
Trichloroethene	µg/L	481	177	37	0.20	100	0.21	32	2.0	3.7	5.3	1.4	M-97
Trichlorofluoromethane	µg/L	479	6	1.3	0.21	100	0.32	100	56	53	34	0.65	M-123
1,2,3-Trichloropropane	µg/L	482	398	83	0.0025	0.25	0.0025	0.95	0.083	0.11	0.11	1.0	M-125
1,2,4-Trimethylbenzene	µg/L	481	2	0.42	0.17	100	16	66	41	41	35	0.86	M-126
1,3,5-Trimethylbenzene	µg/L	479	1	0.21	0.17	100	2.9	2.9	2.9	2.9	--	--	M-73
Vinyl chloride	µg/L	479	2	0.42	0.18	100	0.32	120	60	60	85	1.4	M-125
Xylenes (total)	µg/L	479	1	0.21	0.38	200	110	110	110	110	--	--	M-126

Notes:

-- = No value

µg/L = microgram per liter

Tabel 4-10. Evaluation of Soil Gas Co-located Samples for 5 feet and 15 feet bgs
Nevada Environmental Response Trust Site
Henderson, Nevada

Sample ID	Date	Concentration (µg/m^3) at: 5 ft	15 ft[1]	Percent Difference
RISG-10	March-19	75,000	850,000	1033%
RISG-10	November-19	18,000	92,000	411%
RISG-11	March-19	18,000	25,000	39%
RISG-11	November-19	18,000	32,000	78%
RISG-12	March-19	25,000	46,000	84%
RISG-12	November-19	17,000	51,000	200%
RISG-13	March-19	3,500	7,000	100%
RISG-13	November-19	2,200	10,000	355%
RISG-14	March-19	35,000	58,000	66%
RISG-14	November-19	33,000	89,000	170%
RISG-15	March-19	8,600	33,000	284%
RISG-15	November-19	7,200	45,000	525%
RISG-20	March-19	2,800	5,550	91%
RISG-20	January-20	3,000	5,900	97%
RISG-21	March-19	1,400	2,800	100%
RISG-21	November-19	1,200	3,600	200%
RISG-22	March-19	4,800	7,400	54%
RISG-22	November-19	3,700	10,000	170%
RISG-23	March-19	240	3,700	1442%
RISG-23	November-19	700	8,000	1043%
RISG-24	March-19	680	1,800	165%
RISG-24	November-19	550	2,200	300%
RISG-25	March-19	410	92	**-78%**
RISG-25	November-19	510	93	**-82%**
RISG-26	March-19	7,700	20,000	160%
RISG-26	November-19	5,600	29,000	418%
RISG-79	December-19	1,100	300	**-73%**
RISG-80	November-19	21,000	4,400	**-79%**
RISG-81	November-19	110	310	182%
RISG-82	November-19	4,400	10,000	127%
RISG-83	November-19	14,000	48,000	243%
RISG-84	November-19	23,000	93,000	304%
RISG-85	November-19	1,700	5,900	247%
RISG-86	December-19	11,000	5,200	**-53%**
RISG-87	November-19	18	27	50%
RISG-88	December-19	17	52	206%
RISG-89	January-20	1,600	3,750	134%
RISG-90	December-19	3.1	8.3	168%
			Maximum	1442%
			Minimum	-82%
			Average	234%
			Average (those > 0%)	280%
			Median	166%

[1] All samples were 15' bgs except RISG-22 (12.4') and RISG-81, RISG-85, and RISG-86 (14')

TABLE 5-1. Summary of Soil Gas and Shallow Groundwater COPCs
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	Soil Gas		Shallow Groundwater	Uniquely Associated with Trespassing OSSM Plume? [1]
	at 5 ft bgs	at or around 15 ft bgs		
Acetone	X	X		
Acrylonitrile	X	X		
tert-Amyl methyl ether	X			
Benzene	X	X	X	X
Benzyl chloride	X	X		
Bromobenzene			X	
Bromodichloromethane	X	X	X	
Bromoform	X	X	X	
Bromomethane	X	X		
2-Butanone	X	X	X	
tert-Butyl alcohol	X	X		
n-Butylbenzene	X	X		
sec-Butylbenzene	X	X		
tert-Butylbenzene	X			
Carbon disulfide	X	X		
Carbon tetrachloride	X	X	X	X
3-Chloro-1-propene	X			
Chlorobenzene	X	X	X	X
Chloroethane	X	X		
Chloroform	X	X	X	
Chloromethane	X	X		
2-Chlorotoluene			X	
4-Chlorotoluene			X	
Cumene	X	X		
Cyclohexane	X	X		
p-Cymene	X	X		
Dibromochloromethane	X	X	X	
1,2-Dichlorobenzene	X	X	X	X
1,3-Dichlorobenzene	X	X	X	X
1,4-Dichlorobenzene	X	X	X	X
Dichlorodifluoromethane	X	X		
1,1-Dichloroethane	X	X	X	
1,2-Dichloroethane	X	X	X	
1,1-Dichloroethene	X	X	X	
cis-1,2-Dichloroethene	X	X		
trans-1,2-Dichloroethene	X	X		
1,2-Dichloropropane	X	X		
1,3-Dichloropropane			X	
1,4-Dioxane	X	X	X	
Ethanol	X	X		
Ethylbenzene	X	X		
4-Ethyltoluene	X	X		
Freon 114	X	X		

TABLE 5-1. Summary of Soil Gas and Shallow Groundwater COPCs
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	Soil Gas		Shallow Groundwater	Uniquely Associated with Trespassing OSSM Plume? [1]
	at 5 ft bgs	at or around 15 ft bgs		
n-Heptane	X	X		
Hexachlorobutadiene	X	X	X	
n-Hexane	X			
2-Hexanone	X	X		
alpha-Methyl styrene	X	X		
Methyl tert-butyl ether	X	X		
4-Methyl-2-pentanone	X	X		
Methylene chloride	X	X	X	
Methylmethacrylate		X		
Naphthalene	X	X	X	
n-Octane	X	X		
n-Propylbenzene	X	X		
Styrene	X	X		
1,1,2,2-Tetrachloroethane	X		X	
Tetrachloroethene	X	X	X	
Tetrahydrofuran	X	X		
Toluene	X	X	X	
1,2,3-Trichlorobenzene			X	
1,2,4-Trichlorobenzene	X	X	X	
1,1,1-Trichloroethane	X	X		
1,1,2-Trichloroethane	X			
Trichloroethene	X	X	X	
Trichlorofluoromethane	X	X	X	
1,2,3-Trichloropropane			X	
1,1,2-Trichloro-1,2,2-trifluoroethane	X	X		
1,2,4-Trimethylbenzene	X	X	X	
1,3,5-Trimethylbenzene	X	X	X	
Vinyl acetate	X	X		
Vinyl chloride	X		X	
Xylenes (total)	X	X	X	

Notes:

bgs = below ground surface

ft = feet

COPC = Chemical of potential concern

OSSM = Olin Chlor Alkali/Stauffer/Syngenta/Montrose

OU = Operable Unit

[1] Please refer to Section 7.5.2.4 in the Remedial Investigation Report for OU-1 and OU-2, Revision 1 (Ramboll 2023) for more deta

Source:

Ramboll. 2023. Remedial Investigation Report for OU-1 and OU-2, Revision 1, Nevada Environmental Response Trust Site, Henderson, Nevada. August 15.

TABLE 5-2. Physical/Chemical Properties for Soil Gas and Shallow Groundwater Analytes
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical [1]	Molecular Weight MW (g/mol)	Organic Carbon Partition Coefficient, K_{oc} (cm^3/g)	Diffusivity in Air, D_a (cm^2/s)	Diffusivity in Water, D_w (cm^2/s)	Pure Component Water Solubility, S (mg/L)	Henry's Law Constant at 25° C H (atm-m^3/mol)	Normal Boiling Point, T_B (^oK)	Critical Temperature, T_C (^oK)	Enthalpy of Vaporization at the Normal Boiling Point, ΔHv, b (cal/mol)	Source
Acenaphthene	154.21	5.03E+03	5.06E-02	8.33E-06	3.90E+00	1.84E-04	552.00	803.15	12155.00	NDEP (2023)
Acenaphthylene	152.20	5.62E+03	5.24E-02	7.78E-06	1.61E+01	1.14E-04	553.15	--	--	EPISuite (USEPA 2012) + 2-Methylnaphthalene for diffusivities
Acetone	58.08	2.36E+00	1.06E-01	1.15E-05	1.00E+06	3.50E-05	328.50	508.10	6955.00	NDEP (2023)
Acrolein	56.07	1.00E+00	1.12E-01	1.22E-05	2.12E+05	1.22E-04	325.60	506.00	6730.77	NDEP (2023)
Acrylonitrile	53.06	8.51E+00	1.14E-01	1.23E-05	7.45E+04	1.38E-04	350.30	519.00	7786.00	NDEP (2023)
tert-Amyl methyl ether	102.18	2.27E+01	6.54E-02	7.76E-06	1.07E+04	1.32E-03	359.45	--	--	EPISuite (USEPA 2012) + Diisopropyl Ether for diffusivities
Anthracene	178.24	1.64E+04	3.90E-02	7.85E-06	4.34E-02	5.56E-05	612.90	873.00	13121.00	NDEP (2023)
Benzene	78.12	1.46E+02	8.95E-02	1.03E-05	1.79E+03	5.55E-03	353.00	562.16	7342.00	NDEP (2023)
Benzo(a)anthracene	228.30	1.77E+05	2.61E-02	6.75E-06	9.40E-03	1.20E-05	710.75	1066.13	16000.00	NDEP (2023)
Benzyl chloride	126.59	4.46E+02	6.34E-02	8.81E-06	5.25E+02	4.12E-04	452.00	685.00	8773.26	NDEP (2023)
Bis(2-chloroethyl) ether	143.01	3.22E+01	5.67E-02	8.71E-06	1.72E+04	1.70E-05	451.50	659.79	10803.00	NDEP (2023)
Bis(2-chloro-1-methylethyl) ether	171.07	8.29E+01	3.99E-02	7.36E-06	1.70E+03	7.42E-05	460.00	690.00	9694.92	NDEP (2023)
Bromobenzene	157.01	2.34E+02	5.37E-02	9.30E-06	4.46E+02	2.47E-03	429.00	670.00	10628.64	NDEP (2023)
Bromochloromethane	129.38	2.17E+01	7.87E-02	1.22E-05	1.67E+04	1.46E-03	341.00	511.50	7167.65	NDEP (2023)
Bromodichloromethane	163.83	3.18E+01	5.63E-02	1.07E-05	3.03E+03	2.12E-03	363.00	585.85	7800.00	NDEP (2023)
Bromoform	252.73	3.18E+01	3.57E-02	1.04E-05	3.10E+03	5.35E-04	422.25	633.38	9472.63	NDEP (2023)
Bromomethane	94.94	1.32E+01	1.00E-01	1.35E-05	1.52E+04	7.34E-03	276.50	467.00	5714.00	NDEP (2023)
4-Bromophenyl-phenyl ether	249.11	3.08E+03	3.97E-02	7.23E-06	1.45E+00	4.69E-05	583.25	--	--	EPISuite (USEPA 2012) + Diphenyl Ether for diffusivities
2-Butanone	72.11	4.51E+00	9.14E-02	1.02E-05	2.23E+05	5.69E-05	352.50	536.78	7480.70	NDEP (2023)
tert-Butyl alcohol	74.12	2.92E+00	9.00E-02	1.00E-05	1.81E+05	9.05E-06	--	--	--	NDEP (2023)
n-Butylbenzene	134.22	1.48E+03	5.28E-02	7.33E-06	1.18E+01	1.59E-02	456.30	720.00	12267.12	NDEP (2023)
sec-Butylbenzene	134.22	1.33E+03	5.28E-02	7.34E-06	1.76E+01	1.76E-02	451.50	677.25	11467.50	NDEP (2023)
tert-Butylbenzene	134.22	1.00E+03	5.30E-02	7.37E-06	2.95E+01	1.32E-02	443.15	664.73	11405.35	NDEP (2023)
Carbon disulfide	76.14	2.17E+01	1.06E-01	1.30E-05	2.16E+03	1.44E-02	319.00	552.00	6391.00	NDEP (2023)
Carbon tetrachloride	153.82	4.39E+01	5.71E-02	9.78E-06	7.93E+02	2.76E-02	349.80	556.60	7127.00	NDEP (2023)
3-Chloro-1-propene	76.53	3.96E+01	9.36E-02	1.08E-05	3.37E+03	1.10E-02	318.10	514.26	6936.08	NDEP (2023)
Chlorobenzene	112.56	2.34E+02	7.21E-02	9.48E-06	4.98E+02	3.11E-03	404.70	632.40	8410.00	NDEP (2023)
Chloroethane	64.52	2.17E+01	1.04E-01	1.16E-05	6.71E+03	1.11E-02	285.30	460.40	5879.40	NDEP (2023)
Chloroform	119.38	3.18E+01	7.69E-02	1.09E-05	7.95E+03	3.67E-03	334.10	536.40	6988.00	NDEP (2023)
Chloromethane	50.49	1.32E+01	1.24E-01	1.36E-05	5.32E+03	8.82E-03	249.00	416.25	5114.60	NDEP (2023)
2-Chloronaphthalene	162.62	2.48E+03	4.47E-02	7.73E-06	1.17E+01	3.20E-04	529.00	793.50	11311.94	NDEP (2023)
2-Chlorophenol	128.56	3.88E+02	6.61E-02	9.48E-06	1.13E+04	1.12E-05	447.90	675.00	9572.00	NDEP (2023)
4-Chlorophenyl-phenyl ether	204.66	3.08E+03	3.97E-02	7.23E-06	3.30E+00	8.73E-05	557.65	--	--	EPISuite (USEPA 2012) + Diphenyl Ether for diffusivities
2-Chlorotoluene	126.59	3.83E+02	6.29E-02	8.72E-06	3.74E+02	3.57E-03	432.00	654.10	9950.50	NDEP (2023)
4-Chlorotoluene	126.59	3.75E+02	6.26E-02	8.66E-06	1.06E+02	4.38E-03	435.40	658.70	10144.98	NDEP (2023)
Cumene	120.20	6.98E+02	6.03E-02	7.86E-06	6.13E+01	1.15E-02	425.40	631.10	10335.30	NDEP (2023)
Cyclohexane	84.16	1.46E+02	8.00E-02	9.11E-06	5.50E+01	1.50E-01	353.70	553.40	7153.60	NDEP (2023)
p-Cymene	134.00	2.20E+02	7.50E-02	7.10E-06	6.10E+01	1.20E+00	--	--	--	NDEP (2023)
Dibenzofuran	168.20	9.16E+03	6.51E-02	7.38E-06	3.10E+00	2.13E-04	560.00	824.00	66400.00	NDEP (2023)
1,2-Dibromo-3-chloropropane	236.33	1.16E+02	3.21E-02	8.90E-06	1.23E+03	1.47E-04	469.00	703.50	9960.05	NDEP (2023)
Dibromochloromethane	208.28	3.18E+01	3.66E-02	1.06E-05	2.70E+03	7.83E-04	393.00	678.20	5900.00	NDEP (2023)
1,2-Dibromoethane	187.86	3.96E+01	4.30E-02	1.04E-05	3.91E+03	6.50E-04	404.60	583.00	8310.03	NDEP (2023)
Dibromomethane	173.84	2.17E+01	5.51E-02	1.19E-05	1.19E+04	8.22E-04	370.00	583.00	7867.88	NDEP (2023)
1,2-Dichlorobenzene	147.00	3.83E+02	5.62E-02	8.92E-06	1.56E+02	1.92E-03	453.00	705.00	9700.00	NDEP (2023)

TABLE 5-2. Physical/Chemical Properties for Soil Gas and Shallow Groundwater Analytes
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical [1]	Molecular Weight MW (g/mol)	Organic Carbon Partition Coefficient, K_{oc} (cm^3/g)	Diffusivity in Air, D_a (cm^2/s)	Diffusivity in Water, D_w (cm^2/s)	Pure Component Water Solubility, S (mg/L)	Henry's Law Constant at 25° C H (atm-m^3/mol)	Normal Boiling Point, T_B (^oK)	Critical Temperature, T_C (^oK)	Enthalpy of Vaporization at the Normal Boiling Point, ΔHv, b (cal/mol)	Source
1,3-Dichlorobenzene	147.00	3.79E+02	6.90E-02	7.90E-06	1.56E+02	1.90E-03	--	--	--	NDEP (2023)
1,4-Dichlorobenzene	147.00	3.75E+02	5.50E-02	8.68E-06	8.13E+01	2.41E-03	447.00	684.75	9271.00	NDEP (2023)
Dichlorodifluoromethane	120.91	4.39E+01	7.60E-02	1.08E-05	2.80E+02	3.43E-01	243.20	384.95	9421.36	NDEP (2023)
1,1-Dichloroethane	98.96	3.18E+01	8.36E-02	1.06E-05	5.04E+03	5.62E-03	330.40	523.00	6895.00	NDEP (2023)
1,2-Dichloroethane	98.96	3.96E+01	8.57E-02	1.10E-05	8.60E+03	1.18E-03	356.50	561.00	7643.00	NDEP (2023)
1,1-Dichloroethene	96.94	3.18E+01	8.63E-02	1.10E-05	2.42E+03	2.61E-02	304.60	576.05	6247.00	NDEP (2023)
cis-1,2-Dichloroethene	96.94	3.96E+01	8.84E-02	1.13E-05	6.41E+03	4.08E-03	328.00	544.00	7192.00	NDEP (2023)
trans-1,2-Dichloroethene	96.94	3.96E+01	8.76E-02	1.12E-05	4.52E+03	9.38E-03	328.00	516.50	6717.00	NDEP (2023)
1,2-Dichloropropane	112.99	6.07E+01	7.33E-02	9.73E-06	2.80E+03	2.82E-03	368.50	572.00	7590.00	NDEP (2023)
1,3-Dichloropropane	112.99	7.22E+01	7.39E-02	9.82E-06	2.75E+03	9.76E-04	393.90	590.85	8102.51	NDEP (2023)
2,2-Dichloropropane	112.99	4.39E+01	7.33E-02	9.73E-06	3.44E+02	1.61E-02	342.45	--	--	EPISuite (USEPA 2012) + 1,2-Dichloropropane for diffusivities
1,1-Dichloropropene	110.97	6.07E+01	7.63E-02	1.01E-05	7.49E+02	5.00E-02	349.65	--	--	EPISuite (USEPA 2012) + 1,3-Dichloropropene for diffusivities
1,3-Dichloropropene	110.97	7.22E+01	7.63E-02	1.01E-05	2.80E+03	3.55E-03	385.00	587.38	7900.00	NDEP (2023)
Diisopropyl ether	102.18	2.28E+01	6.54E-02	7.76E-06	8.80E+03	2.56E-03	341.50	499.90	No DHv,b	NDEP (2023)
1,4-Dioxane	88.11	2.63E+00	8.74E-02	1.05E-05	1.00E+06	4.80E-06	374.65	585.15	8687.35	NDEP (2023)
Ethanol	46.00	1.00E+00	1.24E-01	1.37E-05	1.00E+06	5.00E-06	--	--	--	NDEP (2023)
Ethyl tert-butyl ether	102.18	2.11E+01	6.54E-02	7.76E-06	1.20E+04	1.64E-03	345.75	--	--	EPISuite (USEPA 2012) + Diisopropyl Ether for diffusivities
Ethyl acetate	88.11	5.58E+00	8.23E-02	9.70E-06	8.00E+04	1.34E-04	350.10	523.30	7633.66	NDEP (2023)
Ethylbenzene	106.17	4.46E+02	6.85E-02	8.46E-06	1.69E+02	7.88E-03	409.10	617.20	8501.00	NDEP (2023)
4-Ethyltoluene	120.19	2.20E+02	7.50E-02	7.10E-06	6.10E+01	1.20E+00	--	--	--	NDEP (2023)
Fluorene	166.22	9.16E+03	4.40E-02	7.89E-06	1.69E+00	9.62E-05	568.00	870.00	12666.00	NDEP (2023)
Formaldehyde	30.03	1.00E+00	1.67E-01	1.74E-05	4.00E+05	3.37E-07	254.05	412.35	5919.90	NDEP (2023)
Freon 114	170.92	1.97E+02	3.76E-02	8.59E-06	1.30E+02	2.80E+00	276.95	--	--	EPISuite (USEPA 2012) + 1,1,2-Trichloro-1,2,2-trifluoroethane for diffusivities
n-Heptane	100.00	8.20E+03	6.16E-02	6.45E-06	3.40E+00	2.00E+00	371.50	No Tcrit	No DHv,b	NDEP (2023)
Hexachlorobenzene	284.78	6.20E+03	2.90E-02	7.85E-06	6.20E-03	1.70E-03	598.15	897.23	11703.45	NDEP (2023)
Hexachlorobutadiene	260.76	8.45E+02	2.67E-02	7.03E-06	3.20E+00	1.03E-02	488.15	732.23	10206.00	NDEP (2023)
Hexachlorocyclopentadiene	272.77	1.40E+03	2.72E-02	7.22E-06	1.80E+00	2.70E-02	512.15	768.23	42992.28	NDEP (2023)
Hexachloroethane	236.74	1.97E+02	3.21E-02	8.89E-06	5.00E+01	3.89E-03	427.60	641.40	11711.30	NDEP (2023)
n-Hexane	86.18	1.32E+02	7.31E-02	8.17E-06	9.50E+00	1.80E+00	341.70	508.00	6895.15	NDEP (2023)
2-Hexanone	100.16	1.50E+01	7.04E-02	8.44E-06	1.72E+04	9.32E-05	400.60	600.90	8610.39	NDEP (2023)
alpha-Methyl styrene	118.18	6.98E+02	6.29E-02	8.19E-06	1.16E+02	2.55E-03	438.40	657.00	11419.16	NDEP (2023)
Methyl tert-butyl ether	88.15	1.16E+01	7.53E-02	8.59E-06	5.10E+04	5.87E-04	328.20	497.10	6677.66	NDEP (2023)
4-Methyl-2-pentanone	100.16	1.26E+01	6.98E-02	8.35E-06	1.90E+04	1.38E-04	389.50	571.00	8243.11	NDEP (2023)
Methylene chloride	84.93	2.17E+01	9.99E-02	1.25E-05	1.30E+04	3.25E-03	313.00	510.00	6706.00	NDEP (2023)
Methylmethacrylate	100.12	9.14E+00	7.50E-02	9.21E-06	1.50E+04	3.19E-04	373.50	567.00	8974.90	NDEP (2023)
1-Methylnaphthalene	142.20	2.53E+03	5.28E-02	7.85E-06	2.58E+01	5.14E-04	517.70	771.80	13690.65	NDEP (2023)
2-Methylnaphthalene	142.20	2.48E+03	5.24E-02	7.78E-06	2.46E+01	5.18E-04	514.10	761.00	12600.00	NDEP (2023)
Naphthalene	128.18	1.54E+03	6.05E-02	8.38E-06	3.10E+01	4.40E-04	490.90	748.40	10373.00	NDEP (2023)
Nitrobenzene	123.11	2.26E+02	6.81E-02	9.45E-06	2.09E+03	2.40E-05	483.80	719.00	10566.00	NDEP (2023)
2-Nitrophenol	139.11	2.97E+02	5.88E-02	8.67E-06	2.50E+03	1.28E-05	534.64	--	--	EPISuite (USEPA 2012) + o-Nitrotoluene for diffusivities
Octachlorostyrene	379.71	5.51E+04	2.90E-02	7.85E-06	1.74E-03	2.30E-04	625.77	--	--	EPISuite (USEPA 2012) + Hexachlorobenzene for diffusivities
n-Octane	114.23	4.37E+02	6.16E-02	6.45E-06	6.60E-01	3.21E+00	398.75	--	--	EPISuite (USEPA 2012) + n-Heptane for diffusivities
Phenanthrene	178.00	3.70E+03	4.21E-02	7.69E-06	1.10E+00	2.30E-05	--	--	--	NDEP (2023)
n-Propylbenzene	120.20	8.13E+02	6.02E-02	7.83E-06	5.22E+01	1.05E-02	432.20	630.00	9123.00	NDEP (2023)

TABLE 5-2. Physical/Chemical Properties for Soil Gas and Shallow Groundwater Analytes
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical [1]	Molecular Weight MW (g/mol)	Organic Carbon Partition Coefficient, K_{oc} (cm^3/g)	Diffusivity in Air, D_a (cm^2/s)	Diffusivity in Water, D_w (cm^2/s)	Pure Component Water Solubility, S (mg/L)	Henry's Law Constant at 25° C H (atm-m^3/mol)	Normal Boiling Point, T_B (^oK)	Critical Temperature, T_C (^oK)	Enthalpy of Vaporization at the Normal Boiling Point, ΔHv, b (cal/mol)	Source
Pyrene	202.26	5.43E+04	2.78E-02	7.25E-06	1.35E-01	1.19E-05	677.00	936.00	14370.00	NDEP (2023)
Styrene	104.15	4.46E+02	7.11E-02	8.78E-06	3.10E+02	2.75E-03	418.00	636.00	8737.00	NDEP (2023)
1,1,1,2-Tetrachloroethane	167.85	8.60E+01	4.82E-02	9.10E-06	1.07E+03	2.50E-03	403.50	624.00	9768.28	NDEP (2023)
1,1,2,2-Tetrachloroethane	167.85	9.49E+01	4.89E-02	9.29E-06	2.83E+03	3.67E-04	419.50	661.15	8996.00	NDEP (2023)
Tetrachloroethene	165.83	9.49E+01	5.05E-02	9.46E-06	2.06E+02	1.77E-02	394.30	620.20	8288.00	NDEP (2023)
Tetrahydrofuran	72.11	1.08E+01	9.94E-02	1.08E-05	1.00E+06	7.05E-05	339.00	541.15	7073.99	NDEP (2023)
Toluene	92.14	2.34E+02	7.78E-02	9.20E-06	5.26E+02	6.64E-03	383.60	591.79	7930.00	NDEP (2023)
1,2,3-Trichlorobenzene	181.45	1.38E+03	3.95E-02	8.38E-06	1.80E+01	1.25E-03	491.50	762.50	12611.53	NDEP (2023)
1,2,4-Trichlorobenzene	181.45	1.36E+03	3.96E-02	8.40E-06	4.90E+01	1.42E-03	486.50	725.00	10471.00	NDEP (2023)
1,1,1-Trichloroethane	133.41	4.39E+01	6.48E-02	9.60E-06	1.29E+03	1.72E-02	347.00	545.00	7136.00	NDEP (2023)
1,1,2-Trichloroethane	133.41	6.07E+01	6.69E-02	1.00E-05	4.59E+03	8.24E-04	386.80	602.00	8322.00	NDEP (2023)
Trichloroethene	131.39	6.07E+01	6.87E-02	1.02E-05	1.28E+03	9.85E-03	360.20	544.20	7505.00	NDEP (2023)
Trichlorofluoromethane	137.37	4.39E+01	6.54E-02	1.00E-05	1.10E+03	9.70E-02	296.70	471.00	5998.90	NDEP (2023)
1,2,3-Trichloropropane	147.43	1.16E+02	5.75E-02	9.24E-06	1.75E+03	3.43E-04	430.00	652.00	9171.00	NDEP (2023)
1,1,2-Trichloro-1,2,2-trifluoroethane	187.38	1.97E+02	3.76E-02	8.59E-06	1.70E+02	5.26E-01	320.70	487.30	6462.56	NDEP (2023)
1,2,4-Trimethylbenzene	120.20	6.14E+02	6.07E-02	7.92E-06	5.70E+01	6.16E-03	442.30	649.17	9368.80	NDEP (2023)
1,3,5-Trimethylbenzene	120.20	6.02E+02	6.02E-02	7.84E-06	4.82E+01	8.77E-03	437.70	637.25	9321.00	NDEP (2023)
Vinyl acetate	86.09	5.58E+00	8.49E-02	1.00E-05	2.00E+04	5.11E-04	345.50	519.13	7800.00	NDEP (2023)
Vinyl chloride	62.50	2.17E+01	1.07E-01	1.20E-05	8.80E+03	2.78E-02	259.70	432.00	5250.00	NDEP (2023)
Xylenes (total)	106.17	3.83E+02	6.85E-02	8.46E-06	1.06E+02	6.63E-03	411.30	616.20	8523.00	NDEP (2023)

Notes:

-- = Not available
atm-m^3/mol = atmosphere-cubic meter per mole
cal/mol = calorie per mole
cm^3/g = cubic centimeter per gram
cm^2/s = square centimeter per second
g/mol = gram per mole
^oK = degrees Kelvin
mg/L = milligram per liter
EPISuite = Estimation Programs Interface Suite
NDEP = Nevada Division of Environmental Protection
USEPA = United States Environmental Protection Agency

[1] Volatile compounds defined by USEPA (2021) as chemicals with vapor pressure greater than 1 millimeter (mm) Hg or Henry's Law constant greater than 0.00001 atm-m^3/mole.

Sources:

NDEP. 2023. User's Guide and Background Technical Document for NDEP Basic Comparison Levels (BCLs) for Human Health for the BMI Complex and Common Areas. December 2008, Revision 16, June.
USEPA. 2012. Estimation Programs Interface Suite™ for Microsoft® Windows, v 4.11. Washington, DC, USA.
USEPA. 2023. Regional Screening Levels User's Guide. May.

TABLE 5-3. Modeling Parameters
Nevada Environmental Response Trust Site
Henderson, Nevada

Parameter	Value	Unit	Note
Source/Receptor Parameters			
Soil temperature at source	17	Celsius	Estimated average temperature (USEPA 2017a)
Commercial Indoor (slab-on-grade), Trailer, and Outdoor Scenarios			
Depth to groundwater	762	cm	Site-specific estimate (25 feet)
Soil gas sampling depths	152.4	cm	Site-specific estimates based on sampling depths (5, 15 feet)
	457.2	cm	
Commercial Basement and Construction Trench Scenarios			
Depth of basement bottom	304.8	cm	Site-specific estimate (10 feet)
Depth of construction trench	304.8	cm	Assumed (10 feet)
Depth from basement/trench bottom to groundwater	457.2	cm	Site-specific estimate (15 feet)
Distance from basement/trench to soil gas sample	152.4	cm	Estimate of distance between basement/trench bottom/walls and soil gas sample (5 feet)
Soil Parameters			
USDA soil type	Loamy Sand	--	Site-specific estimate based on soil boring logs and site measurements. See text for further discussion.
Bulk density	1.722	g/cm^3	Site-specific measurement
Total porosity	0.358	unitless	Site-specific measurement
Water content	0.148	unitless	Site-specific measurement
Parameters Used For Benzene Degradation			
Fraction organic carbon	0.006	unitless	Default value (USEPA 2002)
Minimum oxygen content for aerobic respiration	1	%	Default value (API 2012)
First order biodegradation rate for benzene	0.79	1/hour	Default value (API 2012)
Building Foundation Parameters			
Commercial Indoor (slab-on-grade) and Basement Scenarios			
Depth to bottom of foundation	20	cm	Default value for commercial slab-on-grade building (USEPA 2017b)
Foundation thickness	20	cm	Default value for commercial slab-on-grade building (USEPA 2017b)
Foundation crack ratio	0.001	unitless	Default value for commercial slab-on-grade building (USEPA 2017b)
$Q_{soil}/Q_{building}$	0.003	unitless	Default value for commercial slab-on-grade building (USEPA 2017b)
Commercial Trailer Scenarios			
Depth to bottom of foundation, dirt floor	0	cm	Site-specific estimate

TABLE 5-3. Modeling Parameters
Nevada Environmental Response Trust Site
Henderson, Nevada

Parameter	Value	Unit	Note
Foundation thickness	0	cm	Default value for dirt floor (USEPA 2017b)
Foundation crack ratio	1	unitless	Default value for dirt floor (USEPA 2017b)
Air Dispersion Parameters			
Commercial Indoor (slab-on-grade), Trailer, and Basement Scenarios			
Air exchange rate	1.5	1/hour	Default value for commercial building (USEPA 2017b)
Enclosed floor space area	1500	m^2	Default value for commercial building (USEPA 2017b)
Mixing height of building	300	cm	Default value for commercial building (USEPA 2017b)
Outdoor Air Scenarios			
Site-specific dispersion factor (Q/C)	32.29	g/m^2-s per kg/m^3	Based on the total area of 259 acres for OU-1 Operations Area
Construction Trench Scenarios			
Length of construction trench	609.6	cm	Assumed (20 feet)
Width of construction trench	152.4	cm	Assumed (5 feet)
Trench wind speed	0.41	m/s	Conservative estimate (1/10 of site-specific windspeed)
Site-specific dispersion factor (Q/C)	34.17	g/m^2-s per kg/m^3	Site-specific estimate based on box model

Notes:

-- =Not applicable
cm = centimeter
g/cm^3 = gram per cubic centimeter
g/m^2-s per kg/m^3 = (gram per square meter-second) per (kilogram per cubic meter)
m^2 = square meter
m/s = meter per second
API = American Petroleum Institute
OU = Operable unit
USDA = United States Department of Agriculture
USEPA = United States Environmental Protection Agency

Sources:

API. 2012. BIOVAPOR – A 1-D Vapor Intrusion Model with Oxygen-Limited Aerobic Biodegradation. Version 2.1. November.

USEPA. 2002. Supplemental Guidance for Developing. Soil Screening Levels for Superfund Sites. December.

USEPA. 2017a. Documentation for EPA's Implementation of the Johnson and Ettinger Model to Evaluate Site Specific Vapor Intrusion into Buildings, Version 6.0. September.

USEPA. 2017b. EPA Spreadsheet for Modeling Subsurface Vapor Intrusion. Version 6.0. September.

TABLE 5-4. Soil Properties Data for the Operations Area of OU-1
Nevada Environmental Response Trust Site
Henderson, Nevada

Sample ID [1]	Depth (ft)	Water-filled Porosity [2] (%Vb)	Dry Bulk Density [3] (g/cm^3)	Grain Density [4] (g/cm^3)	Soil Total Porosity [5] (%Vb)	Soil Type
SA56-10BSPLP	10	0.134	1.689	2.719	0.379	Loamy Sand
RSAM3-10BSPLP	10	0.145	1.593	2.674	0.404	Loamy Sand
SA166-10BSPLP	10	0.100	1.721	2.681	0.358	Loamy Sand
SA182-10BSPLP	10	0.182	1.740	2.601	0.331	Sandy Loam
RSAJ3-10BSPLP	10	0.154	1.770	2.682	0.340	Loamy Sand
RSAI7-10B	10	0.138	1.661	2.682	0.381	Sand
SA34-10BSPLP	10	0.169	1.738	2.696	0.355	Loamy Sand
SA52-15BSPLP [6]	15	0.239	1.405	2.710	0.481	Sand
RSAQ8-10BSPLP	10	0.148	1.697	2.695	0.370	Sand
RSAN8-10BSPLP	10	0.189	1.679	2.683	0.374	Loamy Sand
RSAQ4-10BSPLP	10	0.141	1.841	2.705	0.319	Sand
SA148-10BSPLP	10	0.119	1.762	2.732	0.355	Sand
SA30-9BSPLP	9	0.160	1.805	2.711	0.334	Sand
SA128-10BSPLP	10	0.156	1.654	2.654	0.377	Loamy Sand
SA102-10BSPLP	10	0.135	1.769	2.696	0.344	Sand
SA64-10BSPLP	10	0.148	1.717	2.651	0.352	Sand
Mean	9.93	0.148	1.722	2.684	0.358	Loamy Sand
Minimum	9	0.100	1.593	2.601	0.319	NA
Maximum	10	0.189	1.841	2.732	0.404	NA
Median	10	0.148	1.721	2.683	0.355	NA

Notes:

ft = feet

g/cm^3 = grams per cubic centimeter

ASTM = American Society for Testing and Materials

NA = Not applicable

OU = Operable unit

Vb = Volume-based

[1] The soil properties were reported in Northgate and Exponent (2010).

[2] As measured according to ASTM D 2216 and converted from mass-based water moisture to volumetric water content.

[3] As measured according to ASTM D 2937.

[4] As measured according to ASTM D 854.

[5] Calculated from dry bulk density and grain density.

[6] Sample not included in the evaluation because it represents wetter than average conditions in OU-1.

Source:

Northgate and Exponent. 2010. Site-Wide Soil Gas Human Health Risk Assessment, Tronox LLC, Henderson, Nevada, November 22.

TABLE 5-5. Transfer Factors for Analytes Migrating from Soil Gas to Indoor Air, Outdoor Air, and Trench Air
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	TF for Soil Gas Migrating to Indoor Air ($\mu g/m^3$ per $\mu g/m^3$)		TF for Soil Gas Migrating to Outdoor Air ($\mu g/m^3$ per $\mu g/m^3$)		TF for Soil Gas Migrating to Trench Air ($\mu g/m^3$ per $\mu g/m^3$)	TF for Soil Gas Migrating to Basement Indoor Air ($\mu g/m^3$ per $\mu g/m^3$)	TF for Soil Gas Migrating to Trailer Indoor Air ($\mu g/m^3$ per $\mu g/m^3$)	
	5 ft bgs	15 ft bgs	5 ft bgs	15 ft bgs	5 ft below or beside Trench	5 ft below or beside Basement	5 ft bgs	15 ft bgs
Acetone	2.7E-04	8.6E-05	9.2E-06	3.1E-06	5.2E-05	2.7E-04	2.5E-04	8.3E-05
Acrolein	2.7E-04	8.8E-05	2.7E-06	9.0E-07	1.5E-05	2.7E-04	2.6E-04	8.5E-05
Acrylonitrile	2.8E-04	9.0E-05	2.6E-06	8.7E-07	1.5E-05	2.8E-04	2.6E-04	8.7E-05
tert-Amyl methyl ether	1.6E-04	5.2E-05	1.1E-07	3.5E-08	6.0E-07	1.6E-04	1.5E-04	4.9E-05
Benzene	9.0E-18	3.9E-19	2.0E-21	8.9E-23	1.1E-20	9.0E-18	8.2E-18	3.7E-19
Benzyl chloride	1.6E-04	5.0E-05	5.3E-07	1.8E-07	3.0E-06	1.6E-04	1.4E-04	4.8E-05
Bromodichloromethane	1.4E-04	4.5E-05	8.3E-08	2.8E-08	4.7E-07	1.4E-04	1.3E-04	4.3E-05
Bromoform	9.3E-05	2.9E-05	2.4E-07	8.0E-08	1.4E-06	9.3E-05	8.2E-05	2.7E-05
Bromomethane	2.5E-04	7.9E-05	3.7E-08	1.2E-08	2.1E-07	2.5E-04	2.3E-04	7.6E-05
2-Butanone	2.3E-04	7.3E-05	5.1E-06	1.7E-06	2.9E-05	2.3E-04	2.1E-04	7.1E-05
tert-Butyl alcohol	2.4E-04	7.7E-05	2.3E-05	7.8E-06	1.3E-04	2.4E-04	2.2E-04	7.4E-05
n-Butylbenzene	1.3E-04	4.2E-05	1.4E-08	4.6E-09	7.8E-08	1.3E-04	1.2E-04	4.0E-05
sec-Butylbenzene	1.3E-04	4.2E-05	1.2E-08	4.0E-09	6.8E-08	1.3E-04	1.2E-04	4.0E-05
tert-Butylbenzene	1.3E-04	4.2E-05	1.6E-08	5.3E-09	9.1E-08	1.3E-04	1.2E-04	4.0E-05
Carbon disulfide	2.6E-04	8.3E-05	2.1E-08	7.0E-09	1.2E-07	2.6E-04	2.4E-04	8.0E-05
Carbon tetrachloride	1.4E-04	4.5E-05	6.2E-09	2.1E-09	3.5E-08	1.4E-04	1.3E-04	4.3E-05
3-Chloro-1-propene	2.3E-04	7.4E-05	2.5E-08	8.3E-09	1.4E-07	2.3E-04	2.1E-04	7.1E-05
Chlorobenzene	1.8E-04	5.7E-05	7.6E-08	2.5E-08	4.3E-07	1.8E-04	1.6E-04	5.5E-05
Chloroethane	2.5E-04	8.1E-05	2.6E-08	8.5E-09	1.5E-07	2.5E-04	2.4E-04	7.8E-05
Chloroform	1.9E-04	6.1E-05	6.2E-08	2.1E-08	3.5E-07	1.9E-04	1.7E-04	5.8E-05
Chloromethane	3.0E-04	9.7E-05	3.6E-08	1.2E-08	2.1E-07	3.0E-04	2.8E-04	9.4E-05
Cumene	1.5E-04	4.8E-05	2.0E-08	6.5E-09	1.1E-07	1.5E-04	1.4E-04	4.6E-05
Cyclohexane	2.0E-04	6.3E-05	1.6E-09	5.4E-10	9.1E-09	2.0E-04	1.8E-04	6.0E-05
p-Cymene	1.9E-04	5.9E-05	1.3E-10	4.5E-11	7.6E-10	1.9E-04	1.7E-04	5.7E-05
1,2-Dibromo-3-chloropropane	8.5E-05	2.6E-05	8.3E-07	2.8E-07	4.7E-06	8.5E-05	7.5E-05	2.5E-05
Dibromochloromethane	9.5E-05	2.9E-05	1.3E-07	4.4E-08	7.5E-07	9.5E-05	8.3E-05	2.8E-05
1,2-Dibromoethane	1.1E-04	3.4E-05	2.2E-07	7.4E-08	1.3E-06	1.1E-04	9.8E-05	3.3E-05
1,2-Dichlorobenzene	1.4E-04	4.5E-05	1.0E-07	3.5E-08	6.0E-07	1.4E-04	1.3E-04	4.2E-05
1,3-Dichlorobenzene	1.7E-04	5.5E-05	7.8E-08	2.6E-08	4.4E-07	1.7E-04	1.6E-04	5.2E-05

TABLE 5-5. Transfer Factors for Analytes Migrating from Soil Gas to Indoor Air, Outdoor Air, and Trench Air
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	TF for Soil Gas Migrating to Indoor Air ($\mu g/m^3$ per $\mu g/m^3$)		TF for Soil Gas Migrating to Outdoor Air ($\mu g/m^3$ per $\mu g/m^3$)		TF for Soil Gas Migrating to Trench Air ($\mu g/m^3$ per $\mu g/m^3$)	TF for Soil Gas Migrating to Basement Indoor Air ($\mu g/m^3$ per $\mu g/m^3$)	TF for Soil Gas Migrating to Trailer Indoor Air ($\mu g/m^3$ per $\mu g/m^3$)	
	5 ft bgs	15 ft bgs	5 ft bgs	15 ft bgs	5 ft below or beside Trench	5 ft below or beside Basement	5 ft bgs	15 ft bgs
1,4-Dichlorobenzene	1.4E-04	4.4E-05	8.0E-08	2.7E-08	4.6E-07	1.4E-04	1.2E-04	4.2E-05
Dichlorodifluoromethane	1.9E-04	6.0E-05	6.8E-10	2.3E-10	3.8E-09	1.9E-04	1.7E-04	5.7E-05
1,1-Dichloroethane	2.1E-04	6.6E-05	4.4E-08	1.5E-08	2.5E-07	2.1E-04	1.9E-04	6.3E-05
1,2-Dichloroethane	2.1E-04	6.8E-05	2.3E-07	7.5E-08	1.3E-06	2.1E-04	1.9E-04	6.5E-05
1,1-Dichloroethene	2.1E-04	6.8E-05	9.3E-09	3.1E-09	5.3E-08	2.1E-04	2.0E-04	6.5E-05
cis-1,2-Dichloroethene	2.2E-04	7.0E-05	6.4E-08	2.1E-08	3.7E-07	2.2E-04	2.0E-04	6.7E-05
trans-1,2-Dichloroethene	2.2E-04	6.9E-05	2.7E-08	9.1E-09	1.5E-07	2.2E-04	2.0E-04	6.6E-05
1,2-Dichloropropane	1.8E-04	5.8E-05	8.1E-08	2.7E-08	4.6E-07	1.8E-04	1.7E-04	5.5E-05
1,3-Dichloropropene	1.9E-04	6.0E-05	6.9E-08	2.3E-08	3.9E-07	1.9E-04	1.7E-04	5.8E-05
Diisopropyl ether	1.6E-04	5.2E-05	5.3E-08	1.8E-08	3.0E-07	1.6E-04	1.5E-04	4.9E-05
1,4-Dioxane	2.7E-04	8.8E-05	7.8E-05	2.6E-05	4.4E-04	2.7E-04	2.6E-04	8.5E-05
Ethanol	3.4E-04	1.1E-04	6.2E-05	2.1E-05	3.5E-04	3.4E-04	3.3E-04	1.1E-04
Ethyl tert-butyl ether	1.6E-04	5.2E-05	8.6E-08	2.9E-08	4.9E-07	1.6E-04	1.5E-04	4.9E-05
Ethyl acetate	2.1E-04	6.6E-05	1.9E-06	6.4E-07	1.1E-05	2.1E-04	1.9E-04	6.3E-05
Ethylbenzene	1.7E-04	5.4E-05	2.9E-08	9.7E-09	1.6E-07	1.7E-04	1.6E-04	5.2E-05
4-Ethyltoluene	1.9E-04	5.9E-05	1.3E-10	4.5E-11	7.6E-10	1.9E-04	1.7E-04	5.7E-05
Freon 114	9.7E-05	3.0E-05	2.9E-11	9.6E-12	1.6E-10	9.7E-05	8.5E-05	2.8E-05
n-Heptane	1.6E-04	4.9E-05	6.6E-11	2.2E-11	3.7E-10	1.6E-04	1.4E-04	4.7E-05
Hexachlorobutadiene	7.0E-05	2.1E-05	9.8E-09	3.3E-09	5.6E-08	7.0E-05	6.1E-05	2.0E-05
n-Hexane	1.8E-04	5.8E-05	1.2E-10	4.0E-11	6.9E-10	1.8E-04	1.7E-04	5.5E-05
2-Hexanone	1.8E-04	5.7E-05	2.6E-06	8.6E-07	1.5E-05	1.8E-04	1.6E-04	5.4E-05
alpha-Methyl styrene	1.6E-04	5.0E-05	9.8E-08	3.3E-08	5.6E-07	1.6E-04	1.4E-04	4.8E-05
Methyl tert-butyl ether	1.9E-04	6.0E-05	3.8E-07	1.3E-07	2.1E-06	1.9E-04	1.7E-04	5.7E-05
4-Methyl-2-pentanone	1.8E-04	5.6E-05	1.7E-06	5.6E-07	9.5E-06	1.8E-04	1.6E-04	5.3E-05
Methylene chloride	2.4E-04	7.9E-05	8.9E-08	3.0E-08	5.0E-07	2.4E-04	2.3E-04	7.6E-05
Methylmethacrylate	1.9E-04	6.0E-05	8.0E-07	2.7E-07	4.5E-06	1.9E-04	1.7E-04	5.7E-05
Naphthalene	1.5E-04	4.8E-05	5.2E-07	1.7E-07	3.0E-06	1.5E-04	1.4E-04	4.6E-05
n-Octane	1.6E-04	4.9E-05	4.1E-11	1.4E-11	2.3E-10	1.6E-04	1.4E-04	4.7E-05

TABLE 5-5. Transfer Factors for Analytes Migrating from Soil Gas to Indoor Air, Outdoor Air, and Trench Air
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	TF for Soil Gas Migrating to Indoor Air ($\mu g/m^3$ per $\mu g/m^3$)		TF for Soil Gas Migrating to Outdoor Air ($\mu g/m^3$ per $\mu g/m^3$)		TF for Soil Gas Migrating to Trench Air ($\mu g/m^3$ per $\mu g/m^3$)	TF for Soil Gas Migrating to Basement Indoor Air ($\mu g/m^3$ per $\mu g/m^3$)	TF for Soil Gas Migrating to Trailer Indoor Air ($\mu g/m^3$ per $\mu g/m^3$)	
	5 ft bgs	15 ft bgs	5 ft bgs	15 ft bgs	5 ft below or beside Trench	5 ft below or beside Basement	5 ft bgs	15 ft bgs
n-Propylbenzene	1.5E-04	4.8E-05	2.0E-08	6.7E-09	1.1E-07	1.5E-04	1.4E-04	4.5E-05
Styrene	1.8E-04	5.6E-05	8.8E-08	2.9E-08	5.0E-07	1.8E-04	1.6E-04	5.4E-05
1,1,1,2-Tetrachloroethane	1.2E-04	3.8E-05	6.8E-08	2.3E-08	3.9E-07	1.2E-04	1.1E-04	3.6E-05
1,1,2,2-Tetrachloroethane	1.3E-04	3.9E-05	4.6E-07	1.5E-07	2.6E-06	1.3E-04	1.1E-04	3.7E-05
Tetrachloroethene	1.3E-04	4.0E-05	9.3E-09	3.1E-09	5.3E-08	1.3E-04	1.1E-04	3.8E-05
Tetrahydrofuran	2.5E-04	7.9E-05	4.3E-06	1.4E-06	2.4E-05	2.5E-04	2.3E-04	7.6E-05
Toluene	1.9E-04	6.1E-05	3.7E-08	1.2E-08	2.1E-07	1.9E-04	1.8E-04	5.9E-05
1,2,4-Trichlorobenzene	1.0E-04	3.2E-05	1.1E-07	3.6E-08	6.1E-07	1.0E-04	9.0E-05	3.0E-05
1,1,1-Trichloroethane	1.6E-04	5.1E-05	1.1E-08	3.8E-09	6.4E-08	1.6E-04	1.5E-04	4.9E-05
1,1,2-Trichloroethane	1.7E-04	5.3E-05	2.6E-07	8.8E-08	1.5E-06	1.7E-04	1.5E-04	5.1E-05
Trichloroethene	1.7E-04	5.4E-05	2.2E-08	7.2E-09	1.2E-07	1.7E-04	1.6E-04	5.2E-05
Trichlorofluoromethane	1.6E-04	5.2E-05	1.9E-09	6.2E-10	1.1E-08	1.6E-04	1.5E-04	4.9E-05
1,2,3-Trichloropropane	1.5E-04	4.6E-05	5.9E-07	2.0E-07	3.3E-06	1.5E-04	1.3E-04	4.4E-05
1,1,2-Trichloro-1,2,2-trifluoroethane	9.7E-05	3.0E-05	2.1E-10	6.8E-11	1.2E-09	9.7E-05	8.5E-05	2.8E-05
1,2,4-Trimethylbenzene	1.5E-04	4.8E-05	3.5E-08	1.2E-08	2.0E-07	1.5E-04	1.4E-04	4.6E-05
1,3,5-Trimethylbenzene	1.5E-04	4.8E-05	2.5E-08	8.2E-09	1.4E-07	1.5E-04	1.4E-04	4.6E-05
Vinyl acetate	2.1E-04	6.7E-05	5.2E-07	1.7E-07	3.0E-06	2.1E-04	1.9E-04	6.4E-05
Vinyl chloride	2.6E-04	8.4E-05	1.0E-08	3.4E-09	5.7E-08	2.6E-04	2.4E-04	8.1E-05
Xylenes (total)	1.7E-04	5.4E-05	3.5E-08	1.2E-08	2.0E-07	1.7E-04	1.6E-04	5.2E-05

Notes:

-- = Not calculated

bgs = below ground surface

ft = feet

$\mu g/m^3$ = microgram per cubic meter

TF = transfer factor, equivalent to attenuation factor for soil gas

TABLE 5-6.Transfer Factors for Analytes Migrating from Shallow Groundwater to Indoor Air, Outdoor Air, and Trench Air
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	TF for Vapors from Groundwater Migrating to Indoor Air ($\mu g/m^3$ per $\mu g/L$)	TF for Vapors from Groundwater Migrating to Outdoor Air ($\mu g/m^3$ per $\mu g/L$)	TF for Vapors from Groundwater Migrating to Trench Air ($\mu g/m^3$ per $\mu g/L$)	TF for Vapors from Groundwater Migrating to Basement Indoor Air ($\mu g/m^3$ per $\mu g/L$)	TF for Vapors from Groundwater Migrating to Trailer Indoor Air ($\mu g/m^3$ per $\mu g/L$)
Acenaphthene	7.9E-05	2.9E-06	2.6E-05	1.2E-04	7.6E-05
Acenaphthylene	1.0E-04	3.7E-06	3.2E-05	1.5E-04	9.7E-05
Anthracene	1.9E-05	7.2E-07	6.7E-06	3.2E-05	1.8E-05
Benzene	2.1E-17	7.8E-19	7.1E-18	3.4E-17	2.0E-17
Benzo(a)anthracene	3.3E-06	1.2E-07	1.2E-06	5.7E-06	3.2E-06
Bis(2-chloroethyl) ether	1.1E-05	4.3E-07	4.0E-06	1.9E-05	1.1E-05
Bis(2-chloro-1-methylethyl) ether	3.3E-05	1.2E-06	1.1E-05	5.4E-05	3.2E-05
Bromobenzene	1.0E-03	3.8E-05	3.0E-04	1.4E-03	9.9E-04
Bromochloromethane	1.1E-03	4.1E-05	3.3E-04	1.5E-03	1.1E-03
Bromodichloromethane	1.1E-03	4.1E-05	3.3E-04	1.5E-03	1.1E-03
Bromoform	1.9E-04	6.9E-06	5.9E-05	2.8E-04	1.8E-04
Bromomethane	7.4E-03	2.8E-04	2.2E-03	1.0E-02	7.2E-03
4-Bromophenyl-phenyl ether	3.5E-05	1.3E-06	1.2E-05	5.7E-05	3.4E-05
2-Butanone	6.6E-05	2.5E-06	2.2E-05	1.0E-04	6.4E-05
n-Butylbenzene	5.6E-03	2.1E-04	1.6E-03	7.6E-03	5.4E-03
sec-Butylbenzene	6.3E-03	2.4E-04	1.8E-03	8.6E-03	6.1E-03
tert-Butylbenzene	4.8E-03	1.8E-04	1.4E-03	6.6E-03	4.6E-03
Carbon tetrachloride	1.4E-02	5.4E-04	4.1E-03	2.0E-02	1.4E-02
Chlorobenzene	1.9E-03	7.2E-05	5.6E-04	2.6E-03	1.9E-03
Chloroethane	1.1E-02	4.3E-04	3.3E-03	1.6E-02	1.1E-02
Chloroform	2.7E-03	1.0E-04	7.7E-04	3.7E-03	2.6E-03
Chloromethane	1.1E-02	4.3E-04	3.3E-03	1.6E-02	1.1E-02
2-Chloronaphthalene	1.2E-04	4.6E-06	3.9E-05	1.9E-04	1.2E-04
2-Chlorophenol	9.9E-06	3.7E-07	3.5E-06	1.7E-05	9.6E-06
4-Chlorophenyl-phenyl ether	6.1E-05	2.3E-06	2.0E-05	9.7E-05	5.9E-05
2-Chlorotoluene	1.7E-03	6.5E-05	5.0E-04	2.4E-03	1.7E-03
4-Chlorotoluene	2.1E-03	7.8E-05	6.0E-04	2.8E-03	2.0E-03
Cumene	5.1E-03	1.9E-04	1.5E-03	6.9E-03	4.9E-03
p-Cymene	1.1E+00	4.3E-02	3.3E-01	1.5E+00	1.1E+00
Dibenzofuran	5.8E-06	2.2E-07	2.1E-06	9.9E-06	5.6E-06
1,2-Dibromo-3-chloropropane	5.1E-05	1.9E-06	1.7E-05	8.2E-05	4.9E-05
Dibromochloromethane	3.3E-04	1.2E-05	1.0E-04	4.8E-04	3.1E-04

TABLE 5-6.Transfer Factors for Analytes Migrating from Shallow Groundwater to Indoor Air, Outdoor Air, and Trench Air
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	TF for Vapors from Groundwater Migrating to Indoor Air ($\mu g/m^3$ per $\mu g/L$)	TF for Vapors from Groundwater Migrating to Outdoor Air ($\mu g/m^3$ per $\mu g/L$)	TF for Vapors from Groundwater Migrating to Trench Air ($\mu g/m^3$ per $\mu g/L$)	TF for Vapors from Groundwater Migrating to Basement Indoor Air ($\mu g/m^3$ per $\mu g/L$)	TF for Vapors from Groundwater Migrating to Trailer Indoor Air ($\mu g/m^3$ per $\mu g/L$)
1,2-Dibromoethane	2.7E-04	1.0E-05	8.5E-05	4.0E-04	2.6E-04
Dibromomethane	4.5E-04	1.7E-05	1.4E-04	6.5E-04	4.4E-04
1,2-Dichlorobenzene	8.7E-04	3.3E-05	2.6E-04	1.2E-03	8.4E-04
1,3-Dichlorobenzene	1.7E-03	6.4E-05	5.0E-04	2.4E-03	1.7E-03
1,4-Dichlorobenzene	1.1E-03	4.0E-05	3.2E-04	1.5E-03	1.0E-03
Dichlorodifluoromethane	2.3E-01	8.7E-03	6.7E-02	3.1E-01	2.2E-01
1,1-Dichloroethane	4.4E-03	1.6E-04	1.3E-03	6.0E-03	4.3E-03
1,2-Dichloroethane	9.5E-04	3.6E-05	2.8E-04	1.3E-03	9.2E-04
1,1-Dichloroethene	2.2E-02	8.2E-04	6.3E-03	3.0E-02	2.1E-02
cis-1,2-Dichloroethene	3.4E-03	1.3E-04	9.8E-04	4.6E-03	3.3E-03
trans-1,2-Dichloroethene	7.7E-03	2.9E-04	2.2E-03	1.1E-02	7.5E-03
1,2-Dichloropropane	1.9E-03	7.0E-05	5.5E-04	2.6E-03	1.8E-03
1,3-Dichloropropane	6.6E-04	2.5E-05	2.0E-04	9.3E-04	6.4E-04
2,2-Dichloropropane	1.5E-02	5.6E-04	4.3E-03	2.0E-02	1.5E-02
1,1-Dichloropropene	4.8E-02	1.8E-03	1.4E-02	6.6E-02	4.7E-02
1,3-Dichloropropene	2.4E-03	8.9E-05	6.9E-04	3.3E-03	2.3E-03
1,4-Dioxane	6.8E-06	2.6E-07	2.4E-06	1.2E-05	6.6E-06
Ethyl tert-butyl ether	1.4E-03	5.3E-05	4.1E-04	1.9E-03	1.4E-03
Ethylbenzene	4.4E-03	1.7E-04	1.3E-03	6.1E-03	4.3E-03
Fluorene	3.9E-05	1.4E-06	1.3E-05	6.3E-05	3.7E-05
Formaldehyde	3.2E-06	1.3E-07	1.2E-06	5.1E-06	3.4E-06
Hexachlorobenzene	3.6E-04	1.3E-05	1.1E-04	5.1E-04	3.4E-04
Hexachlorobutadiene	2.0E-03	7.6E-05	5.9E-04	2.8E-03	2.0E-03
Hexachlorocyclopentadiene	8.0E-04	3.0E-05	2.4E-04	1.1E-03	7.8E-04
Hexachloroethane	9.0E-04	3.3E-05	2.6E-04	1.3E-03	8.7E-04
Methylene chloride	3.1E-03	1.2E-04	9.1E-04	4.3E-03	3.0E-03
1-Methylnaphthalene	1.9E-04	7.1E-06	5.9E-05	2.8E-04	1.8E-04
2-Methylnaphthalene	2.0E-04	7.5E-06	6.2E-05	3.0E-04	1.9E-04
Naphthalene	2.3E-04	8.5E-06	7.1E-05	3.4E-04	2.2E-04
Nitrobenzene	1.9E-05	6.9E-07	6.5E-06	3.1E-05	1.8E-05
2-Nitrophenol	1.6E-05	5.8E-07	5.5E-06	2.6E-05	1.5E-05
Octachlorostyrene	1.1E-04	4.1E-06	3.6E-05	1.7E-04	1.1E-04

TABLE 5-6.Transfer Factors for Analytes Migrating from Shallow Groundwater to Indoor Air, Outdoor Air, and Trench Air
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	TF for Vapors from Groundwater Migrating to Indoor Air ($\mu g/m^3$ per $\mu g/L$)	TF for Vapors from Groundwater Migrating to Outdoor Air ($\mu g/m^3$ per $\mu g/L$)	TF for Vapors from Groundwater Migrating to Trench Air ($\mu g/m^3$ per $\mu g/L$)	TF for Vapors from Groundwater Migrating to Basement Indoor Air ($\mu g/m^3$ per $\mu g/L$)	TF for Vapors from Groundwater Migrating to Trailer Indoor Air ($\mu g/m^3$ per $\mu g/L$)
Phenanthrene	1.9E-05	7.2E-07	6.8E-06	3.2E-05	1.9E-05
n-Propylbenzene	4.9E-03	1.8E-04	1.4E-03	6.7E-03	4.7E-03
Pyrene	3.6E-06	1.3E-07	1.3E-06	6.2E-06	3.5E-06
Styrene	1.6E-03	6.1E-05	4.7E-04	2.2E-03	1.6E-03
1,1,1,2-Tetrachloroethane	9.8E-04	3.7E-05	2.9E-04	1.4E-03	9.5E-04
1,1,2,2-Tetrachloroethane	1.8E-04	6.7E-06	5.7E-05	2.7E-04	1.7E-04
Tetrachloroethene	7.5E-03	2.8E-04	2.2E-03	1.0E-02	7.3E-03
Toluene	4.4E-03	1.7E-04	1.3E-03	6.1E-03	4.3E-03
1,2,3-Trichlorobenzene	3.6E-04	1.3E-05	1.1E-04	5.1E-04	3.5E-04
1,2,4-Trichlorobenzene	4.4E-04	1.7E-05	1.3E-04	6.3E-04	4.3E-04
1,1,1-Trichloroethane	1.0E-02	3.8E-04	2.9E-03	1.4E-02	9.8E-03
1,1,2-Trichloroethane	5.1E-04	1.9E-05	1.5E-04	7.3E-04	5.0E-04
Trichloroethene	6.0E-03	2.2E-04	1.7E-03	8.2E-03	5.8E-03
Trichlorofluoromethane	6.2E-02	2.3E-03	1.8E-02	8.5E-02	6.0E-02
1,2,3-Trichloropropane	1.9E-04	7.1E-06	6.0E-05	2.9E-04	1.8E-04
1,2,4-Trimethylbenzene	2.9E-03	1.1E-04	8.4E-04	4.0E-03	2.8E-03
1,3,5-Trimethylbenzene	4.0E-03	1.5E-04	1.2E-03	5.5E-03	3.9E-03
Vinyl chloride	3.1E-02	1.2E-03	8.9E-03	4.2E-02	3.0E-02
Xylenes (total)	3.7E-03	1.4E-04	1.1E-03	5.1E-03	3.6E-03

Notes:
-- = Not calculated
µg/L = microgram per liter
$\mu g/m^3$ = microgram per cubic meter
TF = Transfer factor

TABLE 5-7. Exposure Assumptions
Nevada Environmental Response Trust Site
Henderson, Nevada

Exposure Factors	Units	Symbol	Indoor Commercial/ Industrial Worker		Outdoor Commercial/ Industrial Worker		Construction Worker	
			Value	Source	Value	Source	Value	Source
Population-Specific Exposure Assumptions								
Exposure Time	hours/day	ET	8	NDEP 2023	8	NDEP 2023	4	VDEQ 2019
Exposure Frequency	days/year	EF	250	NDEP 2023	225	NDEP 2023	30	[1]
Exposure Duration	years	ED	25	NDEP 2023	25	NDEP 2023	1	USEPA 2023
Averaging Time for Carcinogens	days	AT_c	25,550	NDEP 2023	25,550	NDEP 2023	25,550	USEPA 2023
Averaging Time for Noncarcinogens	days	AT_{nc}	9,125	NDEP 2023	9,125	NDEP 2023	365	USEPA 2023
Inhalation of Vapor Migrating from Soil Gas or Groundwater to Indoor, Outdoor, or Trench Air								
Conversion Factor	hour/day	CF	24	--	24	--	24	--
Intake Factor for Vapor Inhalation, cancer	unitless	$IF_{vapor.inh\_c}$	8.2E-02	USEPA 2009	7.3E-02	USEPA 2009	2.0E-04	USEPA 2023
Intake Factor for Vapor Inhalation, noncancer	unitless	$IF_{vapor.inh\_nc}$	2.3E-01	USEPA 2009	2.1E-01	USEPA 2009	1.4E-02	USEPA 2023

Notes:

-- = Not applicable
NDEP = Nevada Division of Environmental Protection
USEPA = United States Environmental Protection Agency
VDEQ = Virginia Department of Environmental Quality

[1] Recommended exposure frequency in NDEP's January 12, 2017 comment letter (NDEP 2017).

Sources:

NDEP. 2017. Response to: Soil Gas Investigation and Health Risk Assessment for Parcels C, D, F, G, and H, Revision 1. January 12.
NDEP. 2023. User's Guide and Background Technical Document for the NDEP Basic Comparison Levels (BCLs) for Human Health for the BMI Complex and Common Areas, December 2008, Revision 16, June.
VDEQ. 2019. Virginia Unified Risk Assessment Model - VURAM User's Guide. July.
USEPA. 2009. Risk Assessment Guidance for Superfund. Vol. 1: Part F, Supplemental Guidance for Inhalation Risk Assessment. Final. January.
USEPA. 2023. Regional Screening Levels User's Guide. May.

TABLE 5-8. Chronic and Subchronic Inhalation Toxicity Criteria for Soil Gas and Shallow Groundwater Analytes
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	Inhalation Unit Risk ($\mu g/m^3)^{-1}$		USEPA Weight-of-Evidence Carcinogen Classification		Inhalation Chronic RfC ($\mu g/m^3$)		Inhalation Subchronic RfC ($\mu g/m^3$)	
Acenaphthene	--	--	D	USEPA 2018	3.0	IRIS [1]	3.0	IRIS [1,2]
Acenaphthylene	--	--	D	IRIS	3.0	IRIS [1]	3.0	IRIS [1,2]
Acetone	--	--	D	IRIS	31,000	NDEP	31,000	NDEP [2]
Acrolein	--	--	D	IRIS	0.020	IRIS	0.092	ATSDR
Acrylonitrile	0.000068	IRIS	B1	IRIS	2.0	IRIS	2.0	IRIS [2]
tert-Amyl methyl ether	--	--	--	--	3,000	IRIS [3]	3,000	IRIS [2,3]
Anthracene	--	--	D	IRIS	3.0	IRIS [1]	3.0	IRIS [1,2]
Benzene	0.0000078	IRIS	A	IRIS	30	IRIS	80	PPRTV
Benzo(a)anthracene	0.000060	IRIS	B2	IRIS	--	--	--	--
Benzyl chloride	0.000049	Cal/EPA	B2	IRIS	1.0	PPRTV	4.0	PPRTV
Bis(2-chloroethyl) ether	0.00033	IRIS	B2	IRIS	--	--	120	ATSDR
Bis(2-chloro-1-methylethyl) ether	--	--	--	--	--	--	--	--
Bromobenzene	--	--	D	IRIS	60	IRIS	200	IRIS
Bromochloromethane	--	--	D	IRIS	40	PPRTV Appendix	100	PPRTV
Bromodichloromethane	0.000037	Cal/EPA	B2	IRIS	600	IRIS [4]	20	PPRTV
Bromoform	0.0000011	IRIS	B2	IRIS	--	--	--	--
Bromomethane	--	--	D	IRIS	5.0	IRIS	100	PPRTV
4-Bromophenyl-phenyl ether	--	--	D	IRIS	--	--	--	--
2-Butanone	--	--	D	IRIS	5,000	IRIS	1,000	HEAST
tert-Butyl alcohol	--	--	--	--	5,000	IRIS	5,000	IRIS [2]
n-Butylbenzene	--	--	--	--	400	IRIS [6]	90	HEAST [6]
sec-Butylbenzene	--	--	--	--	400	IRIS [6]	90	HEAST [6]
tert-Butylbenzene	--	--	--	--	400	IRIS [6]	90	HEAST [6]
Carbon disulfide	--	--	--	--	700	IRIS	700	HEAST
Carbon tetrachloride	0.0000060	IRIS	B2	IRIS	100	IRIS	190	ATSDR
3-Chloro-1-propene	0.0000060	Cal/EPA	C	IRIS	1.0	IRIS	10	HEAST
Chlorobenzene	--	--	D	IRIS	50	PPRTV	500	PPRTV
Chloroethane	--	--	B2	PPRTV	10,000	IRIS	4,000	PPRTV
Chloroform	0.000023	IRIS	B2	IRIS	98	ATSDR	240	ATSDR
Chloromethane	--	--	D	IRIS	90	IRIS	3,000	PPRTV
2-Chloronaphthalene	--	--	--	--	1.0	RIVM	1.0	RIVM [2]
2-Chlorophenol	--	--	D	PPRTV	50	PPRTV [7]	500	PPRTV [7]
4-Chlorophenyl-phenyl ether	--	--	--	--	--	--	--	--
2-Chlorotoluene	--	--	D	PPRTV	50	PPRTV [7]	800	PPRTV Appendix
4-Chlorotoluene	--	--	D	PPRTV	50	PPRTV [7]	500	PPRTV [7]
Cumene	--	--	D	IRIS	400	IRIS	90	HEAST
Cyclohexane	--	--	D	IRIS	6,000	IRIS	18,000	PPRTV
p-Cymene	--	--	--	--	400	IRIS [6]	90	HEAST [6]
Dibenzofuran	--	--	D	IRIS	--	--	--	--
1,2-Dibromo-3-chloropropane	0.0060	PPRTV	B2	PPRTV	0.20	IRIS	2.0	PPRTV
Dibromochloromethane	--	--	C	IRIS	--	--	--	--
1,2-Dibromoethane	0.00060	IRIS	B2	IRIS	9.0	IRIS	2.0	HEAST
Dibromomethane	--	--	D	PPRTV	4.0	PPRTV Appendix	40	PPRTV Appendix
1,2-Dichlorobenzene	--	--	D	IRIS	200	HEAST	2,000	HEAST
1,3-Dichlorobenzene	--	--	D	IRIS	200	HEAST [8]	2,000	HEAST [8]
1,4-Dichlorobenzene	0.000011	Cal/EPA	C	USEPA 2018	800	IRIS	1,200	ATSDR
Dichlorodifluoromethane	--	--	D	PPRTV	100	PPRTV Appendix	1,000	PPRTV
1,1-Dichloroethane	0.0000016	Cal/EPA	C	IRIS	--	--	--	--
1,2-Dichloroethane	0.000026	IRIS	B2	IRIS	7.0	PPRTV	70	PPRTV
1,1-Dichloroethene	--	--	C	IRIS	200	IRIS	4.0	ATSDR
cis-1,2-Dichloroethene	--	--	D	IRIS	40	PPRTV Appendix	400	PPRTV Appendix
trans-1,2-Dichloroethene	--	--	D	IRIS	40	PPRTV Appendix	790	ATSDR
1,2-Dichloropropane	0.0000037	PPRTV	B2	USEPA 2018	4.0	IRIS	9.2	ATSDR
1,3-Dichloropropane	--	--	--	--	4.0	IRIS [9]	9.2	ATSDR [9]

TABLE 5-8. Chronic and Subchronic Inhalation Toxicity Criteria for Soil Gas and Shallow Groundwater Analytes
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	Inhalation Unit Risk ($\mu g/m^3)^{-1}$		USEPA Weight-of-Evidence Carcinogen Classification		Inhalation Chronic RfC ($\mu g/m^3$)		Inhalation Subchronic RfC ($\mu g/m^3$)	
2,2-Dichloropropane	--	--	--	--	4.0	IRIS [9]	9.2	ATSDR [9]
1,1-Dichloropropene	--	--	--	--	20	IRIS [10]	36	ATSDR [10]
1,3-Dichloropropene	0.0000040	IRIS	B2	IRIS	20	IRIS	36	ATSDR
Diisopropyl ether	--	--	--	--	700	PPRTV	700	PPRTV
1,4-Dioxane	0.0000050	IRIS	B2	IRIS	30	IRIS	720	ATSDR
Ethanol	--	--	--	--	100,000	NDEP	100,000	NDEP [2]
Ethyl tert-butyl ether	0.000000080	IRIS	--	--	40,000	IRIS	40,000	IRIS [2]
Ethyl acetate	--	--	D	PPRTV	70	PPRTV	700	PPRTV
Ethylbenzene	0.0000025	Cal/EPA	D	IRIS	1,000	IRIS	9,000	PPRTV
4-Ethyltoluene	--	--	--	--	400	IRIS [6]	90	HEAST [6]
Fluorene	--	--	D	IRIS	3.0	IRIS [1]	3.0	IRIS [1,2]
Formaldehyde	0.000013	IRIS	B1	IRIS	9.8	ATSDR	37	ATSDR
Freon 114	--	--	--	--	5,000	PPRTV [11]	50,000	PPRTV [11]
n-Heptane	--	--	D	IRIS	400	PPRTV	4,000	PPRTV
Hexachlorobenzene	0.00046	IRIS	B2	IRIS	--	--	--	--
Hexachlorobutadiene	0.000022	IRIS	C	IRIS	--	--	--	--
Hexachlorocyclopentadiene	--	--	E	IRIS	0.20	IRIS	110	ATSDR
Hexachloroethane	0.000011	Cal/EPA	B2	IRIS	30	IRIS	58,100	ATSDR
n-Hexane	--	--	D	IRIS	700	IRIS	2,000	PPRTV
2-Hexanone	--	--	D	IRIS	30	IRIS	30	IRIS [2]
alpha-Methyl styrene	--	--	--	--	1,000	IRIS [12]	3,000	HEAST [12]
Methyl tert-butyl ether	0.00000026	Cal/EPA	--	--	3,000	IRIS	3,000	IRIS [2]
4-Methyl-2-pentanone	--	--	D	IRIS	3,000	IRIS	800	HEAST
Methylene chloride	0.000000010	IRIS	B2	IRIS	600	IRIS	1,040	ATSDR
Methylmethacrylate	--	--	E	IRIS	700	IRIS	700	IRIS [2]
1-Methylnaphthalene	--	--	--	--	3.0	IRIS [1]	3.0	IRIS [1,2]
2-Methylnaphthalene	--	--	D	IRIS	3.0	IRIS [1]	3.0	IRIS [1,2]
Naphthalene	0.000034	Cal/EPA	C	IRIS	3.0	IRIS	3.0	IRIS [2]
Nitrobenzene	0.000040	IRIS	B2	IRIS	9.0	IRIS	20	HEAST
2-Nitrophenol	--	--	D	PPRTV	--	--	0.50	PPRTV
Octachlorostyrene	--	--	--	--	--	--	--	--
n-Octane	--	--	--	--	20	PPRTV [13]	200	PPRTV [13]
Phenanthrene	--	--	D	IRIS	3.0	IRIS [1]	3.0	IRIS [1,2]
n-Propylbenzene	--	--	D	PPRTV	1,000	PPRTV Appendix	1,000	PPRTV Appendix
Pyrene	--	--	D	IRIS	3.0	IRIS [1]	3.0	IRIS [1,2]
Styrene	--	--	--	--	1,000	IRIS	3,000	HEAST
1,1,1,2-Tetrachloroethane	0.0000074	IRIS	C	IRIS	--	--	--	--
1,1,2,2-Tetrachloroethane	0.000058	Cal/EPA	B2	IRIS	--	--	--	--
Tetrachloroethene	0.00000026	IRIS	B1	IRIS	40	IRIS	41	ATSDR
Tetrahydrofuran	--	--	C	IRIS	2,000	IRIS	2,000	IRIS [2]
Toluene	--	--	D	IRIS	5,000	IRIS	5,000	PPRTV
1,2,3-Trichlorobenzene	--	--	D	PPRTV	2.0	PPRTV [14]	20	PPRTV [14]
1,2,4-Trichlorobenzene	--	--	D	IRIS	2.0	PPRTV	20	PPRTV
1,1,1-Trichloroethane	--	--	D	IRIS	5,000	IRIS	5,000	IRIS
1,1,2-Trichloroethane	0.000016	IRIS	C	IRIS	0.20	PPRTV Appendix	11	ATSDR
Trichloroethene	0.0000041	IRIS	A	IRIS	2.0	IRIS	2.2	ATSDR
Trichlorofluoromethane	--	--	D	PPRTV	--	--	1,000	PPRTV
1,2,3-Trichloropropane	--	--	B2	IRIS	0.30	IRIS	0.30	IRIS [2]
1,1,2-Trichloro-1,2,2-trifluoroethane	--	--	D	PPRTV	5,000	PPRTV	50,000	PPRTV
1,2,4-Trimethylbenzene	--	--	D	IRIS	60	IRIS	200	IRIS
1,3,5-Trimethylbenzene	--	--	D	IRIS	60	IRIS	200	IRIS
Vinyl acetate	--	--	--	--	200	IRIS	35	ATSDR
Vinyl chloride	0.0000044	IRIS	A	IRIS	100	IRIS	100	IRIS [2]

TABLE 5-8. Chronic and Subchronic Inhalation Toxicity Criteria for Soil Gas and Shallow Groundwater Analytes
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	Inhalation Unit Risk ($\mu g/m^3)^{-1}$		USEPA Weight-of-Evidence Carcinogen Classification		Inhalation Chronic RfC ($\mu g/m^3$)		Inhalation Subchronic RfC ($\mu g/m^3$)	
Xylenes (total)	--	--	D	IRIS	100	IRIS	400	PPRTV

Notes:
-- = Not available
$\mu g/m^3$ = microgram per cubic meter
ATSDR = Agency for Toxic Substances and Disease Registry (values as cited in USEPA 2023a)
Cal/EPA = California Environmental Protection Agency (values as cited in USEPA 2023a)
HEAST = Health Effects Assessment Summary Tables (values as cited in USEPA 2023a)
IRIS = Integrated Risk Information System (USEPA 2023b)
NDEP = Nevada Division of Environmental Protection (NDEP 2023)
PPRTV = Provisional Peer Reviewed Toxicity Values for Superfund (values as cited in USEPA 2023a)
RfC = Reference concentration
RIVM = National Institute for Public Health and the Environment, the Netherlands
USEPA = United States Environmental Protection Agency

USEPA Weight-of-Evidence Carcinogen Classification:
A = Human carcinogen
B1 = Probable carcinogen, limited human evidence
B2 = Probable carcinogen, sufficient evidence in animals
C = Possible human carcinogen
D = Not classifiable
E = Evidence of noncarcinogenicity

[1] Use naphthalene as surrogate.
[2] Use chronic RfC as surrogate.
[3] Use methyl tert butyl ether as surrogate.
[4] Use dichloromethane (methylene chloride) as surrogate.
[5] Use sec-butyl alcohol as surrogate.
[6] Use cumene as surrogate.
[7] Use chlorobenzene as surrogate.
[8] Use 1,2-dichlorobenzene as surrogate.
[9] Use 1,2-dichloropropane as surrogate.
[10] Use 1,3-dichloropropene as surrogate.
[11] Use 1,1,2-trichloro-1,2,2-trifluoroethane as surrogate.
[12] Use styrene as surrogate.
[13] Use n-nonane as surrogate.
[14] Use 1,2,4-trichlorobenzene as surrogate.

Sources:
NDEP. 2023. Basic Comparison Level (BCL) Table. June.
RIVM. Toxicological Profile for Beta Chloronaphthalene (Internal Reviews). Available at:
https://tera.org/sseus/iternew/chemdetail.php?rec=CHLORONAPHTHALENE%2C+BETA&hide1=00000000000000663&term1=beta&kind1=name&orgs11=0&stype1=contains&start1=
USEPA. 2018. Prioritized Chronic Dose-Response Values for Screening Risk Assessments. June.
USEPA. 2023a. Regional Screening Levels User's Guide. May.
USEPA. 2023b. Integrated Risk Information System (IRIS). Available online at https://www.epa.gov/iris. Accessed on May 30, 2023.

TABLE 5-9. Risk-Based Target Concentrations for Soil Gas Analytes -- Indoor Commercial/Industrial Workers Exposed to Soil Gas Migrating to Indoor Air
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	5 ft bgs			15 ft bgs			5 ft below or beside Basement			5 ft bgs under Trailer			15 ft bgs under Trailer		
	$RBTC_{SG-IA-C}$ (µg/m^3)	$RBTC_{SG-IA-NC}$ (µg/m^3)	Minimum RBTC (µg/m^3)	$RBTC_{SG-IA-C}$ (µg/m^3)	$RBTC_{SG-IA-NC}$ (µg/m^3)	Minimum RBTC (µg/m^3)	$RBTC_{SG-IA-C}$ (µg/m^3)	$RBTC_{SG-IA-NC}$ (µg/m^3)	Minimum RBTC (µg/m^3)	$RBTC_{SG-IA-C}$ (µg/m^3)	$RBTC_{SG-IA-NC}$ (µg/m^3)	Minimum RBTC (µg/m^3)	$RBTC_{SG-IA-C}$ (µg/m^3)	$RBTC_{SG-IA-NC}$ (µg/m^3)	Minimum RBTC (µg/m^3)
Acetone	--	5.1E+08	5.1E+08	--	1.6E+09	1.6E+09	--	5.1E+08	5.1E+08	--	5.5E+08	5.5E+08	--	1.6E+09	1.6E+09
Acrolein	--	3.2E+02	3.2E+02	--	9.9E+02	9.9E+02	--	3.2E+02	3.2E+02	--	3.4E+02	3.4E+02	--	1.0E+03	1.0E+03
Acrylonitrile	6.5E+02	3.2E+04	6.5E+02	2.0E+03	9.8E+04	2.0E+03	6.5E+02	3.2E+04	6.5E+02	6.9E+02	3.4E+04	6.9E+02	2.1E+03	1.0E+05	2.1E+03
tert-Amyl methyl ether	--	8.0E+07	8.0E+07	--	2.5E+08	2.5E+08	--	8.0E+07	8.0E+07	--	8.9E+07	8.9E+07	--	2.7E+08	2.7E+08
Benzene	1.8E+17	1.5E+19	1.8E+17	4.1E+18	3.4E+20	4.1E+18	1.8E+17	1.5E+19	1.8E+17	1.9E+17	1.6E+19	1.9E+17	4.3E+18	3.6E+20	4.3E+18
Benzyl chloride	1.6E+03	2.7E+04	1.6E+03	5.0E+03	8.7E+04	5.0E+03	1.6E+03	2.7E+04	1.6E+03	1.7E+03	3.0E+04	1.7E+03	5.2E+03	9.1E+04	5.2E+03
Bromodichloromethane	2.3E+03	1.8E+07	2.3E+03	7.4E+03	5.9E+07	7.4E+03	2.3E+03	1.8E+07	2.3E+03	2.6E+03	2.1E+07	2.6E+03	7.8E+03	6.2E+07	7.8E+03
Bromoform	1.2E+05	--	1.2E+05	3.9E+05	--	3.9E+05	1.2E+05	--	1.2E+05	1.4E+05	--	1.4E+05	4.1E+05	--	4.1E+05
Bromomethane	--	8.9E+04	8.9E+04	--	2.8E+05	2.8E+05	--	8.9E+04	8.9E+04	--	9.6E+04	9.6E+04	--	2.9E+05	2.9E+05
2-Butanone	--	9.5E+07	9.5E+07	--	3.0E+08	3.0E+08	--	9.5E+07	9.5E+07	--	1.0E+08	1.0E+08	--	3.1E+08	3.1E+08
tert-Butyl alcohol	--	9.1E+07	9.1E+07	--	2.8E+08	2.8E+08	--	9.1E+07	9.1E+07	--	9.8E+07	9.8E+07	--	2.9E+08	2.9E+08
n-Butylbenzene	--	1.3E+07	1.3E+07	--	4.2E+07	4.2E+07	--	1.3E+07	1.3E+07	--	1.5E+07	1.5E+07	--	4.4E+07	4.4E+07
sec-Butylbenzene	--	1.3E+07	1.3E+07	--	4.2E+07	4.2E+07	--	1.3E+07	1.3E+07	--	1.5E+07	1.5E+07	--	4.4E+07	4.4E+07
tert-Butylbenzene	--	1.3E+07	1.3E+07	--	4.2E+07	4.2E+07	--	1.3E+07	1.3E+07	--	1.5E+07	1.5E+07	--	4.4E+07	4.4E+07
Carbon disulfide	--	1.2E+07	1.2E+07	--	3.7E+07	3.7E+07	--	1.2E+07	1.2E+07	--	1.3E+07	1.3E+07	--	3.8E+07	3.8E+07
Carbon tetrachloride	1.4E+04	3.0E+06	1.4E+04	4.5E+04	9.7E+06	4.5E+04	1.4E+04	3.0E+06	1.4E+04	1.6E+04	3.4E+06	1.6E+04	4.7E+04	1.0E+07	4.7E+04
3-Chloro-1-propene	8.9E+03	1.9E+04	8.9E+03	2.8E+04	5.9E+04	2.8E+04	8.9E+03	1.9E+04	8.9E+03	9.6E+03	2.1E+04	9.6E+03	2.9E+04	6.2E+04	2.9E+04
Chlorobenzene	--	1.2E+06	1.2E+06	--	3.8E+06	3.8E+06	--	1.2E+06	1.2E+06	--	1.3E+06	1.3E+06	--	4.0E+06	4.0E+06
Chloroethane	--	1.7E+08	1.7E+08	--	5.4E+08	5.4E+08	--	1.7E+08	1.7E+08	--	1.9E+08	1.9E+08	--	5.6E+08	5.6E+08
Chloroform	2.8E+03	2.2E+06	2.8E+03	8.8E+03	7.1E+06	8.8E+03	2.8E+03	2.2E+06	2.8E+03	3.1E+03	2.5E+06	3.1E+03	9.2E+03	7.4E+06	9.2E+03
Chloromethane	--	1.3E+06	1.3E+06	--	4.1E+06	4.1E+06	--	1.3E+06	1.3E+06	--	1.4E+06	1.4E+06	--	4.2E+06	4.2E+06
Cumene	--	1.1E+07	1.1E+07	--	3.7E+07	3.7E+07	--	1.1E+07	1.1E+07	--	1.3E+07	1.3E+07	--	3.8E+07	3.8E+07
Cyclohexane	--	1.3E+08	1.3E+08	--	4.2E+08	4.2E+08	--	1.3E+08	1.3E+08	--	1.5E+08	1.5E+08	--	4.4E+08	4.4E+08
p-Cymene	--	9.4E+06	9.4E+06	--	3.0E+07	3.0E+07	--	9.4E+06	9.4E+06	--	1.0E+07	1.0E+07	--	3.1E+07	3.1E+07
1,2-Dibromo-3-chloropropane	2.4E+01	1.0E+04	2.4E+01	7.8E+01	3.3E+04	7.8E+01	2.4E+01	1.0E+04	2.4E+01	2.7E+01	1.2E+04	2.7E+01	8.2E+01	3.5E+04	8.2E+01
Dibromochloromethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane	1.8E+02	3.6E+05	1.8E+02	5.9E+02	1.1E+06	5.9E+02	1.8E+02	3.6E+05	1.8E+02	2.1E+02	4.0E+05	2.1E+02	6.3E+02	1.2E+06	6.3E+02
1,2-Dichlorobenzene	--	6.1E+06	6.1E+06	--	2.0E+07	2.0E+07	--	6.1E+06	6.1E+06	--	6.9E+06	6.9E+06	--	2.1E+07	2.1E+07
1,3-Dichlorobenzene	--	5.1E+06	5.1E+06	--	1.6E+07	1.6E+07	--	5.1E+06	5.1E+06	--	5.6E+06	5.6E+06	--	1.7E+07	1.7E+07
1,4-Dichlorobenzene	8.0E+03	2.5E+07	8.0E+03	2.5E+04	8.0E+07	2.5E+04	8.0E+03	2.5E+07	8.0E+03	8.9E+03	2.8E+07	8.9E+03	2.7E+04	8.4E+07	2.7E+04
Dichlorodifluoromethane	--	2.3E+06	2.3E+06	--	7.3E+06	7.3E+06	--	2.3E+06	2.3E+06	--	2.5E+06	2.5E+06	--	7.6E+06	7.6E+06
1,1-Dichloroethane	3.7E+04	--	3.7E+04	1.2E+05	--	1.2E+05	3.7E+04	--	3.7E+04	4.0E+04	--	4.0E+04	1.2E+05	--	1.2E+05
1,2-Dichloroethane	2.2E+03	1.4E+05	2.2E+03	7.0E+03	4.5E+05	7.0E+03	2.2E+03	1.4E+05	2.2E+03	2.4E+03	1.6E+05	2.4E+03	7.3E+03	4.7E+05	7.3E+03
1,1-Dichloroethene	--	4.1E+06	4.1E+06	--	1.3E+07	1.3E+07	--	4.1E+06	4.1E+06	--	4.5E+06	4.5E+06	--	1.3E+07	1.3E+07
cis-1,2-Dichloroethene	--	8.0E+05	8.0E+05	--	2.5E+06	2.5E+06	--	8.0E+05	8.0E+05	--	8.7E+05	8.7E+05	--	2.6E+06	2.6E+06
trans-1,2-Dichloroethene	--	8.1E+05	8.1E+05	--	2.5E+06	2.5E+06	--	8.1E+05	8.1E+05	--	8.8E+05	8.8E+05	--	2.6E+06	2.6E+06
1,2-Dichloropropane	1.8E+04	9.6E+04	1.8E+04	5.7E+04	3.0E+05	5.7E+04	1.8E+04	9.6E+04	1.8E+04	2.0E+04	1.1E+05	2.0E+04	6.0E+04	3.2E+05	6.0E+04
1,3-Dichloropropene	1.6E+04	4.6E+05	1.6E+04	5.1E+04	1.5E+06	5.1E+04	1.6E+04	4.6E+05	1.6E+04	1.8E+04	5.1E+05	1.8E+04	5.3E+04	1.5E+06	5.3E+04
Diisopropyl ether	--	1.9E+07	1.9E+07	--	5.9E+07	5.9E+07	--	1.9E+07	1.9E+07	--	2.1E+07	2.1E+07	--	6.2E+07	6.2E+07
1,4-Dioxane	9.0E+03	4.8E+05	9.0E+03	2.8E+04	1.5E+06	2.8E+04	9.0E+03	4.8E+05	9.0E+03	9.6E+03	5.1E+05	9.6E+03	2.9E+04	1.5E+06	2.9E+04
Ethanol	--	1.3E+09	1.3E+09	--	3.9E+09	3.9E+09	--	1.3E+09	1.3E+09	--	1.3E+09	1.3E+09	--	4.0E+09	4.0E+09

TABLE 5-9. Risk-Based Target Concentrations for Soil Gas Analytes -- Indoor Commercial/Industrial Workers Exposed to Soil Gas Migrating to Indoor Air
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	5 ft bgs			15 ft bgs			5 ft below or beside Basement			5 ft bgs under Trailer			15 ft bgs under Trailer		
	RBTC$_{SG-IA-C}$ (µg/m^3)	RBTC$_{SG-IA-NC}$ (µg/m^3)	Minimum RBTC (µg/m^3)	RBTC$_{SG-IA-C}$ (µg/m^3)	RBTC$_{SG-IA-NC}$ (µg/m^3)	Minimum RBTC (µg/m^3)	RBTC$_{SG-IA-C}$ (µg/m^3)	RBTC$_{SG-IA-NC}$ (µg/m^3)	Minimum RBTC (µg/m^3)	RBTC$_{SG-IA-C}$ (µg/m^3)	RBTC$_{SG-IA-NC}$ (µg/m^3)	Minimum RBTC (µg/m^3)	RBTC$_{SG-IA-C}$ (µg/m^3)	RBTC$_{SG-IA-NC}$ (µg/m^3)	Minimum RBTC (µg/m^3)
Ethyl tert-butyl ether	9.3E+05	1.1E+09	9.3E+05	3.0E+06	3.4E+09	3.0E+06	9.3E+05	1.1E+09	9.3E+05	1.0E+06	1.2E+09	1.0E+06	3.1E+06	3.5E+09	3.1E+06
Ethyl acetate	--	1.5E+06	1.5E+06	--	4.7E+06	4.7E+06	--	1.5E+06	1.5E+06	--	1.6E+06	1.6E+06	--	4.9E+06	4.9E+06
Ethylbenzene	2.9E+04	2.5E+07	2.9E+04	9.0E+04	8.1E+07	9.0E+04	2.9E+04	2.5E+07	2.9E+04	3.2E+04	2.8E+07	3.2E+04	9.5E+04	8.5E+07	9.5E+04
4-Ethyltoluene	--	9.4E+06	9.4E+06	--	3.0E+07	3.0E+07	--	9.4E+06	9.4E+06	--	1.0E+07	1.0E+07	--	3.1E+07	3.1E+07
Freon 114	--	2.3E+08	2.3E+08	--	7.3E+08	7.3E+08	--	2.3E+08	2.3E+08	--	2.6E+08	2.6E+08	--	7.7E+08	7.7E+08
n-Heptane	--	1.1E+07	1.1E+07	--	3.6E+07	3.6E+07	--	1.1E+07	1.1E+07	--	1.3E+07	1.3E+07	--	3.8E+07	3.8E+07
Hexachlorobutadiene	8.0E+03	--	8.0E+03	2.6E+04	--	2.6E+04	8.0E+03	--	8.0E+03	9.2E+03	--	9.2E+03	2.8E+04	--	2.8E+04
n-Hexane	--	1.7E+07	1.7E+07	--	5.3E+07	5.3E+07	--	1.7E+07	1.7E+07	--	1.9E+07	1.9E+07	--	5.6E+07	5.6E+07
2-Hexanone	--	7.3E+05	7.3E+05	--	2.3E+06	2.3E+06	--	7.3E+05	7.3E+05	--	8.1E+05	8.1E+05	--	2.4E+06	2.4E+06
alpha-Methyl styrene	--	2.8E+07	2.8E+07	--	8.8E+07	8.8E+07	--	2.8E+07	2.8E+07	--	3.1E+07	3.1E+07	--	9.2E+07	9.2E+07
Methyl tert-butyl ether	2.5E+05	7.0E+07	2.5E+05	7.9E+05	2.2E+08	7.9E+05	2.5E+05	7.0E+07	2.5E+05	2.8E+05	7.7E+07	2.8E+05	8.3E+05	2.3E+08	8.3E+05
4-Methyl-2-pentanone	--	7.4E+07	7.4E+07	--	2.4E+08	2.4E+08	--	7.4E+07	7.4E+07	--	8.2E+07	8.2E+07	--	2.5E+08	2.5E+08
Methylene chloride	5.0E+06	1.1E+07	5.0E+06	1.6E+07	3.3E+07	1.6E+07	5.0E+06	1.1E+07	5.0E+06	5.4E+06	1.2E+07	5.4E+06	1.6E+07	3.5E+07	1.6E+07
Methylmethacrylate	--	1.6E+07	1.6E+07	--	5.1E+07	5.1E+07	--	1.6E+07	1.6E+07	--	1.8E+07	1.8E+07	--	5.4E+07	5.4E+07
Naphthalene	2.3E+03	8.6E+04	2.3E+03	7.5E+03	2.7E+05	7.5E+03	2.3E+03	8.6E+04	2.3E+03	2.6E+03	9.5E+04	2.6E+03	7.9E+03	2.9E+05	7.9E+03
n-Octane	--	5.6E+05	5.6E+05	--	1.8E+06	1.8E+06	--	5.6E+05	5.6E+05	--	6.3E+05	6.3E+05	--	1.9E+06	1.9E+06
n-Propylbenzene	--	2.9E+07	2.9E+07	--	9.2E+07	9.2E+07	--	2.9E+07	2.9E+07	--	3.2E+07	3.2E+07	--	9.6E+07	9.6E+07
Styrene	--	2.5E+07	2.5E+07	--	7.8E+07	7.8E+07	--	2.5E+07	2.5E+07	--	2.7E+07	2.7E+07	--	8.1E+07	8.1E+07
1,1,1,2-Tetrachloroethane	1.3E+04	--	1.3E+04	4.3E+04	--	4.3E+04	1.3E+04	--	1.3E+04	1.5E+04	--	1.5E+04	4.5E+04	--	4.5E+04
1,1,2,2-Tetrachloroethane	1.7E+03	--	1.7E+03	5.4E+03	--	5.4E+03	1.7E+03	--	1.7E+03	1.9E+03	--	1.9E+03	5.7E+03	--	5.7E+03
Tetrachloroethene	3.7E+05	1.4E+06	3.7E+05	1.2E+06	4.4E+06	1.2E+06	3.7E+05	1.4E+06	3.7E+05	4.1E+05	1.5E+06	4.1E+05	1.2E+06	4.6E+06	1.2E+06
Tetrahydrofuran	--	3.5E+07	3.5E+07	--	1.1E+08	1.1E+08	--	3.5E+07	3.5E+07	--	3.8E+07	3.8E+07	--	1.1E+08	1.1E+08
Toluene	--	1.1E+08	1.1E+08	--	3.6E+08	3.6E+08	--	1.1E+08	1.1E+08	--	1.2E+08	1.2E+08	--	3.7E+08	3.7E+08
1,2,4-Trichlorobenzene	--	8.6E+04	8.6E+04	--	2.8E+05	2.8E+05	--	8.6E+04	8.6E+04	--	9.7E+04	9.7E+04	--	2.9E+05	2.9E+05
1,1,1-Trichloroethane	--	1.3E+08	1.3E+08	--	4.3E+08	4.3E+08	--	1.3E+08	1.3E+08	--	1.5E+08	1.5E+08	--	4.5E+08	4.5E+08
1,1,2-Trichloroethane	4.6E+03	5.2E+03	4.6E+03	1.4E+04	1.6E+04	1.4E+04	4.6E+03	5.2E+03	4.6E+03	5.0E+03	5.8E+03	5.0E+03	1.5E+04	1.7E+04	1.5E+04
Trichloroethene	1.7E+04	5.1E+04	1.7E+04	5.5E+04	1.6E+05	5.5E+04	1.7E+04	5.1E+04	1.7E+04	1.9E+04	5.6E+04	1.9E+04	5.8E+04	1.7E+05	5.8E+04
Trichlorofluoromethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichloropropane	--	9.0E+03	9.0E+03	--	2.9E+04	2.9E+04	--	9.0E+03	9.0E+03	--	1.0E+04	1.0E+04	--	3.0E+04	3.0E+04
1,1,2-Trichloro-1,2,2-trifluoroethane	--	2.3E+08	2.3E+08	--	7.3E+08	7.3E+08	--	2.3E+08	2.3E+08	--	2.6E+08	2.6E+08	--	7.7E+08	7.7E+08
1,2,4-Trimethylbenzene	--	1.7E+06	1.7E+06	--	5.5E+06	5.5E+06	--	1.7E+06	1.7E+06	--	1.9E+06	1.9E+06	--	5.7E+06	5.7E+06
1,3,5-Trimethylbenzene	--	1.7E+06	1.7E+06	--	5.5E+06	5.5E+06	--	1.7E+06	1.7E+06	--	1.9E+06	1.9E+06	--	5.8E+06	5.8E+06
Vinyl acetate	--	4.2E+06	4.2E+06	--	1.3E+07	1.3E+07	--	4.2E+06	4.2E+06	--	4.5E+06	4.5E+06	--	1.4E+07	1.4E+07
Vinyl chloride	1.1E+04	1.7E+06	1.1E+04	3.3E+04	5.2E+06	3.3E+04	1.1E+04	1.7E+06	1.1E+04	1.1E+04	1.8E+06	1.1E+04	3.4E+04	5.4E+06	3.4E+04
Xylenes (total)	--	2.5E+06	2.5E+06	--	8.1E+06	8.1E+06	--	2.5E+06	2.5E+06	--	2.8E+06	2.8E+06	--	8.5E+06	8.5E+06

Notes:
-- = Not calculated
bgs = below ground surface
ft= feet
µg/m^3 = microgram per cubic meter
RBTC$_{SG-IA-C}$ = Risk-based target concentration, cancer, inhalation of soil gas migrating to indoor air
RBTC$_{SG-IA-NC}$ = Risk-based target concentration, noncancer, inhalation of soil gas migrating to indoor air

TABLE 5-10. Risk-Based Target Concentrations for Soil Gas Analytes -- Outdoor Commercial/Industrial Workers Exposed to Soil Gas Migrating to Outdoor Air
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	5 ft bgs			15 ft bgs		
	$RBTC_{SG-OA-C}$ ($\mu g/m^3$)	$RBTC_{SG-OA-NC}$ ($\mu g/m^3$)	Minimum RBTC ($\mu g/m^3$)	$RBTC_{SG-OA-C}$ ($\mu g/m^3$)	$RBTC_{SG-OA-NC}$ ($\mu g/m^3$)	Minimum RBTC ($\mu g/m^3$)
Acetone	--	1.6E+10	1.6E+10	--	4.9E+10	4.9E+10
Acrolein	--	3.6E+04	3.6E+04	--	1.1E+05	1.1E+05
Acrylonitrile	7.7E+04	3.7E+06	7.7E+04	2.3E+05	1.1E+07	2.3E+05
tert-Amyl methyl ether	--	1.4E+11	1.4E+11	--	4.1E+11	4.1E+11
Benzene	8.8E+20	7.3E+22	8.8E+20	2.0E+22	1.6E+24	2.0E+22
Benzyl chloride	5.2E+05	9.2E+06	5.2E+05	1.6E+06	2.8E+07	1.6E+06
Bromodichloromethane	4.4E+06	3.5E+10	4.4E+06	1.3E+07	1.1E+11	1.3E+07
Bromoform	5.2E+07	--	5.2E+07	1.6E+08	--	1.6E+08
Bromomethane	--	6.6E+08	6.6E+08	--	2.0E+09	2.0E+09
2-Butanone	--	4.8E+09	4.8E+09	--	1.4E+10	1.4E+10
tert-Butyl alcohol	--	1.0E+09	1.0E+09	--	3.1E+09	3.1E+09
n-Butylbenzene	--	1.4E+11	1.4E+11	--	4.3E+11	4.3E+11
sec-Butylbenzene	--	1.6E+11	1.6E+11	--	4.8E+11	4.8E+11
tert-Butylbenzene	--	1.2E+11	1.2E+11	--	3.6E+11	3.6E+11
Carbon disulfide	--	1.6E+11	1.6E+11	--	4.9E+11	4.9E+11
Carbon tetrachloride	3.7E+08	7.8E+10	3.7E+08	1.1E+09	2.3E+11	1.1E+09
3-Chloro-1-propene	9.1E+07	2.0E+08	9.1E+07	2.7E+08	5.9E+08	2.7E+08
Chlorobenzene	--	3.2E+09	3.2E+09	--	9.6E+09	9.6E+09
Chloroethane	--	1.9E+12	1.9E+12	--	5.7E+12	5.7E+12
Chloroform	9.6E+06	7.7E+09	9.6E+06	2.9E+07	2.3E+10	2.9E+07
Chloromethane	--	1.2E+10	1.2E+10	--	3.6E+10	3.6E+10
Cumene	--	9.9E+10	9.9E+10	--	3.0E+11	3.0E+11
Cyclohexane	--	1.8E+13	1.8E+13	--	5.4E+13	5.4E+13
p-Cymene	--	1.5E+13	1.5E+13	--	4.4E+13	4.4E+13
1,2-Dibromo-3-chloropropane	2.7E+03	1.2E+06	2.7E+03	8.2E+03	3.5E+06	8.2E+03
Dibromochloromethane	--	--	--	--	--	--
1,2-Dibromoethane	1.0E+05	2.0E+08	1.0E+05	3.1E+05	5.9E+08	3.1E+05
1,2-Dichlorobenzene	--	9.3E+09	9.3E+09	--	2.8E+10	2.8E+10
1,3-Dichlorobenzene	--	1.2E+10	1.2E+10	--	3.7E+10	3.7E+10
1,4-Dichlorobenzene	1.5E+07	4.8E+10	1.5E+07	4.6E+07	1.5E+11	4.6E+07
Dichlorodifluoromethane	--	7.2E+11	7.2E+11	--	2.2E+12	2.2E+12

TABLE 5-10. Risk-Based Target Concentrations for Soil Gas Analytes -- Outdoor Commercial/Industrial Workers Exposed to Soil Gas Migrating to Outdoor Air
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	5 ft bgs			15 ft bgs		
	$RBTC_{SG\text{-}OA\text{-}C}$ ($\mu g/m^3$)	$RBTC_{SG\text{-}OA\text{-}NC}$ ($\mu g/m^3$)	Minimum RBTC ($\mu g/m^3$)	$RBTC_{SG\text{-}OA\text{-}C}$ ($\mu g/m^3$)	$RBTC_{SG\text{-}OA\text{-}NC}$ ($\mu g/m^3$)	Minimum RBTC ($\mu g/m^3$)
1,1-Dichloroethane	1.9E+08	--	1.9E+08	5.8E+08	--	5.8E+08
1,2-Dichloroethane	2.3E+06	1.5E+08	2.3E+06	7.0E+06	4.5E+08	7.0E+06
1,1-Dichloroethene	--	1.0E+11	1.0E+11	--	3.1E+11	3.1E+11
cis-1,2-Dichloroethene	--	3.0E+09	3.0E+09	--	9.1E+09	9.1E+09
trans-1,2-Dichloroethene	--	7.1E+09	7.1E+09	--	2.1E+10	2.1E+10
1,2-Dichloropropane	4.6E+07	2.4E+08	4.6E+07	1.4E+08	7.2E+08	1.4E+08
1,3-Dichloropropene	5.0E+07	1.4E+09	5.0E+07	1.5E+08	4.3E+09	1.5E+08
Diisopropyl ether	--	6.4E+10	6.4E+10	--	1.9E+11	1.9E+11
1,4-Dioxane	3.5E+04	1.9E+06	3.5E+04	1.1E+05	5.6E+06	1.1E+05
Ethanol	--	7.8E+09	7.8E+09	--	2.3E+10	2.3E+10
Ethyl tert-butyl ether	2.0E+09	2.3E+12	2.0E+09	6.0E+09	6.8E+12	6.0E+09
Ethyl acetate	--	1.8E+08	1.8E+08	--	5.3E+08	5.3E+08
Ethylbenzene	1.9E+08	1.7E+11	1.9E+08	5.6E+08	5.0E+11	5.6E+08
4-Ethyltoluene	--	1.5E+13	1.5E+13	--	4.4E+13	4.4E+13
Freon 114	--	8.5E+14	8.5E+14	--	2.5E+15	2.5E+15
n-Heptane	--	2.9E+13	2.9E+13	--	8.8E+13	8.8E+13
Hexachlorobutadiene	6.3E+07	--	6.3E+07	1.9E+08	--	1.9E+08
n-Hexane	--	2.8E+13	2.8E+13	--	8.4E+13	8.4E+13
2-Hexanone	--	5.7E+07	5.7E+07	--	1.7E+08	1.7E+08
alpha-Methyl styrene	--	4.9E+10	4.9E+10	--	1.5E+11	1.5E+11
Methyl tert-butyl ether	1.4E+08	3.9E+10	1.4E+08	4.2E+08	1.2E+11	4.2E+08
4-Methyl-2-pentanone	--	8.7E+09	8.7E+09	--	2.6E+10	2.6E+10
Methylene chloride	1.5E+10	3.3E+10	1.5E+10	4.6E+10	9.9E+10	4.6E+10
Methylmethacrylate	--	4.3E+09	4.3E+09	--	1.3E+10	1.3E+10
Naphthalene	7.6E+05	2.8E+07	7.6E+05	2.3E+06	8.4E+07	2.3E+06
n-Octane	--	2.4E+12	2.4E+12	--	7.1E+12	7.1E+12
n-Propylbenzene	--	2.4E+11	2.4E+11	--	7.2E+11	7.2E+11
Styrene	--	5.6E+10	5.6E+10	--	1.7E+11	1.7E+11
1,1,1,2-Tetrachloroethane	2.7E+07	--	2.7E+07	8.1E+07	--	8.1E+07
1,1,2,2-Tetrachloroethane	5.2E+05	--	5.2E+05	1.5E+06	--	1.5E+06
Tetrachloroethene	5.7E+09	2.1E+10	5.7E+09	1.7E+10	6.3E+10	1.7E+10

TABLE 5-10. Risk-Based Target Concentrations for Soil Gas Analytes -- Outdoor Commercial/Industrial Workers Exposed to Soil Gas Migrating to Outdoor Air
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	5 ft bgs			15 ft bgs		
	$RBTC_{SG\text{-}OA\text{-}C}$ ($\mu g/m^3$)	$RBTC_{SG\text{-}OA\text{-}NC}$ ($\mu g/m^3$)	Minimum RBTC ($\mu g/m^3$)	$RBTC_{SG\text{-}OA\text{-}C}$ ($\mu g/m^3$)	$RBTC_{SG\text{-}OA\text{-}NC}$ ($\mu g/m^3$)	Minimum RBTC ($\mu g/m^3$)
Tetrahydrofuran	--	2.3E+09	2.3E+09	--	6.8E+09	6.8E+09
Toluene	--	6.5E+11	6.5E+11	--	2.0E+12	2.0E+12
1,2,4-Trichlorobenzene	--	9.0E+07	9.0E+07	--	2.7E+08	2.7E+08
1,1,1-Trichloroethane	--	2.1E+12	2.1E+12	--	6.4E+12	6.4E+12
1,1,2-Trichloroethane	3.2E+06	3.7E+06	3.2E+06	9.7E+06	1.1E+07	9.7E+06
Trichloroethene	1.5E+08	4.5E+08	1.5E+08	4.6E+08	1.4E+09	4.6E+08
Trichlorofluoromethane	--	--	--	--	--	--
1,2,3-Trichloropropane	--	2.5E+06	2.5E+06	--	7.5E+06	7.5E+06
1,1,2-Trichloro-1,2,2-trifluoroethane	--	1.2E+14	1.2E+14	--	3.6E+14	3.6E+14
1,2,4-Trimethylbenzene	--	8.3E+09	8.3E+09	--	2.5E+10	2.5E+10
1,3,5-Trimethylbenzene	--	1.2E+10	1.2E+10	--	3.6E+10	3.6E+10
Vinyl acetate	--	1.9E+09	1.9E+09	--	5.6E+09	5.6E+09
Vinyl chloride	3.1E+08	4.8E+10	3.1E+08	9.2E+08	1.4E+11	9.2E+08
Xylenes (total)	--	1.4E+10	1.4E+10	--	4.2E+10	4.2E+10

Notes:
-- = Not calculated
bgs = below ground surface
ft = feet
$\mu g/m^3$ = microgram per cubic meter
$RBTC_{SG\text{-}OA\text{-}C}$ = Risk-based target concentration, cancer, inhalation of soil gas migrating to outdoor air
$RBTC_{SG\text{-}OA\text{-}NC}$ = Risk-based target concentration, noncancer, inhalation of soil gas migrating to outdoor air

TABLE 5-11. Risk-Based Target Concentrations for Soil Gas Analytes -- Construction Workers Exposed to Soil Gas Migrating to Trench Air
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	5 ft below or beside Trench		
	$RBTC_{SG\text{-}TA\text{-}C}$ ($\mu g/m^3$)	$RBTC_{SG\text{-}TA\text{-}NC}$ ($\mu g/m^3$)	Minimum RBTC ($\mu g/m^3$)
Acetone	--	4.3E+10	4.3E+10
Acrolein	--	4.4E+05	4.4E+05
Acrylonitrile	5.1E+06	9.9E+06	5.1E+06
tert-Amyl methyl ether	--	3.6E+11	3.6E+11
Benzene	5.8E+22	5.2E+23	5.8E+22
Benzyl chloride	3.5E+07	9.7E+07	3.5E+07
Bromodichloromethane	2.9E+08	3.1E+09	2.9E+08
Bromoform	3.4E+09	--	3.4E+09
Bromomethane	--	3.5E+10	3.5E+10
2-Butanone	--	2.5E+09	2.5E+09
tert-Butyl alcohol	--	2.8E+09	2.8E+09
n-Butylbenzene	--	8.5E+10	8.5E+10
sec-Butylbenzene	--	9.6E+10	9.6E+10
tert-Butylbenzene	--	7.2E+10	7.2E+10
Carbon disulfide	--	4.3E+11	4.3E+11
Carbon tetrachloride	2.4E+10	3.9E+11	2.4E+10
3-Chloro-1-propene	6.0E+09	5.2E+09	5.2E+09
Chlorobenzene	--	8.4E+10	8.4E+10
Chloroethane	--	2.0E+12	2.0E+12
Chloroform	6.3E+08	5.0E+10	6.3E+08
Chloromethane	--	1.1E+12	1.1E+12
Cumene	--	5.9E+10	5.9E+10
Cyclohexane	--	1.4E+14	1.4E+14
p-Cymene	--	8.6E+12	8.6E+12
1,2-Dibromo-3-chloropropane	1.8E+05	3.1E+07	1.8E+05
Dibromochloromethane	--	--	--
1,2-Dibromoethane	6.8E+06	1.2E+08	6.8E+06
1,2-Dichlorobenzene	--	2.5E+11	2.5E+11
1,3-Dichlorobenzene	--	3.3E+11	3.3E+11
1,4-Dichlorobenzene	1.0E+09	1.9E+11	1.0E+09
Dichlorodifluoromethane	--	1.9E+13	1.9E+13
1,1-Dichloroethane	1.3E+10	--	1.3E+10
1,2-Dichloroethane	1.5E+08	4.0E+09	1.5E+08
1,1-Dichloroethene	--	5.5E+09	5.5E+09
cis-1,2-Dichloroethene	--	8.0E+10	8.0E+10
trans-1,2-Dichloroethene	--	3.7E+11	3.7E+11
1,2-Dichloropropane	3.0E+09	1.5E+09	1.5E+09
1,3-Dichloropropene	3.3E+09	6.8E+09	3.3E+09
Diisopropyl ether	--	1.7E+11	1.7E+11

TABLE 5-11. Risk-Based Target Concentrations for Soil Gas Analytes -- Construction Workers Exposed to Soil Gas Migrating to Trench Air
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	5 ft below or beside Trench		
	$RBTC_{SG\text{-}TA\text{-}C}$ ($\mu g/m^3$)	$RBTC_{SG\text{-}TA\text{-}NC}$ ($\mu g/m^3$)	Minimum RBTC ($\mu g/m^3$)
1,4-Dioxane	2.3E+06	1.2E+08	2.3E+06
Ethanol	--	2.1E+10	2.1E+10
Ethyl tert-butyl ether	1.3E+11	6.0E+12	1.3E+11
Ethyl acetate	--	4.7E+09	4.7E+09
Ethylbenzene	1.2E+10	4.0E+12	1.2E+10
4-Ethyltoluene	--	8.6E+12	8.6E+12
Freon 114	--	2.2E+16	2.2E+16
n-Heptane	--	7.8E+14	7.8E+14
Hexachlorobutadiene	4.2E+09	--	4.2E+09
n-Hexane	--	2.1E+14	2.1E+14
2-Hexanone	--	1.5E+08	1.5E+08
alpha-Methyl styrene	--	3.9E+11	3.9E+11
Methyl tert-butyl ether	9.2E+09	1.0E+11	9.2E+09
4-Methyl-2-pentanone	--	6.1E+09	6.1E+09
Methylene chloride	1.0E+12	1.5E+11	1.5E+11
Methylmethacrylate	--	1.1E+10	1.1E+10
Naphthalene	5.1E+07	7.4E+07	5.1E+07
n-Octane	--	6.3E+13	6.3E+13
n-Propylbenzene	--	6.4E+11	6.4E+11
Styrene	--	4.4E+11	4.4E+11
1,1,1,2-Tetrachloroethane	1.8E+09	--	1.8E+09
1,1,2,2-Tetrachloroethane	3.4E+07	--	3.4E+07
Tetrachloroethene	3.7E+11	5.7E+10	5.7E+10
Tetrahydrofuran	--	6.0E+09	6.0E+09
Toluene	--	1.7E+12	1.7E+12
1,2,4-Trichlorobenzene	--	2.4E+09	2.4E+09
1,1,1-Trichloroethane	--	5.7E+12	5.7E+12
1,1,2-Trichloroethane	2.1E+08	5.3E+08	2.1E+08
Trichloroethene	1.0E+10	1.3E+09	1.3E+09
Trichlorofluoromethane	--	6.9E+12	6.9E+12
1,2,3-Trichloropropane	--	6.6E+06	6.6E+06
1,1,2-Trichloro-1,2,2-trifluoroethane	--	3.1E+15	3.1E+15
1,2,4-Trimethylbenzene	--	7.3E+10	7.3E+10
1,3,5-Trimethylbenzene	--	1.0E+11	1.0E+11
Vinyl acetate	--	8.7E+08	8.7E+08
Vinyl chloride	2.0E+10	1.3E+11	2.0E+10
Xylenes (total)	--	1.5E+11	1.5E+11

Notes:
-- = Not calculated
ft = feet
$\mu g/m^3$ = microgram per cubic meter
$RBTC_{SG\text{-}TA\text{-}C}$ = Risk-based target concentration, cancer, inhalation of soil gas migrating to trench air
$RBTC_{SG\text{-}TA\text{-}NC}$ = Risk-based target concentration, noncancer, inhalation of soil gas migrating to trench air

TABLE 5-12. Summary of Estimated Soil Gas Cancer Risks and Noncancer Hazard Indices

Nevada Environmental Response Trust Site

Henderson, Nevada

Scenario[1,2]	Depth (ft bgs)	Total Cancer Risk	Total Noncancer HI
Indoor Commercial/Industrial Worker (Slab-on-grade)	5	3E-09 - 3E-05	0.0001 - 0.03
	at or around 15	3E-09 - 1E-04	0.00002 - 0.1
Outdoor Commercial/Industrial Worker	5	2E-09	0.000003
	at or around 15	5E-09	0.000008
Construction Worker	5	1E-14 - 1E-10	0.000000006 - 0.000002
	at or around 15	2E-14 - 1E-09	0.000000003 - 0.00002
Indoor Commercial/Industrial Worker (Basement Scenario)	5	8E-09 - 1E-05	0.0003 - 0.02
	at or around 15	2E-08 - 8E-05	0.0009 - 0.1
Indoor Commercial/Industrial Worker (Trailer Scenario)	5	1E-06 - 5E-06	0.006
	at or around 15	1E-06 - 5E-06	0.005 - 0.007

Notes:

bgs = below ground surface

ft = feet

HI = Hazard index

OU = Operable unit

VOC = volatile organic compound

UCL = Upper confidence limit

[1] The cancer risk and non-cancer chronic HI estimates for the indoor commercial/industrial workers and construction workers were based on the maximum by sample risk/HI results for each scenario.

[2] The cancer risk and non-cancer chronic HI for the outdoor commercial/industrial workers were estimated based on the 95% UCLs calculated using the soil gas VOC data collected over the entire Operations Area of OU-1.

TABLE 5-13. Risk-Based Target Concentrations for Shallow Groundwater Analytes -- Indoor Commercial/Industrial Workers Exposed to Vapors from Groundwater Migrating to Indoor Air
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	Vapors from Groundwater Migrating to Indoor Air			Vapors from Groundwater Migrating to Basement Indoor Air			Vapors from Groundwater Migrating to Trailer Indoor Air		
	$RBTC_{GW.vapor-IA-C}$ (µg/L)	$RBTC_{GW.vapor-IA-NC}$ (µg/L)	Minimum RBTC (µg/L)	$RBTC_{GW.vapor-IA-C}$ (µg/L)	$RBTC_{GW.vapor-IA-NC}$ (µg/L)	Minimum RBTC (µg/L)	$RBTC_{GW.vapor-IA-C}$ (µg/L)	$RBTC_{GW.vapor-IA-NC}$ (µg/L)	Minimum RBTC (µg/L)
Acenaphthene	--	1.7E+05	1.7E+05	--	1.1E+05	1.1E+05	--	1.7E+05	1.7E+05
Acenaphthylene	--	1.3E+05	1.3E+05	--	8.5E+04	8.5E+04	--	1.4E+05	1.4E+05
Anthracene	--	6.8E+05	6.8E+05	--	4.1E+05	4.1E+05	--	7.1E+05	7.1E+05
Benzene	7.6E+16	6.3E+18	7.6E+16	4.7E+16	3.9E+18	4.7E+16	7.8E+16	6.5E+18	7.8E+16
Benzo(a)anthracene	6.1E+04	--	6.1E+04	3.6E+04	--	3.6E+04	6.4E+04	--	6.4E+04
Bis(2-chloroethyl) ether	3.2E+03	--	3.2E+03	1.9E+03	--	1.9E+03	3.4E+03	--	3.4E+03
Bis(2-chloro-1-methylethyl) ether	--	--	--	--	--	--	--	--	--
Bromobenzene	--	2.6E+05	2.6E+05	--	1.8E+05	1.8E+05	--	2.7E+05	2.7E+05
Bromochloromethane	--	1.6E+05	1.6E+05	--	1.1E+05	1.1E+05	--	1.6E+05	1.6E+05
Bromodichloromethane	3.0E+02	2.4E+06	3.0E+02	2.2E+02	1.7E+06	2.2E+02	3.1E+02	2.5E+06	3.1E+02
Bromoform	6.0E+04	--	6.0E+04	4.0E+04	--	4.0E+04	6.2E+04	--	6.2E+04
Bromomethane	--	2.9E+03	2.9E+03	--	2.2E+03	2.2E+03	--	3.0E+03	3.0E+03
4-Bromophenyl-phenyl ether	--	--	--	--	--	--	--	--	--
2-Butanone	--	3.3E+08	3.3E+08	--	2.1E+08	2.1E+08	--	3.4E+08	3.4E+08
n-Butylbenzene	--	3.1E+05	3.1E+05	--	2.3E+05	2.3E+05	--	3.2E+05	3.2E+05
sec-Butylbenzene	--	2.8E+05	2.8E+05	--	2.0E+05	2.0E+05	--	2.9E+05	2.9E+05
tert-Butylbenzene	--	3.7E+05	3.7E+05	--	2.7E+05	2.7E+05	--	3.8E+05	3.8E+05
Carbon tetrachloride	1.4E+02	3.1E+04	1.4E+02	1.0E+02	2.2E+04	1.0E+02	1.5E+02	3.2E+04	1.5E+02
Chlorobenzene	--	1.1E+05	1.1E+05	--	8.3E+04	8.3E+04	--	1.2E+05	1.2E+05
Chloroethane	--	3.8E+06	3.8E+06	--	2.8E+06	2.8E+06	--	3.9E+06	3.9E+06
Chloroform	2.0E+02	1.6E+05	2.0E+02	1.5E+02	1.2E+05	1.5E+02	2.1E+02	1.7E+05	2.1E+02
Chloromethane	--	3.4E+04	3.4E+04	--	2.5E+04	2.5E+04	--	3.5E+04	3.5E+04
2-Chloronaphthalene	--	3.6E+04	3.6E+04	--	2.3E+04	2.3E+04	--	3.7E+04	3.7E+04
2-Chlorophenol	--	2.2E+07	2.2E+07	--	1.3E+07	1.3E+07	--	2.3E+07	2.3E+07
4-Chlorophenyl-phenyl ether	--	--	--	--	--	--	--	--	--
2-Chlorotoluene	--	1.3E+05	1.3E+05	--	9.2E+04	9.2E+04	--	1.3E+05	1.3E+05
4-Chlorotoluene	--	1.1E+05	1.1E+05	--	7.7E+04	7.7E+04	--	1.1E+05	1.1E+05
Cumene	--	3.5E+05	3.5E+05	--	2.5E+05	2.5E+05	--	3.6E+05	3.6E+05
p-Cymene	--	1.5E+03	1.5E+03	--	1.1E+03	1.1E+03	--	1.6E+03	1.6E+03
Dibenzofuran	--	--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane	4.0E+01	1.7E+04	4.0E+01	2.5E+01	1.1E+04	2.5E+01	4.2E+01	1.8E+04	4.2E+01
Dibromochloromethane	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane	7.5E+01	1.4E+05	7.5E+01	5.1E+01	9.8E+04	5.1E+01	7.7E+01	1.5E+05	7.7E+01
Dibromomethane	--	3.9E+04	3.9E+04	--	2.7E+04	2.7E+04	--	4.0E+04	4.0E+04
1,2-Dichlorobenzene	--	1.0E+06	1.0E+06	--	7.2E+05	7.2E+05	--	1.0E+06	1.0E+06
1,3-Dichlorobenzene	--	5.1E+05	5.1E+05	--	3.7E+05	3.7E+05	--	5.3E+05	5.3E+05
1,4-Dichlorobenzene	1.0E+03	3.2E+06	1.0E+03	7.4E+02	2.3E+06	7.4E+02	1.1E+03	3.4E+06	1.1E+03
Dichlorodifluoromethane	--	1.9E+03	1.9E+03	--	1.4E+03	1.4E+03	--	2.0E+03	2.0E+03
1,1-Dichloroethane	1.7E+03	--	1.7E+03	1.3E+03	--	1.3E+03	1.8E+03	--	1.8E+03
1,2-Dichloroethane	5.0E+02	3.2E+04	5.0E+02	3.5E+02	2.3E+04	3.5E+02	5.1E+02	3.3E+04	5.1E+02
1,1-Dichloroethene	--	4.0E+04	4.0E+04	--	3.0E+04	3.0E+04	--	4.1E+04	4.1E+04
cis-1,2-Dichloroethene	--	5.2E+04	5.2E+04	--	3.8E+04	3.8E+04	--	5.4E+04	5.4E+04
trans-1,2-Dichloroethene	--	2.3E+04	2.3E+04	--	1.7E+04	1.7E+04	--	2.3E+04	2.3E+04
1,2-Dichloropropane	1.8E+03	9.4E+03	1.8E+03	1.3E+03	6.8E+03	1.3E+03	1.8E+03	9.7E+03	1.8E+03
1,3-Dichloropropane	--	2.7E+04	2.7E+04	--	1.9E+04	1.9E+04	--	2.8E+04	2.8E+04
2,2-Dichloropropane	--	1.2E+03	1.2E+03	--	8.6E+02	8.6E+02	--	1.2E+03	1.2E+03
1,1-Dichloropropene	--	1.8E+03	1.8E+03	--	1.3E+03	1.3E+03	--	1.9E+03	1.9E+03
1,3-Dichloropropene	1.3E+03	3.7E+04	1.3E+03	9.4E+02	2.7E+04	9.4E+02	1.3E+03	3.8E+04	1.3E+03

TABLE 5-13. Risk-Based Target Concentrations for Shallow Groundwater Analytes -- Indoor Commercial/Industrial Workers Exposed to Vapors from Groundwater Migrating to Indoor Air
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	Vapors from Groundwater Migrating to Indoor Air			Vapors from Groundwater Migrating to Basement Indoor Air			Vapors from Groundwater Migrating to Trailer Indoor Air		
	$RBTC_{GW.vapor-IA-C}$ (µg/L)	$RBTC_{GW.vapor-IA-NC}$ (µg/L)	Minimum RBTC (µg/L)	$RBTC_{GW.vapor-IA-C}$ (µg/L)	$RBTC_{GW.vapor-IA-NC}$ (µg/L)	Minimum RBTC (µg/L)	$RBTC_{GW.vapor-IA-C}$ (µg/L)	$RBTC_{GW.vapor-IA-NC}$ (µg/L)	Minimum RBTC (µg/L)
1,4-Dioxane	3.6E+05	1.9E+07	3.6E+05	2.1E+05	1.1E+07	2.1E+05	3.7E+05	2.0E+07	3.7E+05
Ethyl tert-butyl ether	1.1E+05	1.2E+08	1.1E+05	7.9E+04	9.0E+07	7.9E+04	1.1E+05	1.3E+08	1.1E+05
Ethylbenzene	1.1E+03	9.9E+05	1.1E+03	8.1E+02	7.2E+05	8.1E+02	1.1E+03	1.0E+06	1.1E+03
Fluorene	--	3.4E+05	3.4E+05	--	2.1E+05	2.1E+05	--	3.5E+05	3.5E+05
Formaldehyde	3.0E+05	1.3E+07	3.0E+05	1.8E+05	8.4E+06	1.8E+05	2.8E+05	1.3E+07	2.8E+05
Hexachlorobenzene	7.5E+01	--	7.5E+01	5.2E+01	--	5.2E+01	7.7E+01	--	7.7E+01
Hexachlorobutadiene	2.8E+02	--	2.8E+02	2.0E+02	--	2.0E+02	2.9E+02	--	2.9E+02
Hexachlorocyclopentadiene	--	1.1E+03	1.1E+03	--	7.8E+02	7.8E+02	--	1.1E+03	1.1E+03
Hexachloroethane	1.2E+03	1.5E+05	1.2E+03	8.9E+02	1.0E+05	8.9E+02	1.3E+03	1.5E+05	1.3E+03
Methylene chloride	3.9E+05	8.4E+05	3.9E+05	2.9E+05	6.1E+05	2.9E+05	4.0E+05	8.7E+05	4.0E+05
1-Methylnaphthalene	--	6.9E+04	6.9E+04	--	4.7E+04	4.7E+04	--	7.1E+04	7.1E+04
2-Methylnaphthalene	--	6.5E+04	6.5E+04	--	4.4E+04	4.4E+04	--	6.8E+04	6.8E+04
Naphthalene	1.6E+03	5.8E+04	1.6E+03	1.1E+03	3.9E+04	1.1E+03	1.6E+03	6.0E+04	1.6E+03
Nitrobenzene	1.7E+04	2.1E+06	1.7E+04	9.9E+03	1.3E+06	9.9E+03	1.7E+04	2.2E+06	1.7E+04
2-Nitrophenol	--	--	--	--	--	--	--	--	--
Octachlorostyrene	--	--	--	--	--	--	--	--	--
Phenanthrene	--	6.8E+05	6.8E+05	--	4.1E+05	4.1E+05	--	7.0E+05	7.0E+05
n-Propylbenzene	--	8.9E+05	8.9E+05	--	6.5E+05	6.5E+05	--	9.2E+05	9.2E+05
Pyrene	--	3.6E+06	3.6E+06	--	2.1E+06	2.1E+06	--	3.8E+06	3.8E+06
Styrene	--	2.7E+06	2.7E+06	--	2.0E+06	2.0E+06	--	2.8E+06	2.8E+06
1,1,1,2-Tetrachloroethane	1.7E+03	--	1.7E+03	1.2E+03	--	1.2E+03	1.8E+03	--	1.8E+03
1,1,2,2-Tetrachloroethane	1.2E+03	--	1.2E+03	7.8E+02	--	7.8E+02	1.2E+03	--	1.2E+03
Tetrachloroethene	6.3E+03	2.3E+04	6.3E+03	4.6E+03	1.7E+04	4.6E+03	6.5E+03	2.4E+04	6.5E+03
Toluene	--	4.9E+06	4.9E+06	--	3.6E+06	3.6E+06	--	5.1E+06	5.1E+06
1,2,3-Trichlorobenzene	--	2.4E+04	2.4E+04	--	1.7E+04	1.7E+04	--	2.5E+04	2.5E+04
1,2,4-Trichlorobenzene	--	2.0E+04	2.0E+04	--	1.4E+04	1.4E+04	--	2.0E+04	2.0E+04
1,1,1-Trichloroethane	--	2.2E+06	2.2E+06	--	1.6E+06	1.6E+06	--	2.2E+06	2.2E+06
1,1,2-Trichloroethane	1.5E+03	1.7E+03	1.5E+03	1.0E+03	1.2E+03	1.0E+03	1.5E+03	1.8E+03	1.5E+03
Trichloroethene	5.0E+02	1.5E+03	5.0E+02	3.7E+02	1.1E+03	3.7E+02	5.2E+02	1.5E+03	5.2E+02
Trichlorofluoromethane	--	--	--	--	--	--	--	--	--
1,2,3-Trichloropropane	--	6.9E+03	6.9E+03	--	4.6E+03	4.6E+03	--	7.1E+03	7.1E+03
1,2,4-Trimethylbenzene	--	9.1E+04	9.1E+04	--	6.7E+04	6.7E+04	--	9.4E+04	9.4E+04
1,3,5-Trimethylbenzene	--	6.5E+04	6.5E+04	--	4.7E+04	4.7E+04	--	6.7E+04	6.7E+04
Vinyl chloride	9.1E+01	1.4E+04	9.1E+01	6.7E+01	1.0E+04	6.7E+01	9.3E+01	1.5E+04	9.3E+01
Xylenes (total)	--	1.2E+05	1.2E+05	--	8.6E+04	8.6E+04	--	1.2E+05	1.2E+05

Notes:
-- = Not calculated
µg/L = microgram per liter
$RBTC_{GW.vapor-IA-C}$ = Risk-based target concentration, cancer, inhalation of vapor in indoor air migrating from groundwater
$RBTC_{GW.vapor-IA-NC}$ = Risk-based target concentration, noncancer, inhalation of vapor in indoor air migrating from groundwater

TABLE 5-14. Risk-Based Target Concentrations for Shallow Groundwater Analytes -- Outdoor Commercial/Industrial Workers Exposed to Vapors from Groundwater Migrating to Outdoor Air
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	Vapors from Groundwater Migrating to Outdoor Air		
	$RBTC_{GW.vapor-OA-C}$ (µg/L)	$RBTC_{GW.vapor-OA-NC}$ (µg/L)	Minimum RBTC (µg/L)
Acenaphthene	--	5.0E+06	5.0E+06
Acenaphthylene	--	3.9E+06	3.9E+06
Anthracene	--	2.0E+07	2.0E+07
Benzene	2.2E+18	1.9E+20	2.2E+18
Benzo(a)anthracene	1.8E+06	--	1.8E+06
Bis(2-chloroethyl) ether	9.7E+04	--	9.7E+04
Bis(2-chloro-1-methylethyl) ether	--	--	--
Bromobenzene	--	7.6E+06	7.6E+06
Bromochloromethane	--	4.7E+06	4.7E+06
Bromodichloromethane	8.9E+03	7.1E+07	8.9E+03
Bromoform	1.8E+06	--	1.8E+06
Bromomethane	--	8.7E+04	8.7E+04
4-Bromophenyl-phenyl ether	--	--	--
2-Butanone	--	9.9E+09	9.9E+09
n-Butylbenzene	--	9.3E+06	9.3E+06
sec-Butylbenzene	--	8.2E+06	8.2E+06
tert-Butylbenzene	--	1.1E+07	1.1E+07
Carbon tetrachloride	4.2E+03	9.1E+05	4.2E+03
Chlorobenzene	--	3.4E+06	3.4E+06
Chloroethane	--	1.1E+08	1.1E+08
Chloroform	5.9E+03	4.8E+06	5.9E+03
Chloromethane	--	1.0E+06	1.0E+06
2-Chloronaphthalene	--	1.1E+06	1.1E+06
2-Chlorophenol	--	6.6E+08	6.6E+08
4-Chlorophenyl-phenyl ether	--	--	--
2-Chlorotoluene	--	3.8E+06	3.8E+06
4-Chlorotoluene	--	3.1E+06	3.1E+06
Cumene	--	1.0E+07	1.0E+07
p-Cymene	--	4.6E+04	4.6E+04
Dibenzofuran	--	--	--
1,2-Dibromo-3-chloropropane	1.2E+03	5.2E+05	1.2E+03
Dibromochloromethane	--	--	--
1,2-Dibromoethane	2.2E+03	4.3E+06	2.2E+03
Dibromomethane	--	1.2E+06	1.2E+06
1,2-Dichlorobenzene	--	3.0E+07	3.0E+07
1,3-Dichlorobenzene	--	1.5E+07	1.5E+07
1,4-Dichlorobenzene	3.1E+04	9.6E+07	3.1E+04
Dichlorodifluoromethane	--	5.6E+04	5.6E+04
1,1-Dichloroethane	5.2E+04	--	5.2E+04
1,2-Dichloroethane	1.5E+04	9.5E+05	1.5E+04
1,1-Dichloroethene	--	1.2E+06	1.2E+06
cis-1,2-Dichloroethene	--	1.5E+06	1.5E+06
trans-1,2-Dichloroethene	--	6.7E+05	6.7E+05
1,2-Dichloropropane	5.3E+04	2.8E+05	5.3E+04
1,3-Dichloropropane	--	7.9E+05	7.9E+05
2,2-Dichloropropane	--	3.5E+04	3.5E+04
1,1-Dichloropropene	--	5.4E+04	5.4E+04
1,3-Dichloropropene	3.8E+04	1.1E+06	3.8E+04
1,4-Dioxane	1.1E+07	5.7E+08	1.1E+07

TABLE 5-14. Risk-Based Target Concentrations for Shallow Groundwater Analytes -- Outdoor Commercial/Industrial Workers Exposed to Vapors from Groundwater Migrating to Outdoor Air
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	Vapors from Groundwater Migrating to Outdoor Air		
	$RBTC_{GW.vapor-OA-C}$ (µg/L)	$RBTC_{GW.vapor-OA-NC}$ (µg/L)	Minimum RBTC (µg/L)
Ethyl tert-butyl ether	3.2E+06	3.7E+09	3.2E+06
Ethylbenzene	3.3E+04	2.9E+07	3.3E+04
Fluorene	--	1.0E+07	1.0E+07
Formaldehyde	8.0E+06	3.7E+08	8.0E+06
Hexachlorobenzene	2.2E+03	--	2.2E+03
Hexachlorobutadiene	8.2E+03	--	8.2E+03
Hexachlorocyclopentadiene	--	3.2E+04	3.2E+04
Hexachloroethane	3.7E+04	4.4E+06	3.7E+04
Methylene chloride	1.2E+07	2.5E+07	1.2E+07
1-Methylnaphthalene	--	2.1E+06	2.1E+06
2-Methylnaphthalene	--	1.9E+06	1.9E+06
Naphthalene	4.7E+04	1.7E+06	4.7E+04
Nitrobenzene	4.9E+05	6.3E+07	4.9E+05
2-Nitrophenol	--	--	--
Octachlorostyrene	--	--	--
Phenanthrene	--	2.0E+07	2.0E+07
n-Propylbenzene	--	2.6E+07	2.6E+07
Pyrene	--	1.1E+08	1.1E+08
Styrene	--	8.0E+07	8.0E+07
1,1,1,2-Tetrachloroethane	5.0E+04	--	5.0E+04
1,1,2,2-Tetrachloroethane	3.5E+04	--	3.5E+04
Tetrachloroethene	1.9E+05	6.9E+05	1.9E+05
Toluene	--	1.5E+08	1.5E+08
1,2,3-Trichlorobenzene	--	7.3E+05	7.3E+05
1,2,4-Trichlorobenzene	--	5.9E+05	5.9E+05
1,1,1-Trichloroethane	--	6.4E+07	6.4E+07
1,1,2-Trichloroethane	4.4E+04	5.1E+04	4.4E+04
Trichloroethene	1.5E+04	4.3E+04	1.5E+04
Trichlorofluoromethane	--	--	--
1,2,3-Trichloropropane	--	2.0E+05	2.0E+05
1,2,4-Trimethylbenzene	--	2.7E+06	2.7E+06
1,3,5-Trimethylbenzene	--	1.9E+06	1.9E+06
Vinyl chloride	2.7E+03	4.2E+05	2.7E+03
Xylenes (total)	--	3.5E+06	3.5E+06

Notes:
-- = Not calculated
µg/L = microgram per liter
$RBTC_{GW.vapor-OA-C}$ = Risk-based target concentration, cancer, inhalation of vapor in outdoor air migrating from groundwater
$RBTC_{GW.vapor-OA-NC}$ = Risk-based target concentration, noncancer, inhalation of vapor in outdoor air migrating from groundwater

TABLE 5-15. Risk-Based Target Concentrations for Shallow Groundwater Analytes -- Construction Workers Exposed to Vapors from Groundwater Migrating to Trench Air
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	Vapors from Groundwater Migrating to Trench Air		
	$RBTC_{GW.vapor\text{-}TA\text{-}C}$ (µg/L)	$RBTC_{GW.vapor\text{-}TA\text{-}NC}$ (µg/L)	Minimum RBTC (µg/L)
Acenaphthene	--	8.4E+06	8.4E+06
Acenaphthylene	--	6.8E+06	6.8E+06
Anthracene	--	3.3E+07	3.3E+07
Benzene	9.2E+19	8.2E+20	9.2E+19
Benzo(a)anthracene	7.2E+07	--	7.2E+07
Bis(2-chloroethyl) ether	3.8E+06	2.2E+09	3.8E+06
Bis(2-chloro-1-methylethyl) ether	--	--	--
Bromobenzene	--	4.9E+07	4.9E+07
Bromochloromethane	--	2.2E+07	2.2E+07
Bromodichloromethane	4.2E+05	4.5E+06	4.2E+05
Bromoform	7.9E+07	--	7.9E+07
Bromomethane	--	3.4E+06	3.4E+06
4-Bromophenyl-phenyl ether	--	--	--
2-Butanone	--	3.3E+09	3.3E+09
n-Butylbenzene	--	4.1E+06	4.1E+06
sec-Butylbenzene	--	3.6E+06	3.6E+06
tert-Butylbenzene	--	4.7E+06	4.7E+06
Carbon tetrachloride	2.1E+05	3.4E+06	2.1E+05
Chlorobenzene	--	6.5E+07	6.5E+07
Chloroethane	--	8.8E+07	8.8E+07
Chloroform	2.9E+05	2.3E+07	2.9E+05
Chloromethane	--	6.6E+07	6.6E+07
2-Chloronaphthalene	--	1.9E+06	1.9E+06
2-Chlorophenol	--	1.0E+10	1.0E+10
4-Chlorophenyl-phenyl ether	--	--	--
2-Chlorotoluene	--	1.2E+08	1.2E+08
4-Chlorotoluene	--	6.1E+07	6.1E+07
Cumene	--	4.5E+06	4.5E+06
p-Cymene	--	2.0E+04	2.0E+04
Dibenzofuran	--	--	--
1,2-Dibromo-3-chloropropane	5.0E+04	8.6E+06	5.0E+04
Dibromochloromethane	--	--	--
1,2-Dibromoethane	1.0E+05	1.7E+06	1.0E+05
Dibromomethane	--	2.1E+07	2.1E+07
1,2-Dichlorobenzene	--	5.7E+08	5.7E+08
1,3-Dichlorobenzene	--	2.9E+08	2.9E+08
1,4-Dichlorobenzene	1.5E+06	2.8E+08	1.5E+06
Dichlorodifluoromethane	--	1.1E+06	1.1E+06
1,1-Dichloroethane	2.5E+06	--	2.5E+06
1,2-Dichloroethane	7.0E+05	1.8E+07	7.0E+05
1,1-Dichloroethene	--	4.6E+04	4.6E+04
cis-1,2-Dichloroethene	--	3.0E+07	3.0E+07
trans-1,2-Dichloroethene	--	2.6E+07	2.6E+07
1,2-Dichloropropane	2.5E+06	1.2E+06	1.2E+06
1,3-Dichloropropane	--	3.4E+06	3.4E+06
2,2-Dichloropropane	--	1.6E+05	1.6E+05
1,1-Dichloropropene	--	1.9E+05	1.9E+05
1,3-Dichloropropene	1.9E+06	3.8E+06	1.9E+06
1,4-Dioxane	4.2E+08	2.1E+10	4.2E+08

TABLE 5-15. Risk-Based Target Concentrations for Shallow Groundwater Analytes -- Construction Workers Exposed to Vapors from Groundwater Migrating to Trench Air
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical	Vapors from Groundwater Migrating to Trench Air		
	$RBTC_{GW.vapor\text{-}TA\text{-}C}$ (µg/L)	$RBTC_{GW.vapor\text{-}TA\text{-}NC}$ (µg/L)	Minimum RBTC (µg/L)
Ethyl tert-butyl ether	1.6E+08	7.1E+09	1.6E+08
Ethylbenzene	1.6E+06	5.1E+08	1.6E+06
Fluorene	--	1.7E+07	1.7E+07
Formaldehyde	3.1E+08	2.2E+09	3.1E+08
Hexachlorobenzene	1.0E+05	--	1.0E+05
Hexachlorobutadiene	4.0E+05	--	4.0E+05
Hexachlorocyclopentadiene	--	3.4E+07	3.4E+07
Hexachloroethane	1.8E+06	1.6E+10	1.8E+06
Methylene chloride	5.6E+08	8.3E+07	8.3E+07
1-Methylnaphthalene	--	3.7E+06	3.7E+06
2-Methylnaphthalene	--	3.5E+06	3.5E+06
Naphthalene	2.1E+06	3.1E+06	2.1E+06
Nitrobenzene	2.0E+07	2.2E+08	2.0E+07
2-Nitrophenol	--	6.7E+06	6.7E+06
Octachlorostyrene	--	--	--
Phenanthrene	--	3.2E+07	3.2E+07
n-Propylbenzene	--	5.1E+07	5.1E+07
Pyrene	--	1.7E+08	1.7E+08
Styrene	--	4.6E+08	4.6E+08
1,1,1,2-Tetrachloroethane	2.4E+06	--	2.4E+06
1,1,2,2-Tetrachloroethane	1.6E+06	--	1.6E+06
Tetrachloroethene	9.0E+06	1.4E+06	1.4E+06
Toluene	--	2.8E+08	2.8E+08
1,2,3-Trichlorobenzene	--	1.3E+07	1.3E+07
1,2,4-Trichlorobenzene	--	1.1E+07	1.1E+07
1,1,1-Trichloroethane	--	1.2E+08	1.2E+08
1,1,2-Trichloroethane	2.1E+06	5.1E+06	2.1E+06
Trichloroethene	7.2E+05	9.0E+04	9.0E+04
Trichlorofluoromethane	--	4.1E+06	4.1E+06
1,2,3-Trichloropropane	--	3.6E+05	3.6E+05
1,2,4-Trimethylbenzene	--	1.7E+07	1.7E+07
1,3,5-Trimethylbenzene	--	1.2E+07	1.2E+07
Vinyl chloride	1.3E+05	8.2E+05	1.3E+05
Xylenes (total)	--	2.7E+07	2.7E+07

Notes:
-- = Not calculated
µg/L = microgram per liter
$RBTC_{GW.vapor\text{-}TA\text{-}C}$ = Risk-based target concentration, cancer, inhalation of vapor in trench air migrating from groundwater
$RBTC_{GW.vapor\text{-}TA\text{-}NC}$ = Risk-based target concentration, noncancer, inhalation of vapor in trench air migrating from groundwater

TABLE 5-16. Summary of Estimated Shallow Groundwater Cancer Risks and Noncancer Hazard Indices

Nevada Environmental Response Trust Site

Henderson, Nevada

Scenario[1,2]	Total Cancer Risk	Total Noncancer HI
Indoor Commercial/Industrial Worker (Slab-on-grade)	2E-12 - 1E-04	0.0000003 - 0.4
Outdoor Commercial/Industrial Worker	3E-07	0.001
Construction Worker	2E-15 - 7E-08	0.000000003 - 0.003
Indoor Commercial/Industrial Worker (Basement Scenario)	3E-12 - 7E-07	0.0000004 - 0.003
Indoor Commercial/Industrial Worker (Trailer Scenario)	2E-07 - 1E-04	0.0005 - 0.2

Notes:

HI = Hazard index

OU = Operable unit

VOC = volatile organic compound

UCL = Upper confidence limit

[1] The cancer risk and non-cancer chronic HI estimates for the indoor commercial/industrial workers and construction workers were based on the maximum by sample risk/HI results for each scenario.

[2] The cancer risk and non-cancer chronic HI for the outdoor commercial/industrial workers were estimated based on the 95% UCLs on the mean groundwater concentrations over the entire Operations Area of OU-1.

TABLE 7-1. Soil Gas Data Quality Assessment for Indoor Commercial/Industrial Worker and Construction Worker Scenarios
Nevada Environmental Response Trust Site
Henderson, Nevada

Medium	Soil Gas (5 ft bgs)						Soil Gas (15 ft bgs)					
Exposure Scenario	Indoor Commercial/ Industrial Worker (Slab-on-grade) and Construction Worker		Indoor Commercial/ Industrial Worker (Basement Scenario)		Indoor Commercial/ Industrial Worker (Trailer Scenario)		Indoor Commercial/ Industrial Worker (Slab-on-grade) and Construction Worker		Indoor Commercial/ Industrial Worker (Basement Scenario)		Indoor Commercial/ Industrial Worker (Trailer Scenario)	
Sample Size [1]	25		5		2		29		9		2	
P_1 [2]	0	0	0	0	0	0	0	0	0	0	0	0
Sample Count for Effect Size	1	2	1	2	1	2	1	2	1	2	1	2
Effect size [3]	0.040	0.080	0.20	0.40	0.50	1.0	0.034	0.069	0.11	0.22	0.50	1.0
P_2 [4]	0.040	0.080	0.20	0.40	0.50	1.0	0.034	0.069	0.11	0.22	0.50	1.0
Number of Sample Locations Required [5]												
β=15%	47	23	9	4	3	NA	55	27	17	8	3	NA
β=20%	40	20	8	4	3	NA	47	23	14	7	3	NA
β=25%	34	17	7	3	2	NA	41	20	12	6	2	NA

Notes:

bgs = below ground surface

ft = feet

NA = not available

[1] Sample size is the number of sample locations from Remedial Investigation.

[2] P_1 is the proportion of sample locations with cancer risk or hazard index exceeding the target cancer risk (set as 1.49×10^{-4}, which can be rounded to 1×10^{-4}) or the target hazard index (set as 1.49, which can be rounded to 1) as specified in the null hypothesis. Input 0.000001 in G*Power when P1 is zero, because the minimum input is 0.000001 in Gpower.

[3] Effect size is population proportion, set to defined number of samples over total number of samples.

[4] P_2 is P_1 plus effect size.

[5] Calculations were conducted using the Exact – Generic binomial test in the software program G*Power.

TABLE 7-2. Soil Gas Data Quality Assessment for Outdoor Commercial/Industrial Worker Scenario
Nevada Environmental Response Trust Site
Henderson, Nevada

Medium	Soil Gas (5 ft bgs)		Soil Gas (15 ft bgs)	
Exposure Scenario	Outdoor Commercial/Industrial Worker			
Cancer Risk or HI	Cancer Risk	HI	Cancer Risk	HI
Target Cancer Risk or Target HI [1]	1.49×10^{-4}	1.49	1.49×10^{-4}	1.49
Total Cancer Risk/HI based on 95% UCL[2]	2E-09	0.000003	5E-09	0.000008
Cancer Risk/HI Driver	Chloroform	Chloroform	Chloroform	Chloroform
95% UCL of Driver Chemical Concentration (µg/m^3)	18,400	18,400	152,000	152,000
Cancer Risk/HQ based on 95%UCL of Driver Chemical	1.9E-09	0.0000024	5.3E-09	0.0000066
SD of Driver Chemical Concentration (µg/m^3)	16,521	16,521	159,518	159,518
SD of Cancer Risk/HQ from Driver Chemical [3]	1.7E-09	2.2E-06	5.6E-09	6.9E-06
Number of Sample Locations Required[4]	2	2	2	2
Sample Size [5]	25	25	29	29

Notes:
bgs = below ground surface
ft = feet
µg/m^3 = microgram per cubic meter
HI = Hazard index
HQ = Hazard quotient
SD = Standard deviation
UCL = Upper confidence limit

[1] Target cancer risk is set as 1.49×10^{-4}, which can be rounded to 1×10^{-4}. Target HI is set as 1.49, which can be rounded to 1. These values were input as $Mean_1$ in G*Power, indicating an alternative hypothesis that the mean of the population total cancer risk or HI is greater than target cancer risk or target HI.

[2] The values were input as $Mean_0$ in G*Power, indicating a null hypothesis that the mean of the population total cancer risk or noncancer HI is the same as the total cancer risk or noncancer HI based on the 95% UCL of sample results.

[3] It was assumed that the SD of total cancer risk/HI is similar to the SD of cancer risk/HQ from the driver chemical. These values were input as SD in G*Power to calculate corresponding effect size.

[4] Calculations were conducted using the t tests - Means: difference from constant (one sample case) in the software program G*Power.

[5] Sample size is the number of sample locations from Remedial Investigation.

TABLE 7-3. Shallow Groundwater Data Quality Assessment for Indoor Commercial/Industrial Worker and Construction Worker Scenarios

Nevada Environmental Response Trust Site

Henderson, Nevada

Medium	Groundwater					
Exposure Scenario	Indoor Commercial/ Industrial Worker (Slab-on-grade) and Construction Worker		Indoor Commercial/ Industrial Worker (Basement Scenario)		Indoor Commercial/ Industrial Worker (Trailer Scenario)	
Sample Size [1]	119		11		2	
P_1 [2]	0	0	0	0	0	0
Sample Count for Effect Size	1	2	1	2	1	2
Effect size [3]	0.0084	0.017	0.091	0.18	0.50	1.0
P_2 [4]	0.0084	0.017	0.091	0.18	0.50	1.0
Number of Samples Required [5]						
β=15%	225	111	20	10	3	NA
β=20%	191	94	17	9	3	NA
β=25%	165	81	15	7	2	NA

Notes:

NA = not available

[1] Sample size is the number of sample locations.

[2] P_1 is the proportion of sample locations with cancer risk or hazard index exceeding the target cancer risk (set as 1.49×10^{-4}, which can be rounded to 1×10^{-4}) or the target hazard index (set as 1.49, which can be rounded to 1) as specified in the null hypothesis. Input 0.000001 in G*Power when P1 is zero, because the minimum input is 0.000001 in Gpower.

[3] Effect size is population proportion, set to defined number of samples over total number of samples.

[4] P_2 is P_1 plus effect size.

[5] Calculations were conducted using the Exact – Generic binomial test in the software program G*Power.

TABLE 7-4. Shallow Groundwater Data Quality Assessment for Outdoor Commercial/Industrial Worker Scenario

Nevada Environmental Response Trust Site
Henderson, Nevada

Medium	Groundwater	
Exposure Scenario	Outdoor Commercial/Industrial Worker	
Cancer Risk or HI	Cancer Risk	HI
Target Cancer Risk or Target HI [1]	1.49×10^{-4}	1.49
Cancer Risk/HI based on 95% UCL[2]	3E-07	0.001
Cancer Risk/HI Driver	Chloroform	Chlorobenzene
95% UCL of Driver Chemical Concentration (µg/L)	1,560	1,550
Cancer Risk/HQ based on 95%UCL of Driver Chemical	2.6E-07	0.00046
SD of Driver Chemical Concentration (µg/L)	2,944	3,594
SD of Cancer Risk/HQ from Driver Chemical [3]	4.9E-07	0.0011
Number of Samples Required[4]	2	2
Sample Size [5]	119	119

Notes:
µg/L = microgram per liter
HI = Hazard index
HQ = Hazard quotient
SD = Standard deviation
UCL = Upper confidence limit

[1] Target cancer risk is set as 1.49×10^{-4}, which can be rounded to 1×10^{-4}. Target HI is set as 1.49, which can be rounded to 1. These values were input as $Mean_1$ in G*Power, indicating an alternative hypothesis that the mean of the population total cancer risk or HI is greater than target cancer risk or target HI.

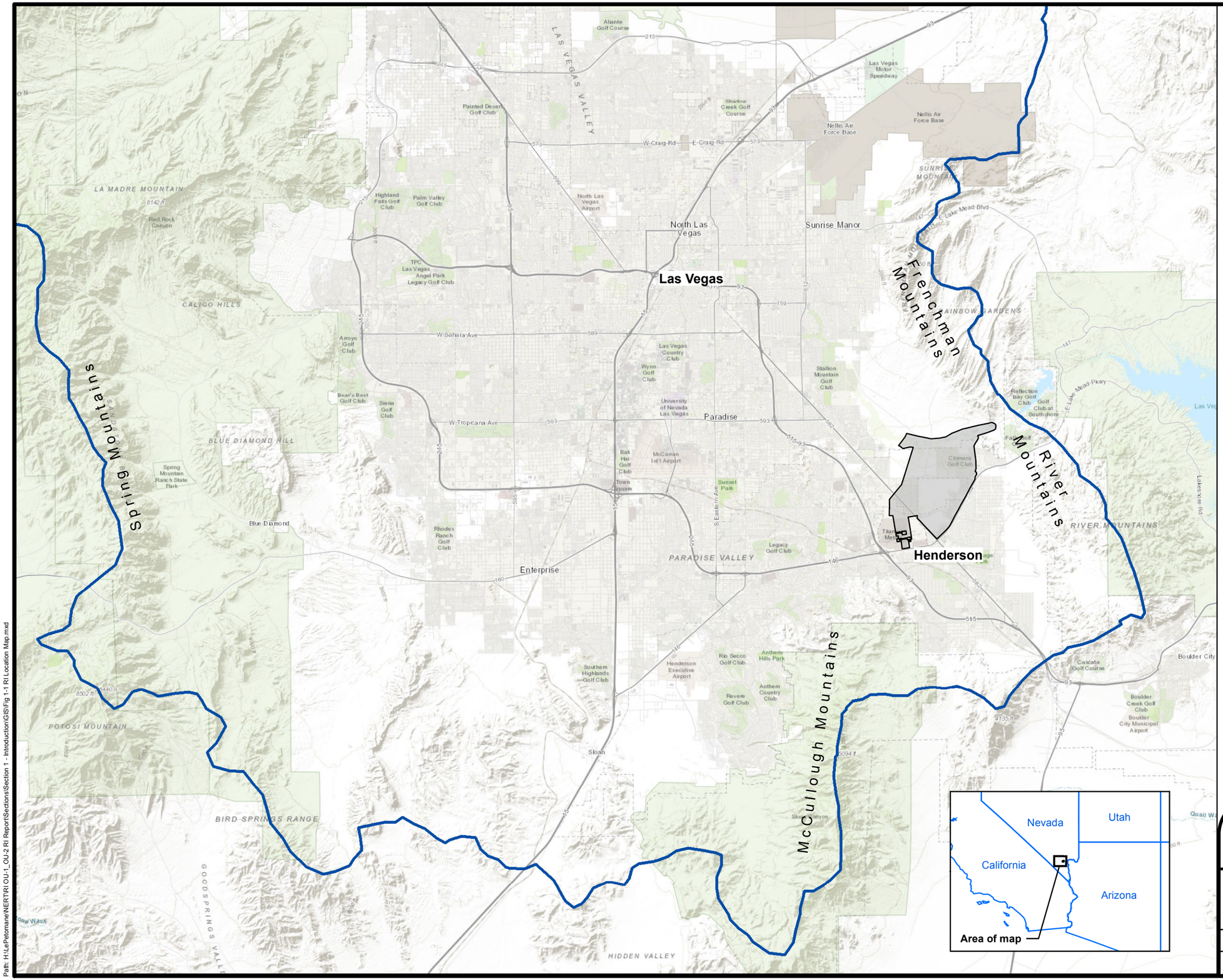
[2] The values were input as $Mean_0$ in G*Power, indicating a null hypothesis that the mean of the population total cancer risk or non-cancer HI is the same as the total cancer risk or noncancer HI based on the 95% UCL of sample results.

[3] It was assumed that the SD of total cancer risk/HI is similar to the SD of cancer risk/HQ from the driver chemical. These values were input as SD in G*Power to calculate corresponding effect size.

[4] Calculations were conducted using the t tests - Means: difference from constant (one sample case) in the software program G*Power.

[5] Sample size is the number of sample locations.

FIGURES



LEGEND:

- Las Vegas Valley Hydrologic Basin
- NERT RI Study Area

Note:
See Figure 1-2 for NERT RI Study Area details.

N

0 2.5 5 Miles

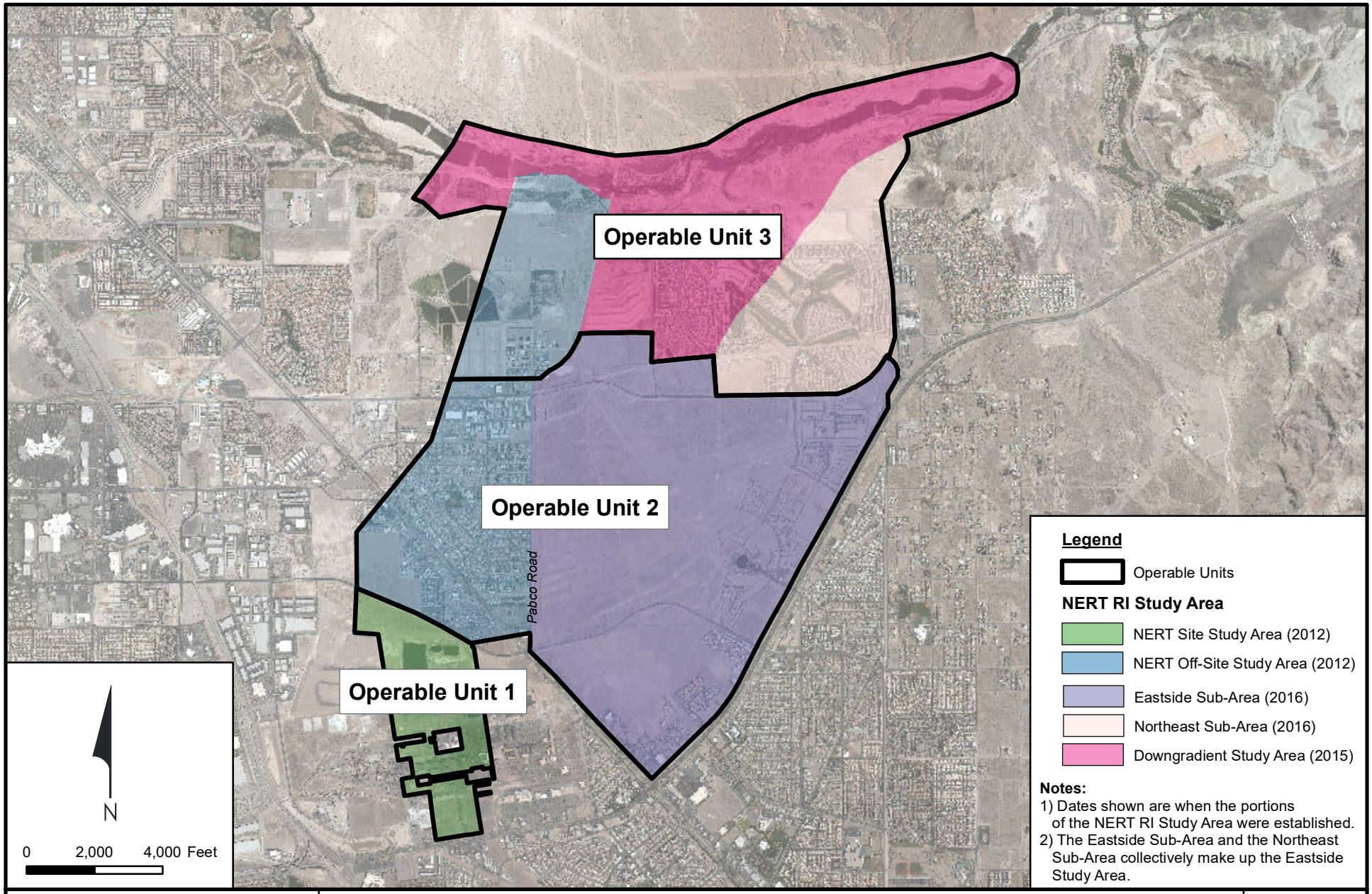
RAMBOLL

NERT RI Study Area Location Map

Nevada Environmental Response Trust Site
Henderson, Nevada

Date:	Contract Number:		Figure
5/31/2023	1690029369-006		ES-1
Drafter: RS	Approved:	Revised:	

Path: H:\LePetomane\NERT\RI OU-1_OU-2 RI Report\Sections\Section 1 - Introduction\GIS\Fig 1-1 RI Location Map.mxd



RAMBOLL

NERT RI Study Area Operable Units
Nevada Environmental Response Trust Site
Henderson, Nevada

Figure
ES-2

Drafter: RS Date: 5/31/2023 Contract Number: 1690029369-006 Approved: Revised:

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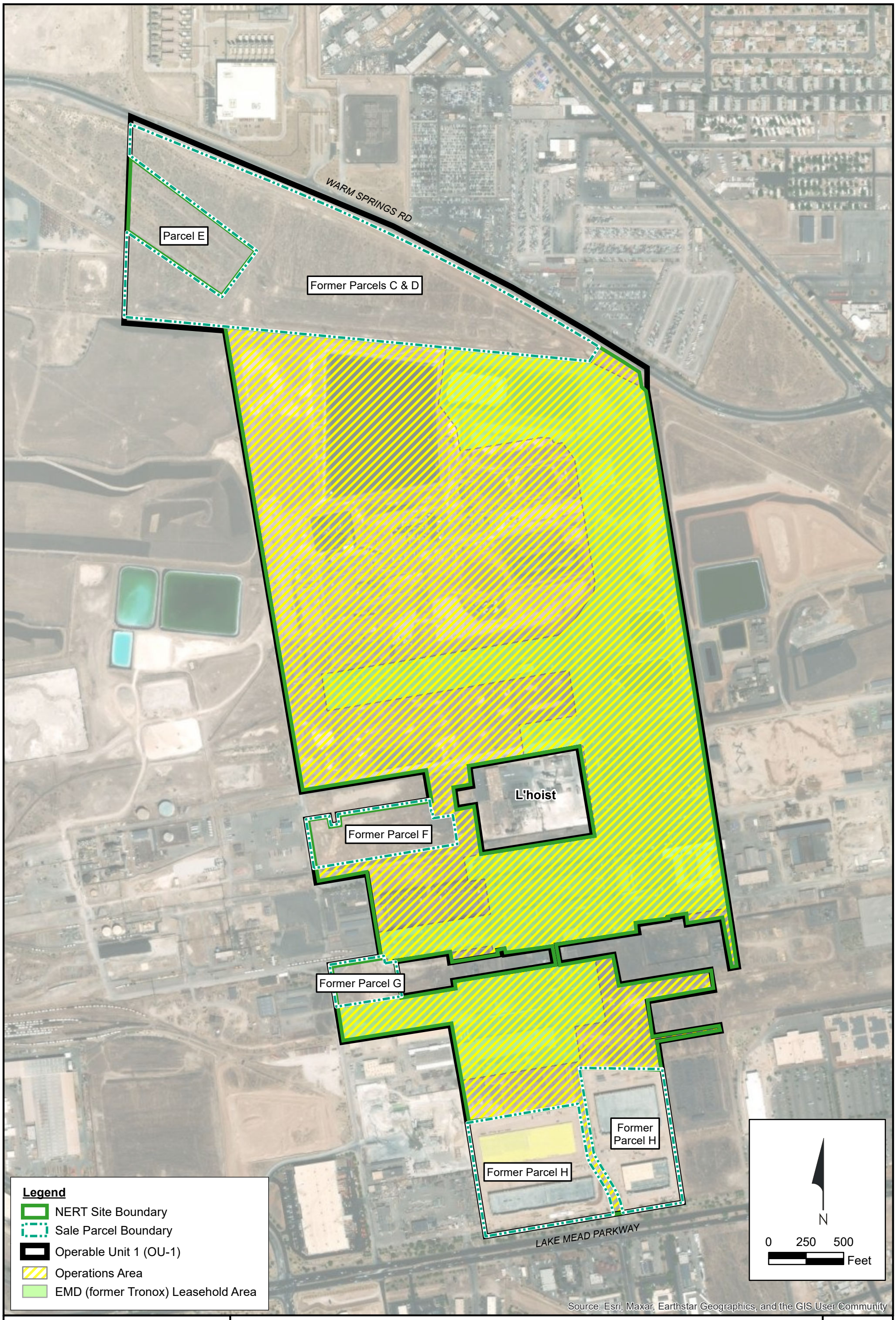


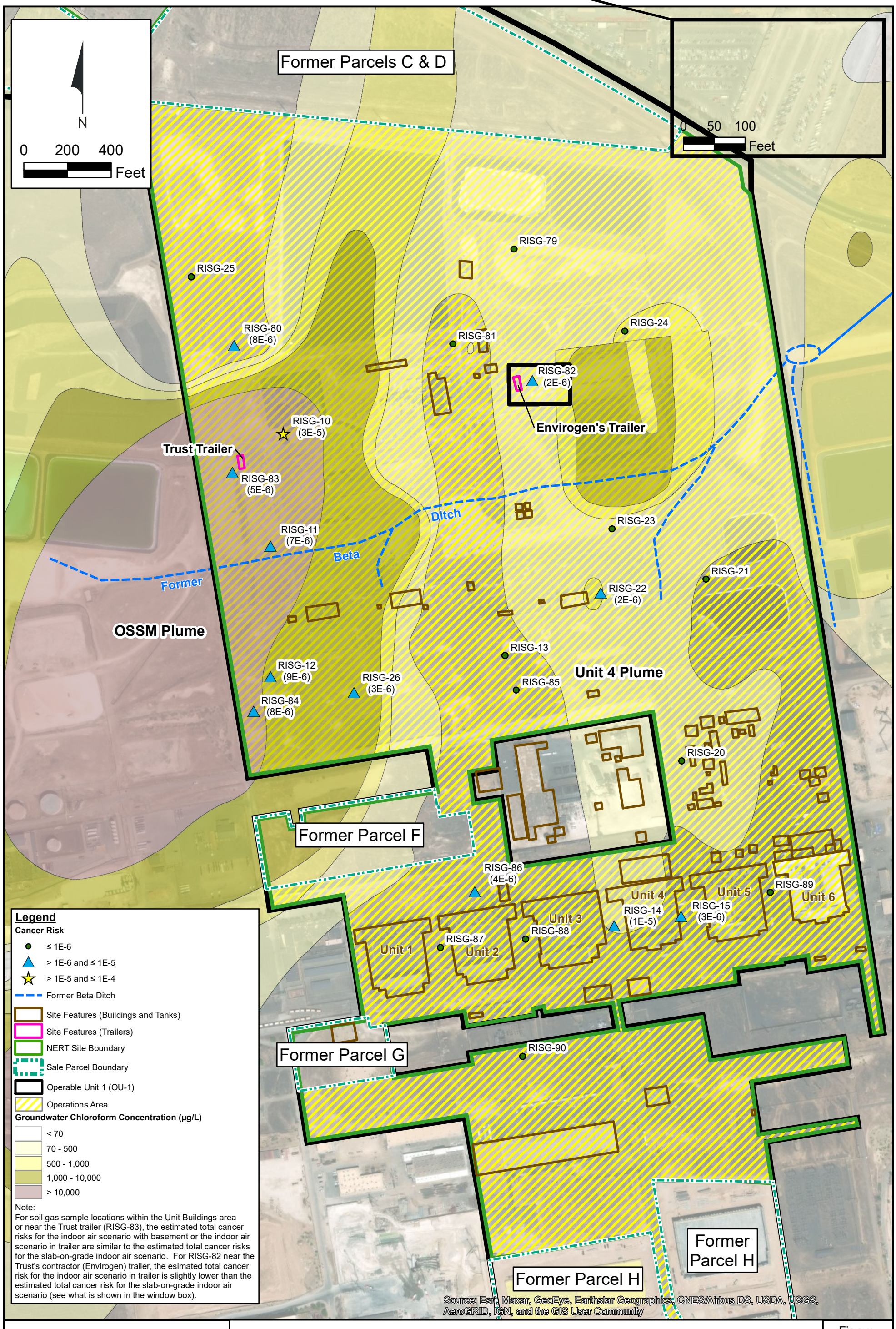
RAMBOLL

Layout of Operable Unit 1
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
ES-3

Drafter: RS | Date: 9/6/2023 | Contract Number: 169002 9369-006 | Approved by: | Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\GIS\MXD\Fig1_BHRAFacilityArea-TronoxLeasehold_BoundaryUpdate.mxd



Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Fig 5-2 Cancer Risk IA 5 ft SG.mxd

RAMBOLL

Estimated Total Cancer Risk for Indoor Commercial/Industrial Workers - Soil Gas at 5 feet bgs (Chloroform Plumes as Depicted in the RI Report for OU-1 and OU-2)
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
ES-4

Drafter: JA	Date: 10/31/2023	Contract Number: 1690029369-006	Approved by:	Revised:

Former Parcels C & D

N

0 200 400

Feet

RISG-25

RISG-80

RISG-79

RISG-81

RISG-24

RISG-82

RISG-10 (1E-4)

Envirogen's Trailer

Trust Trailer

RISG-83 (5E-6)

Ditch

RISG-23

RISG-11 (4E-6)

Beta

Former

RISG-21

RISG-22

OSSM Plume

RISG-13

Unit 4 Plume

RISG-12 (6E-6)

RISG-26 (3E-6)

RISG-85

RISG-84 (1E-5)

RISG-20

Former Parcel F

RISG-86

RISG-17 (3E-5)

Unit 4

RISG-16 (5E-6)

Unit 5

RISG-89

Unit 6

Unit 3

RISG-14 (1E-5)

RISG-15 (5E-6)

Unit 1

RISG-87

Unit 2

RISG-88

RISG-18 (8E-6)

RISG-19 (1E-5)

Former Parcel G

RISG-90

Indoor Air Scenario with Basement

Unit 5

RISG-17 (8E-5)

RISG-16 (2E-5)

Unit 3

Unit 4

RISG-15 (2E-5)

RISG-14 (3E-5)

RISG-19 (4E-5)

RISG-18 (3E-5)

0 100 200

Feet

Former Parcel H

Former Parcel H

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Cancer Risk

- ≤ 1E-6
- > 1E-6 and ≤ 1E-5
- > 1E-5 and ≤ 1E-4

Former Beta Ditch

Site Features (Buildings and Tanks)

Site Features (Trailers)

NERT Site Boundary

Sale Parcel Boundary

Operable Unit 1 (OU-1)

Operations Area

Groundwater Chloroform Concentration (µg/L)

- < 70
- 70 - 500
- 500 - 1,000
- 1,000 - 10,000
- > 10,000

Note:
For soil gas sample locations within the Unit Buildings area (except Unit 4 Building) or near the Trust trailer (RISG-83) or the Trust's contractor (Envirogen) trailer (RISG-82), the estimated total cancer risks for the indoor air scenario with basement or the indoor air scenario in trailer are similar to the estimated total cancer risks for the slab-on-grade indoor air scenario. For soil gas locations beneath or near the Unit 4 Building, the esimated total cancer risk for the indoor air scenario with basement is higher than the estimated total cancer risk for the slab-on-grade indoor air scenario (see what is shown in the window box).

RAMBOLL

Estimated Total Cancer Risk for Indoor Commercial/Industrial Workers - Soil Gas at or around 15 feet bgs (Chloroform Plumes as Depicted in the RI Report for OU-1 and OU-2)

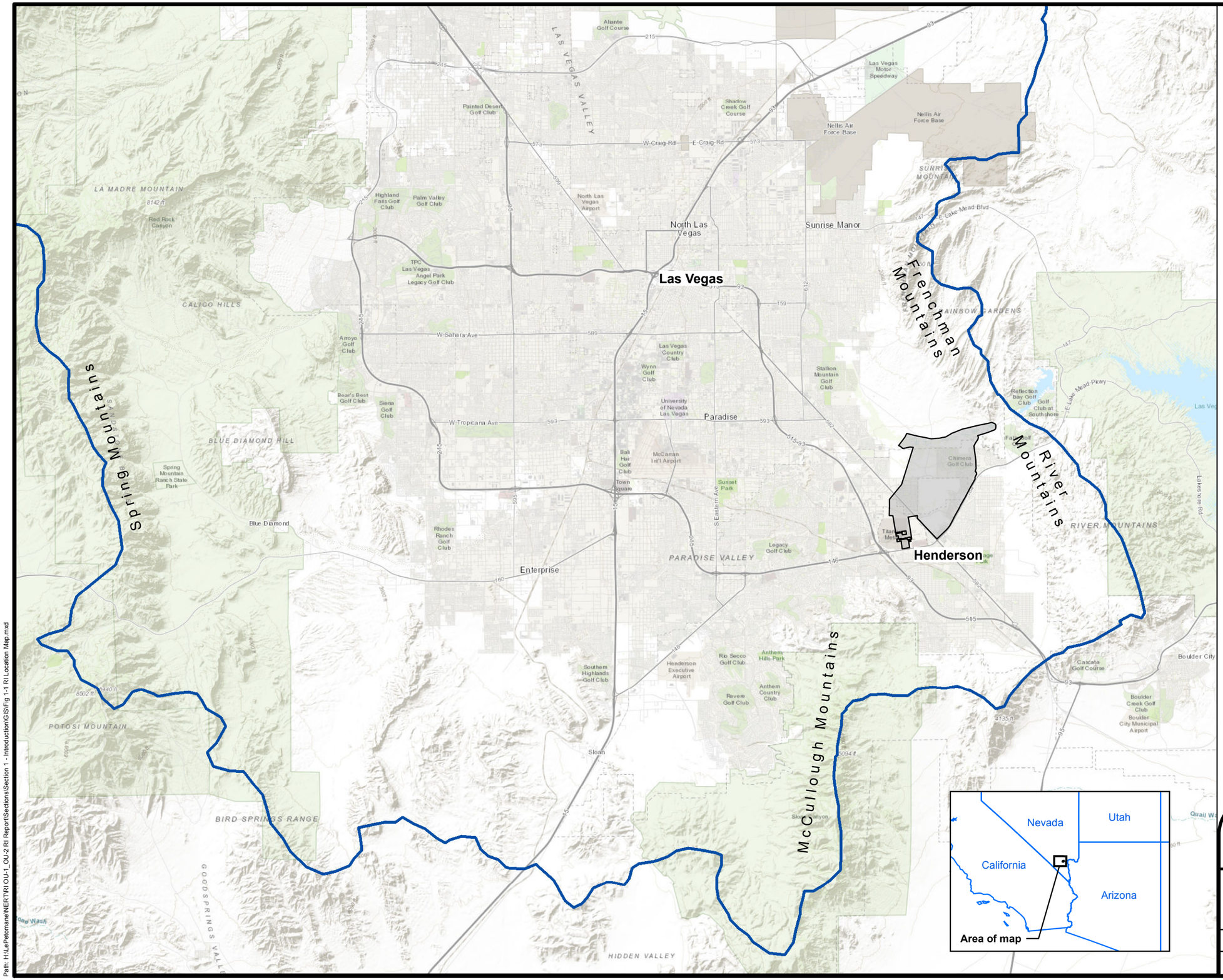
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure

ES-5

Drafter: JA | Date: 10/31/2023 | Contract Number: 1690029369-006 | Approved by: | Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Fig 5-3 Cancer Risk IA 15 ft SG.mxd



LEGEND:

- Las Vegas Valley Hydrologic Basin
- NERT RI Study Area

Note:
See Figure 1-2 for NERT RI Study Area details.

N

0 2.5 5 Miles

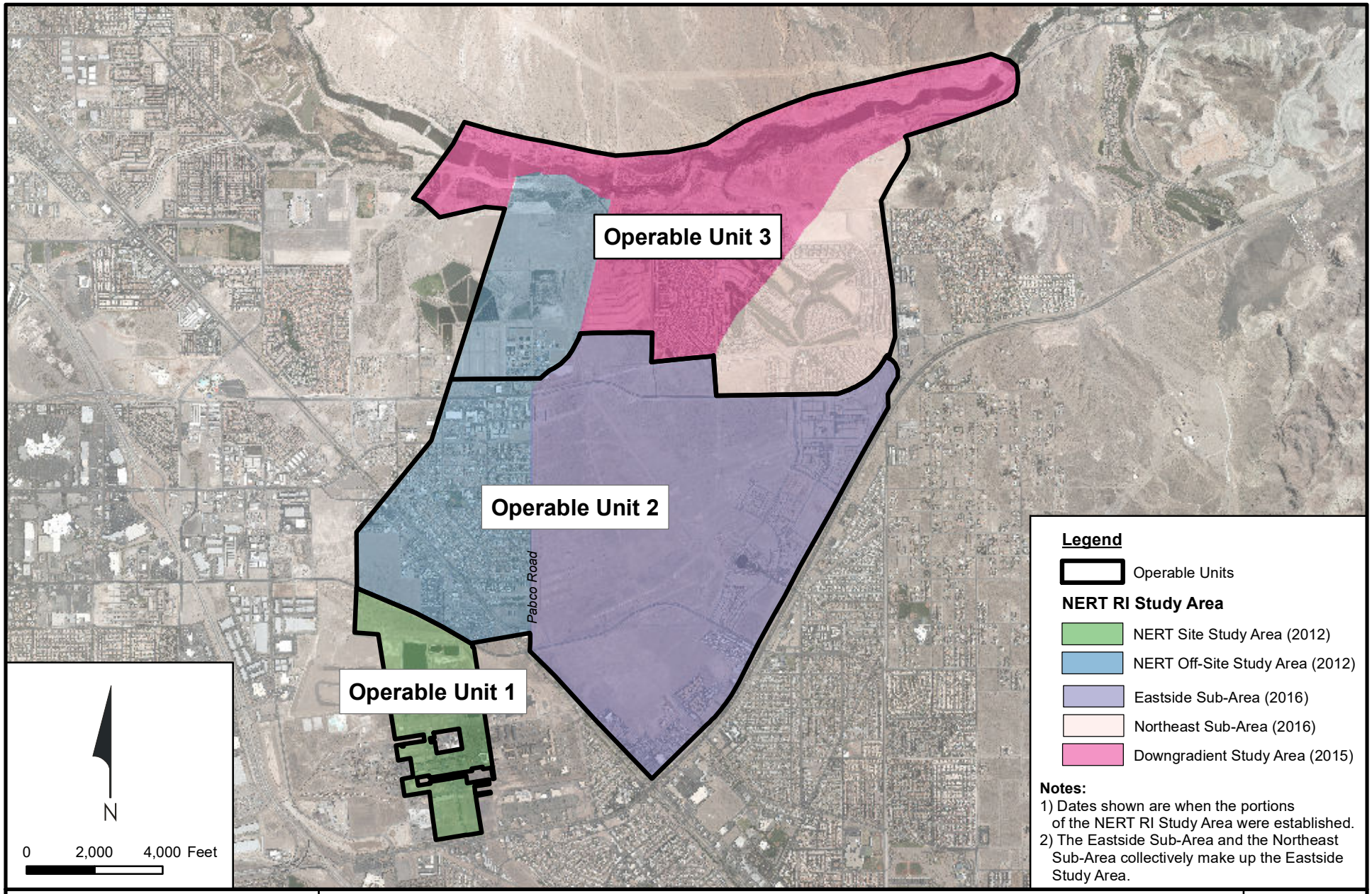
RAMBOLL

NERT RI Study Area Location Map

Nevada Environmental Response Trust Site
Henderson, Nevada

Date:	Contract Number:		Figure
5/31/2023	1690029369-006		1-1
Drafter: RS	Approved:	Revised:	

Path: H:\LePetomane\NERT\RI OU-1_OU-2 RI Report\Sections\Section 1 - Introduction\GIS\Fig 1-1 RI Location Map.mxd



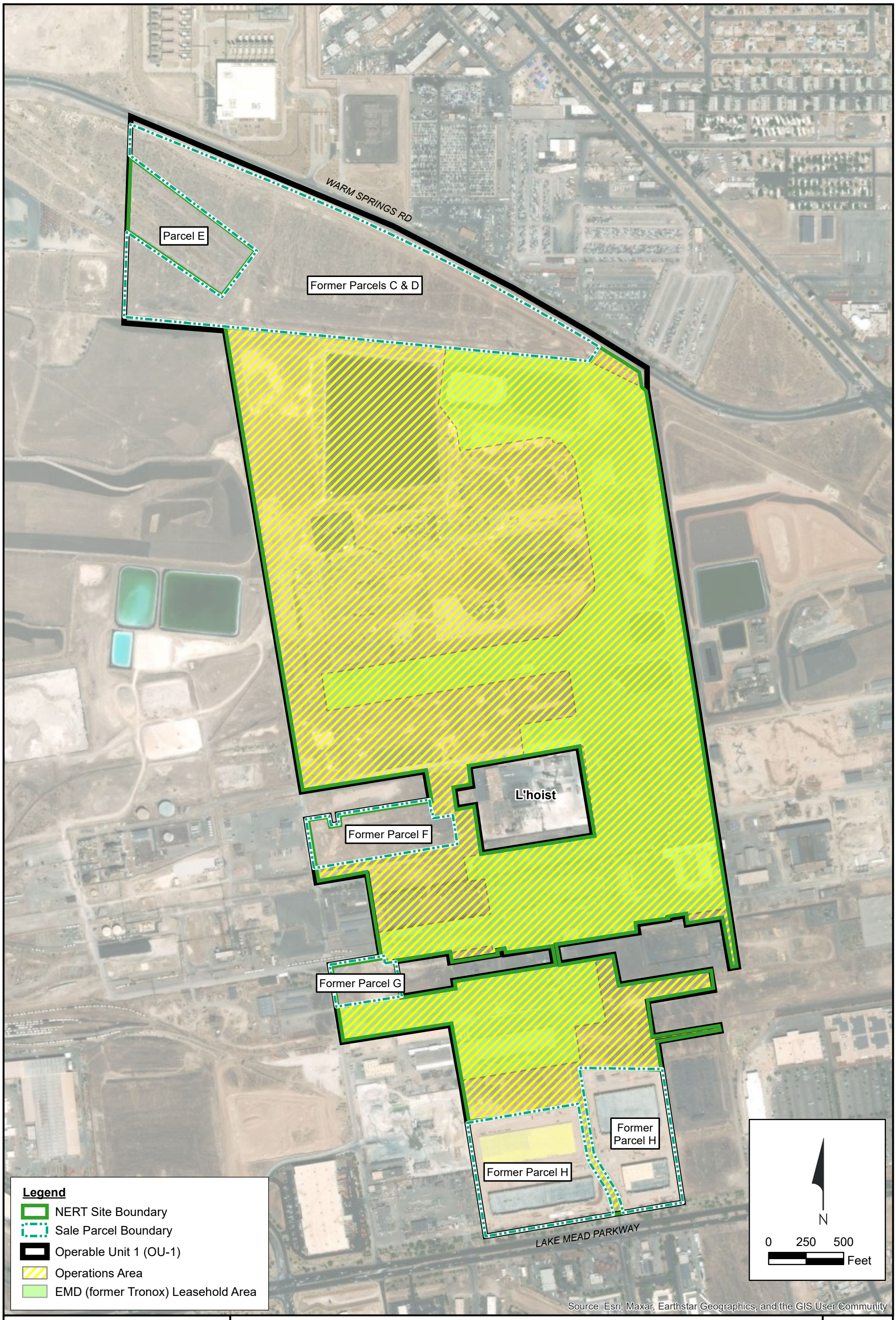
RAMBOLL

NERT RI Study Area Operable Units
Nevada Environmental Response Trust Site
Henderson, Nevada

Figure
1-2

Drafter: RS Date: 5/31/2023 Contract Number: 1690029369-006 Approved: Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil BHRA\GIS\Fig 1-2 RI Study Area Operable Units.mxd



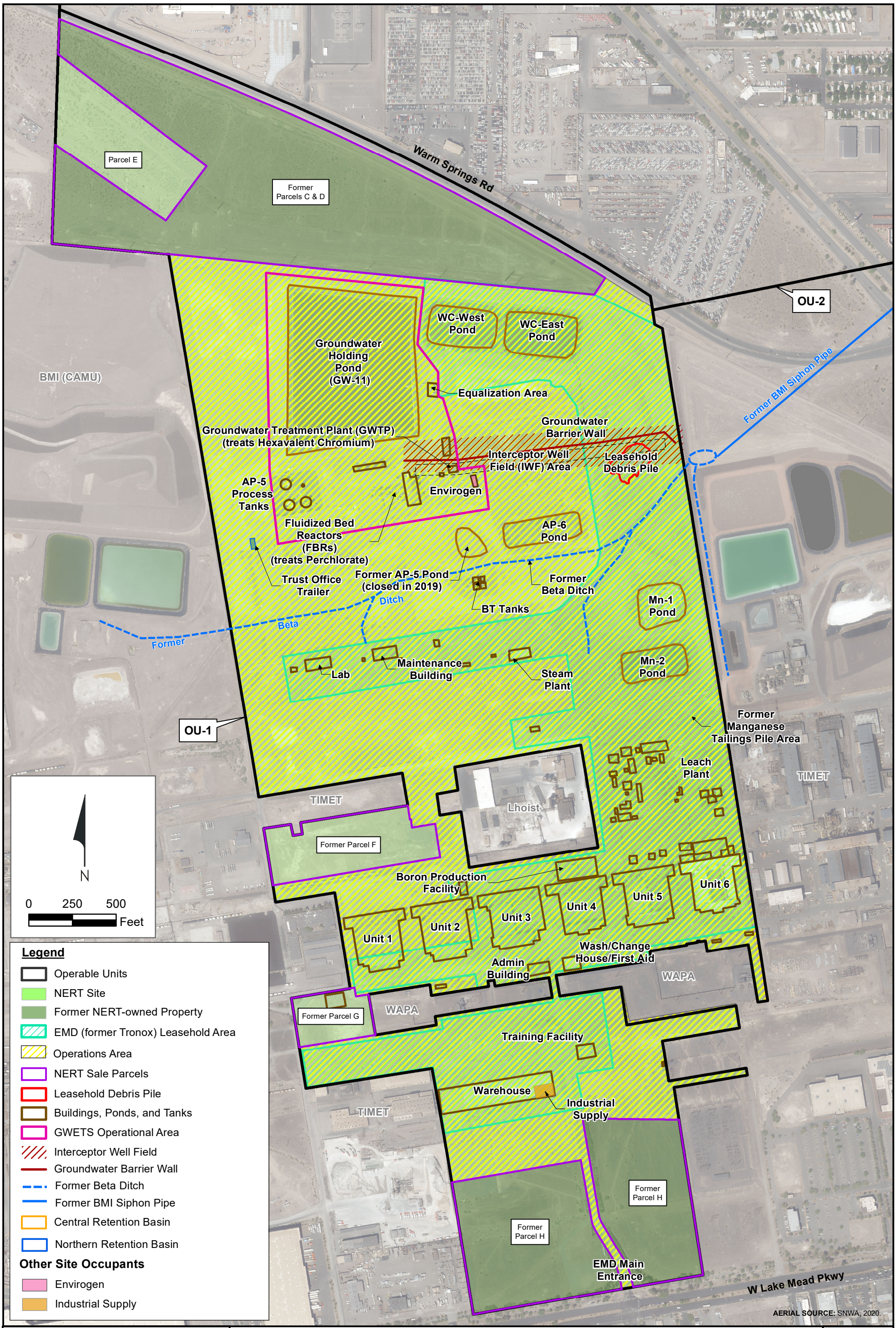
RAMBOLL

Layout of Operable Unit 1
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
1-3

Drafter: RS | Date: 9/6/2023 | Contract Number: 169002 9369-006 | Approved by: | Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\GIS\MXD\Fig1_BHRAFacilityArea-TronoxLeasehold_BoundaryUpdate.mxd

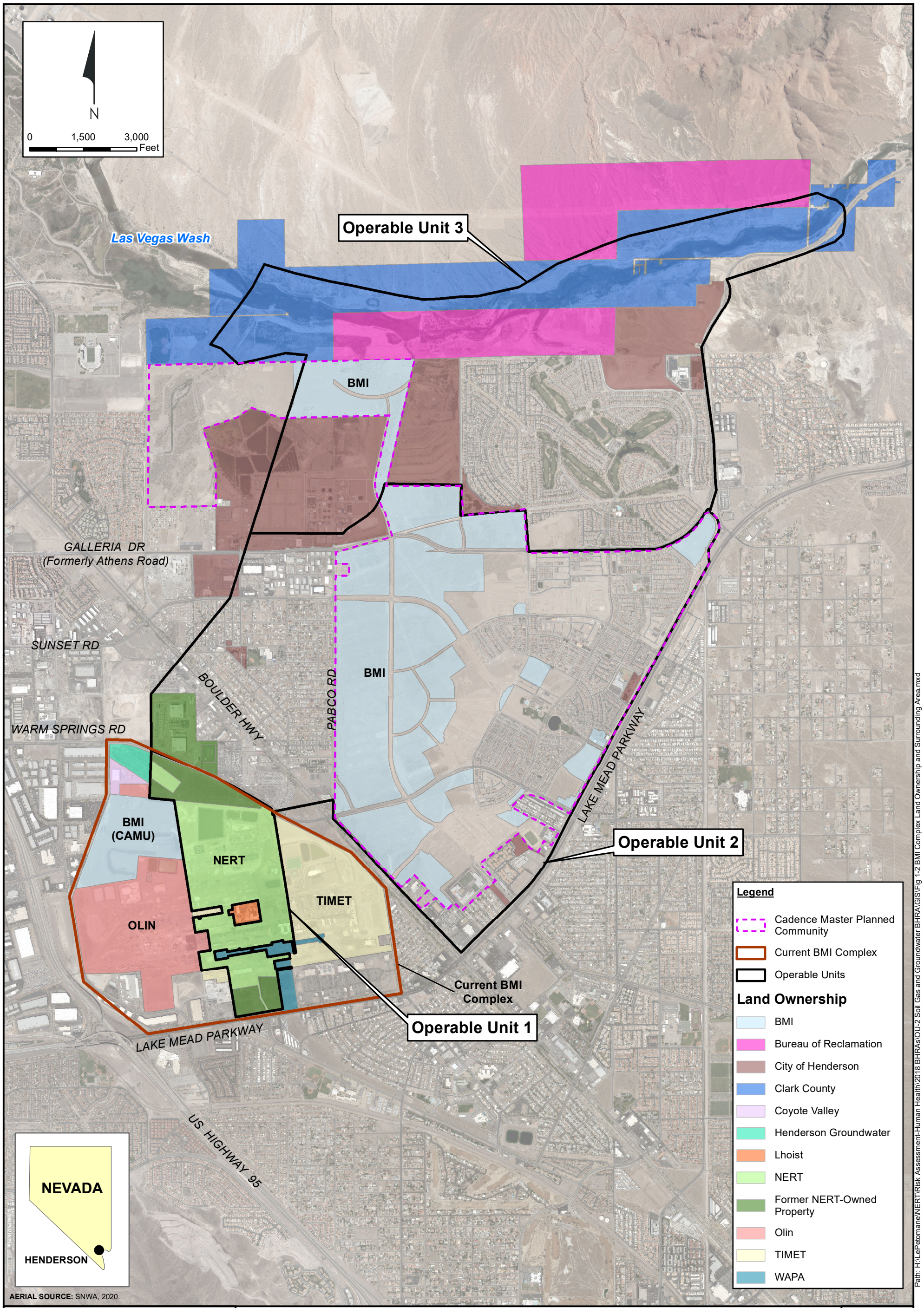


RAMBOLL

Operations Area Features
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
1-4

Drafter: RS/JC | Date: 10/30/2023. | Contract Number: 169002 9369-006 | Approved by: | Revised:

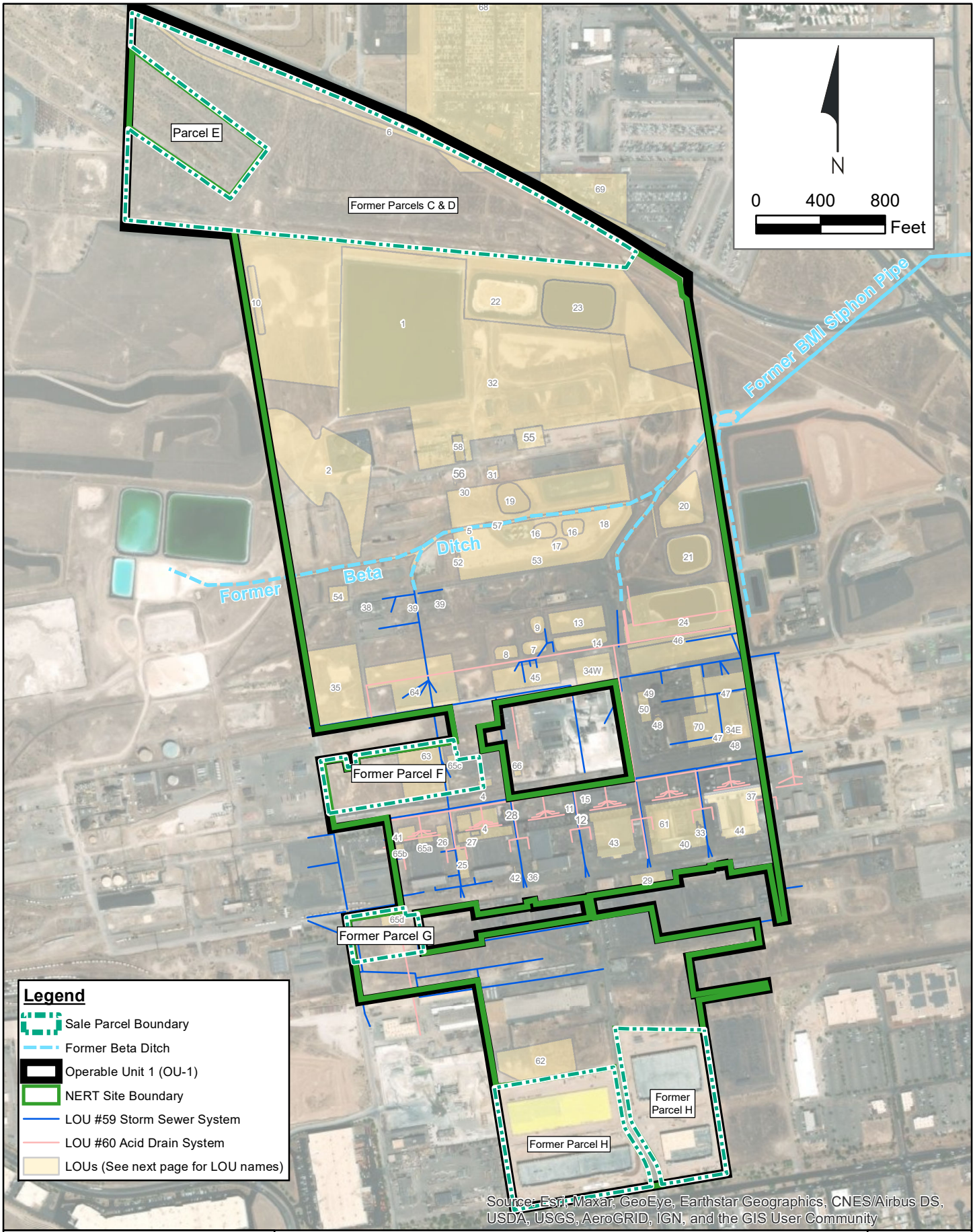


RAMBOLL

Major Land Ownership in the RI Study Area
Nevada Environmental Response Trust Site
Henderson, Nevada

Figure
2-1

Drafter: RS/JC	Date: 5/31/2023	Contract Number: 1690029369-006	Approved by:	Revised:



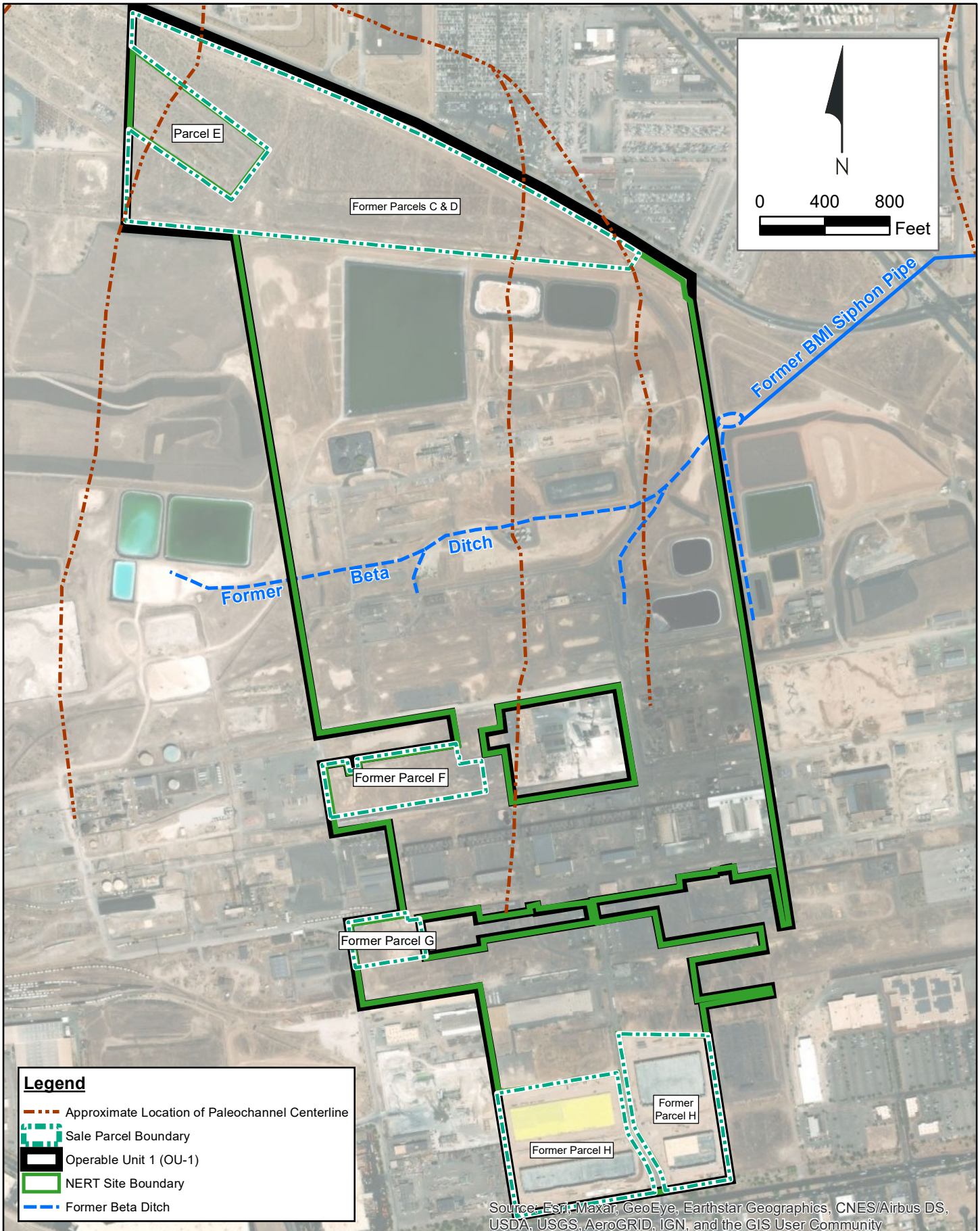
Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-3 BHRA Work Plan\GIS\Figure 2-2 LOU_former_ditch.mxd

RAMBOLL

Letter of Understanding (LOU) Map
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **2-2**

Drafter: RS | Date: 10/30/2023 | Contract Number: 169002 9369-006 | Approved by: | Revised:



RAMBOLL

Operable Unit 1 Paleochannel Feature

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **2-3**

Drafter: SS | Date: 10/30/2023 | Contract Number: 1690029369-006 | Approved by: | Revised:

Path: \\WCEVLFPS1\eng\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Figure 2-3 OU-1 Paleochannel.mxd

Former Parcels C & D

N

0 200 400

Feet

SG19 SG90 SG24 SG91

SG92 RISG-79 SG93

RISG-25

SG20 SG52 RISG-80

RISG-81 RISG-24

SG23 RISG-82

SG21 SG22

RISG-10 SG54 SG87 SG25

RISG-83 SG26

SG57 SG56 SG55 SG82 SG81 SG80

Ditch

RISG-11 SG31 SG79 RISG-23

Beta

Former

SG58 SG59 SG86 RISG-21

SG30 SG28 RISG-22

SG29 SG27 SG78 SG76

SG60

OSSM Plume

RISG-13 SG77 SG75

SG32 SG83 SG89 Unit 4 Plume

RISG-12 RISG-26 SG62 RISG-85

RISG-84 SG94

SG33

SG61 SG63

RISG-20

SG84

Former Parcel F

SG74 SG40 SG36 SG37

RISG-86 RISG-89

SG88 RISG-17 RISG-16

Unit 3 SG70 Unit 4 Unit 5 Unit 6

RISG-14 RISG-15

SG71 SG38

RISG-88 SG69 RISG-19

RISG-87 RISG-18

Unit 1 Unit 2

SG41 SG43

SG44 SG64 SG65 SG42

Former Parcel G

SG46 RISG-90

SG48

SG45

SG68

SG47 SG66 SG67

Former Parcel H

Former Parcel H

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Locations with both shallow (at 5 ft bgs) and deep (at or around 15 ft bgs) soil gas samples collected
- Locations with only shallow (at 5 ft bgs) soil gas samples collected
- Locations with only deep (at or around 15 ft bgs) soil gas samples collected
- Sale Parcel Boundary
- NERT Site Boundary
- Site Features (Buildings and Tanks)
- Operable Unit 1 (OU-1)
- OSSM Site
- Former Beta Ditch
- Paleochannel

Groundwater Chloroform Concentration (µg/L)

- < 70
- 70 - 500
- 500 - 1,000
- 1,000 - 10,000
- > 10,000

RAMBOLL

Soil Gas Probes Included in the BHRA
(Chloroform Plumes as Depicted in the RI Report for OU-1 and OU-2)
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **3-1**

Drafter: SS | Date: 10/31/2023 | Contract Number: 1690029369-006 | Approved by: | Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Fig 3-1 SG Sample location.mxd

Former Parcels C & D

N

0 200 400

Feet

M-6A M-7B M-205 M-206 M-207 M-209 M-211 M-208 M-214 M-203 M-215 M-217 M-219 M-216 M-242 M-245 M-83 M-81A M-80 M-79 M-133 M-74 M-73 M-72 M-176 M-177 M-5A MW-16(NERT) M-134 M-135 M-140 M-70 M-164 M-71 M-58 M-56 M-60 M-175 M-68 M-160 M-69 M-55 M-78 M-174 M-67 M-169 M-170 M-173 M-131 M-172 M-66 M-57A M-166 M-167 M-168 M-65 M-64 UFMW-02D UFMW-03D M-126 UFMW-01D M-25 M-38 M-36D M-22A M-22D M-14A M-37 UFMW-06D M-19 UFMW-04D UFMW-05D DFW-05 DFW-03 DFW-04 Ditch M-202 M-125 Beta M-229 DFW-06 M-35 M-147 Former M-2A M-142 M-75 M-76 M-115 M-128 OSSM Plume M-123 Unit 4 Plume M-32 M-33 M-148A M-223 M-21D M-31A M-124 M-141 M-226 M-77R M-77 M-52 M-97 Former Parcel F M-12A M-11 M-13 M-145 M-237 M-251-60 M-193 Unit 5 Unit 6 M-249-60 M-192 Unit 4 M-191 M-139 Unit 1 Unit 2 Unit 3 M-190 M-189 M-144 M-146 Former Parcel G M-10 M-137 M-138 Former Parcel H Former Parcel H

Legend

- Shallow groundwater wells suitable for vapor intrusion assessment
- Shallow groundwater wells with saturated screen thickness greater than 10 ft
- Shallow groundwater wells with top screen depth deeper than 5 ft from water table
- Sale Parcel Boundary
- NERT Site Boundary
- Site Features (Buildings and Tanks)
- Operable Unit 1 (OU-1)
- OSSM Site
- Former Beta Ditch
- Paleochannel

Groundwater Chloroform Concentration (µg/L)

- < 70
- 70 - 500
- 500 - 1,000
- 1,000 - 10,000
- > 10,000

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

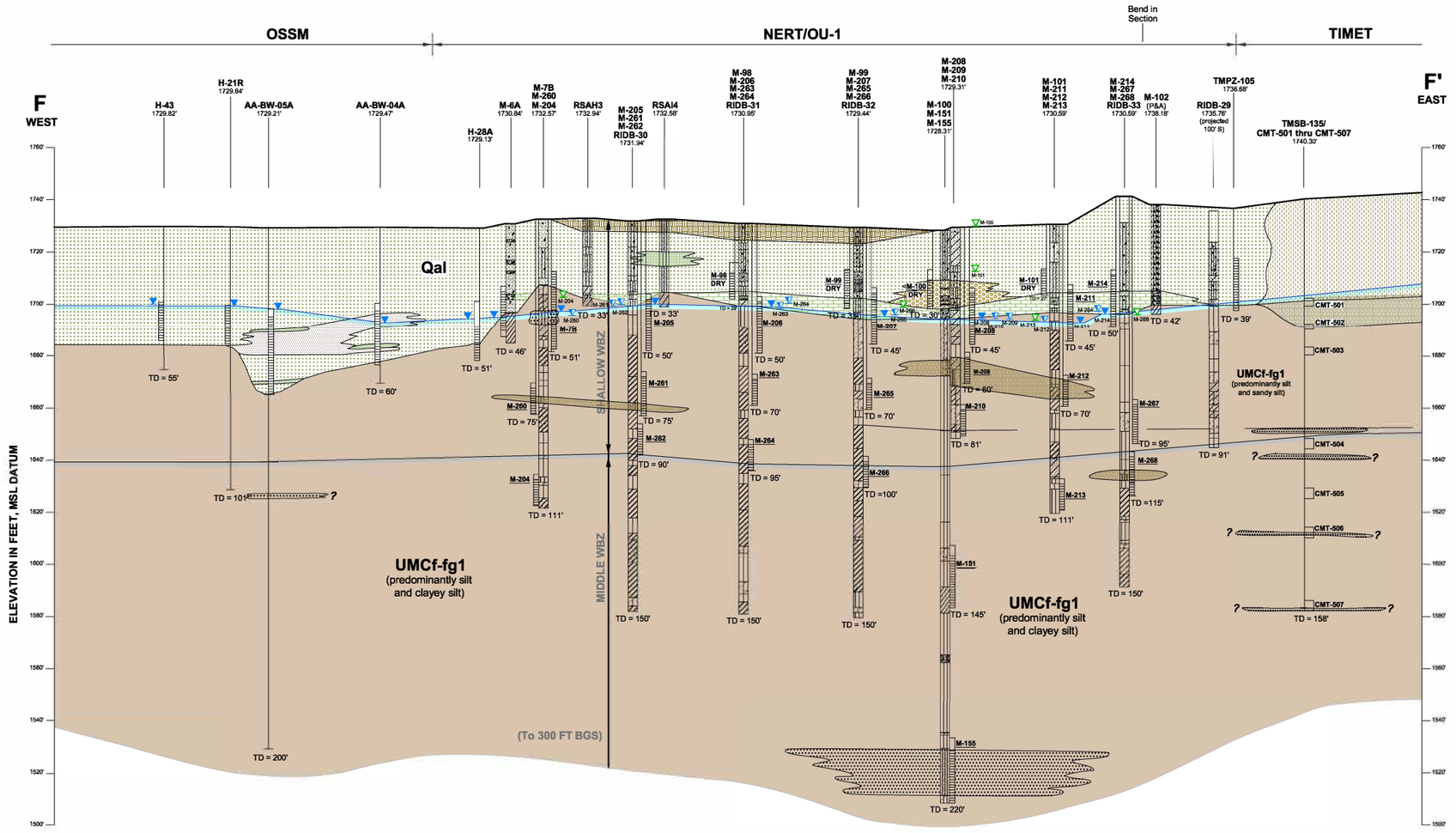
RAMBOLL

Shallow Groundwater Wells Included in the BHRA
(Chloroform Plumes as Depicted in the RI Report for OU-1 and OU-2)
Nevada Environmental Response Trust Site, Henderson, Nevada

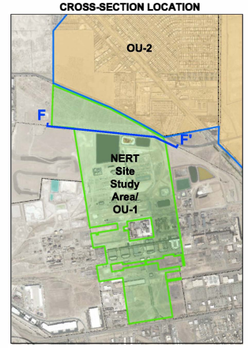
Figure **3-2**

Drafter: SS | Date: 10/31/2023 | Contract Number: 1690029369-006 | Approved by: | Revised:

Path: \\WCEVLFPS1\eng\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Fig 3-2_shallow GW sample loc_screening depths.mxd

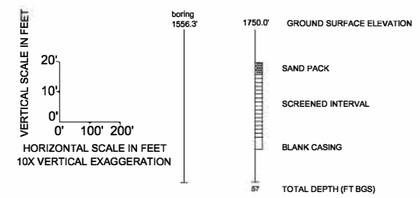


CROSS-SECTION LOCATION



LEGEND

FILL
CALICHE
ALLUVIUM (Qal)
COBBLES/ GRAVEL
GRAVEL/ SANDY GRAVEL
SILTY SAND / SILTY GRAVEL
SAND / SAND WITH GRAVEL
SILTY SAND
CLAYEY SAND
SANDY CLAY/ SILTY CLAY
SANDY SILT
UPPER MUDDY CREEK FORMATION (UMCf)
SILTY CLAY/ CLAYEY SILT
SANDY SILT (fine to very fine sand)
SILTY SAND/ SANDY BED
SILTY SAND/ GRAVEL



GROUNDWATER ELEVATIONS
(feet, mean sea level datum)

Shallow Water-Bearing Zone (0-90 ft)
- Water Table Zone Well
- Deeper Shallow WBZ Well

Middle Water-Bearing Zone (90-300 ft)
- Upper Muddy Creek Formation

Deep Water-Bearing Zone (>300 ft)
- Upper Muddy Creek Formation

NOTES:

1. Stratigraphic interpretation is based in part on available boring logs from previous investigations conducted by others. Lithologic contacts are shown unbroken for clarity, but this does not imply certainty. Interpreted contact shown may be affected by projected borings. Actual subsurface conditions along the cross-section alignment may vary. RI boring logs are presented in Appendix A-2.

2. Groundwater levels measured October 2017 - May 2018.

Q:\DRAWINGS\1690006943\1690011200_xsec_F-F'-ver2.dwg Layout: 11x17 User: rmso Jun 24, 2021 - 4:25pm

RAMBOLL

Subsurface Cross-Section F - F'

Nevada Environmental Response Trust Site
Henderson, Nevada

Figure
3-3

Drafter: RS | Date: 5/31/2023 | Contract Number: 1690029369-006 | Approved by: | Revised:

Former Parcels C & D

SG19
SG90
SG24
SG91
SG92
RISG-79
SG93
RISG-25
SG20
SG52
RISG-80
RISG-81
RISG-24
SG23
RISG-82
SG21
SG22
RISG-10
SG54
SG87
SG25
SG26
RISG-83
SG57
SG56
SG55
SG82
SG80
SG81
SG79
RISG-23
Ditch
RISG-11
SG31
Beta
Former
SG59
SG58
SG86
RISG-21
SG28
RISG-22
SG30
SG29
SG27
SG76
SG78
OSSM Plume
SG60
SG75
RISG-13
SG77
SG83
SG32
SG89
Unit 4 Plume
RISG-26
SG62
RISG-12
RISG-85
SG94
RISG-84
SG61
SG33
SG63
RISG-20
SG84
Former Parcel F
SG74
SG40
RISG-86
RISG-89
SG88
Unit 4
Unit 5
Unit 6
Unit 3
SG70
RISG-15
RISG-88
RISG-14
SG71
RISG-87
SG69
Unit 1
Unit 2
SG43
SG44
SG64
SG65
SG42
Former Parcel G
SG46
RISG-90
SG48
SG45
SG68
SG47
SG67
SG66
Former Parcel H
Former Parcel H

N
0 200 400
Feet

Legend

OU-1 Soil Gas Sample Locations at 5 feet bgs

Category

- Less than detection limit
- <Q1
- Q1 - Q3
- >Q3 - Q3+1.5*IQR
- >Q3+1.5*IQR

Sale Parcel Boundary
NERT Site Boundary
Site Features (Buildings and Tanks)
Operable Unit 1 (OU-1)
Former Beta Ditch

Groundwater Chloroform Concentration (µg/L)

- < 70
- 70 - 500
- 500 - 1,000
- 1,000 - 10,000
- > 10,000

Note:
Q1 = 180 µg/m^3, Q3 = 17,000 µg/m^3,
Q3+1.5*IQR = 42,200 µg/m^3

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Fig 4-1 SG Chloroform quartile plot - 5 ft bgs.mxd

RAMBOLL

Spatial Quartile Plot for Chloroform in Soil Gas Samples at 5 feet bgs (Chloroform Plumes as Depicted in the RI Report for OU-1 and OU-2)
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
4-1

Drafter: JA	Date: 10/31/2023	Contract Number: 1690029369-006	Approved by:	Revised:

N

0 200 400

Feet

SG19 SG90 SG24 SG91 SG92 RISG-79 SG93 RISG-25 SG20 SG52 RISG-80 RISG-81 RISG-24 SG23 RISG-82 SG21 SG22 RISG-10 SG54 SG87 SG25 SG26 RISG-83 SG56 SG55 SG57 SG82 SG80 SG81 SG79 RISG-23 Ditch RISG-11 SG31 Beta Former SG58 SG59 SG86 RISG-21 SG28 RISG-22 SG30 SG29 SG27 SG76 SG78 OSSM Plume SG60 SG75 RISG-13 SG77 SG32 SG83 RISG-12 SG89 Unit 4 Plume SG62 RISG-85 SG94 RISG-84 SG61 SG63 RISG-26 SG33 RISG-20 SG84 SG74 SG40 RISG-86 RISG-89 SG88 Unit 4 Unit 5 Unit 6 Unit 3 SG70 RISG-15 RISG-88 RISG-87 SG69 RISG-14 SG71 Unit 1 Unit 2 SG43 SG44 SG64 SG65 SG42 SG46 RISG-90 SG48 SG45 SG68 SG47 SG66 SG67

Legend

- OU-1 Soil Gas Sample Locations at 5 feet bgs

Category

- Less than detection limit
- <Q1
- Q1 - Q3
- >Q3 - Q3+1.5*IQR
- >Q3+1.5*IQR

- Sale Parcel Boundary
- NERT Site Boundary
- Site Features (Buildings and Tanks)
- Operable Unit 1 (OU-1)
- Former Beta Ditch

Groundwater Chloroform Concentration (µg/L)

- < 70
- 70 - 500
- 500 - 1,000
- 1,000 - 10,000
- > 10,000

Note:
Q1 = 3.2 µg/m^3, Q3 = 52 µg/m^3, Q3+1.5*IQR = 125 µg/m^3

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

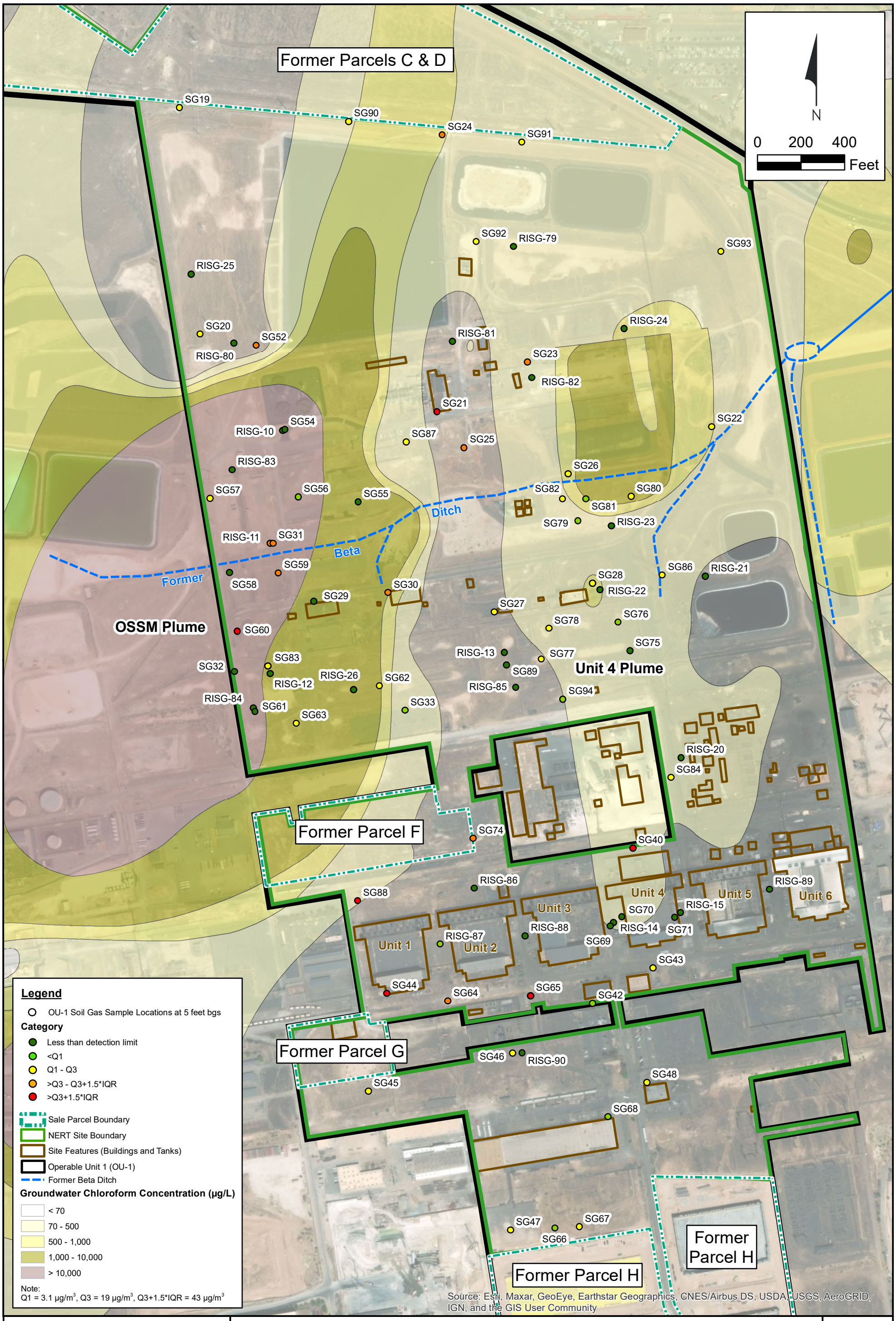
RAMBOLL

Spatial Quartile Plot for Carbon Tetrachloride in Soil Gas Samples at 5 feet bgs (Chloroform Plumes as Depicted in the RI Report for OU-1 and OU-2)
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **4-2**

Drafter: JA | Date: 10/31/2023 | Contract Number: 1690029369-006 | Approved by: | Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Fig 4-2 SG Carbon Tetrachloride quartile plot - 5 ft bgs.mxd



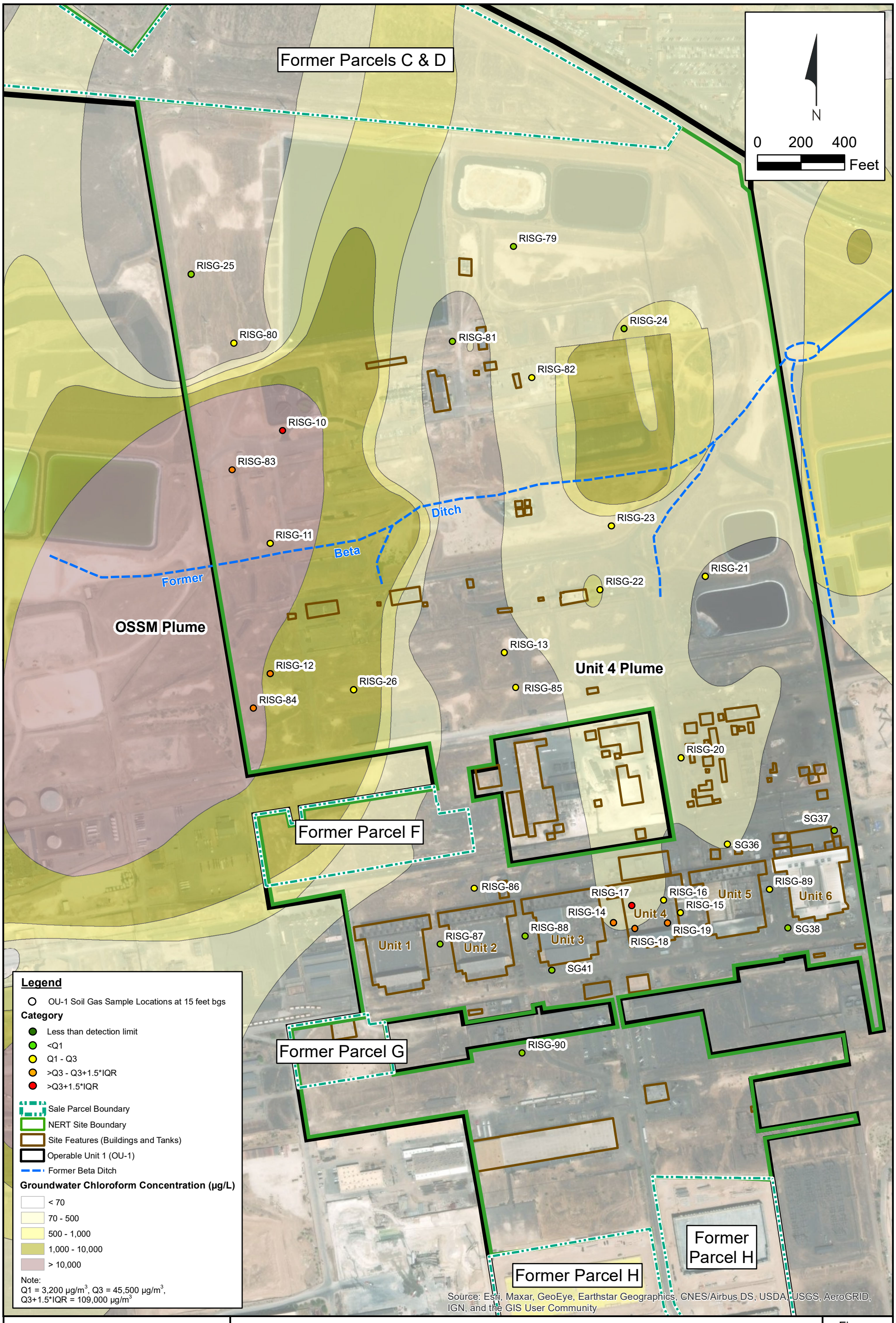
RAMBOLL

Spatial Quartile Plot for 1,4-Dichlorobenzene in Soil Gas Samples at 5 feet bgs (Chloroform Plumes as Depicted in the RI Report for OU-1 and OU-2)
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
4-3

Drafter: JA	Date: 10/31/2023	Contract Number: 1690029369-006	Approved by:	Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Fig 4-3 SG 14-Dichlorobenzene quartile plot - 5 ft bgs.mxd



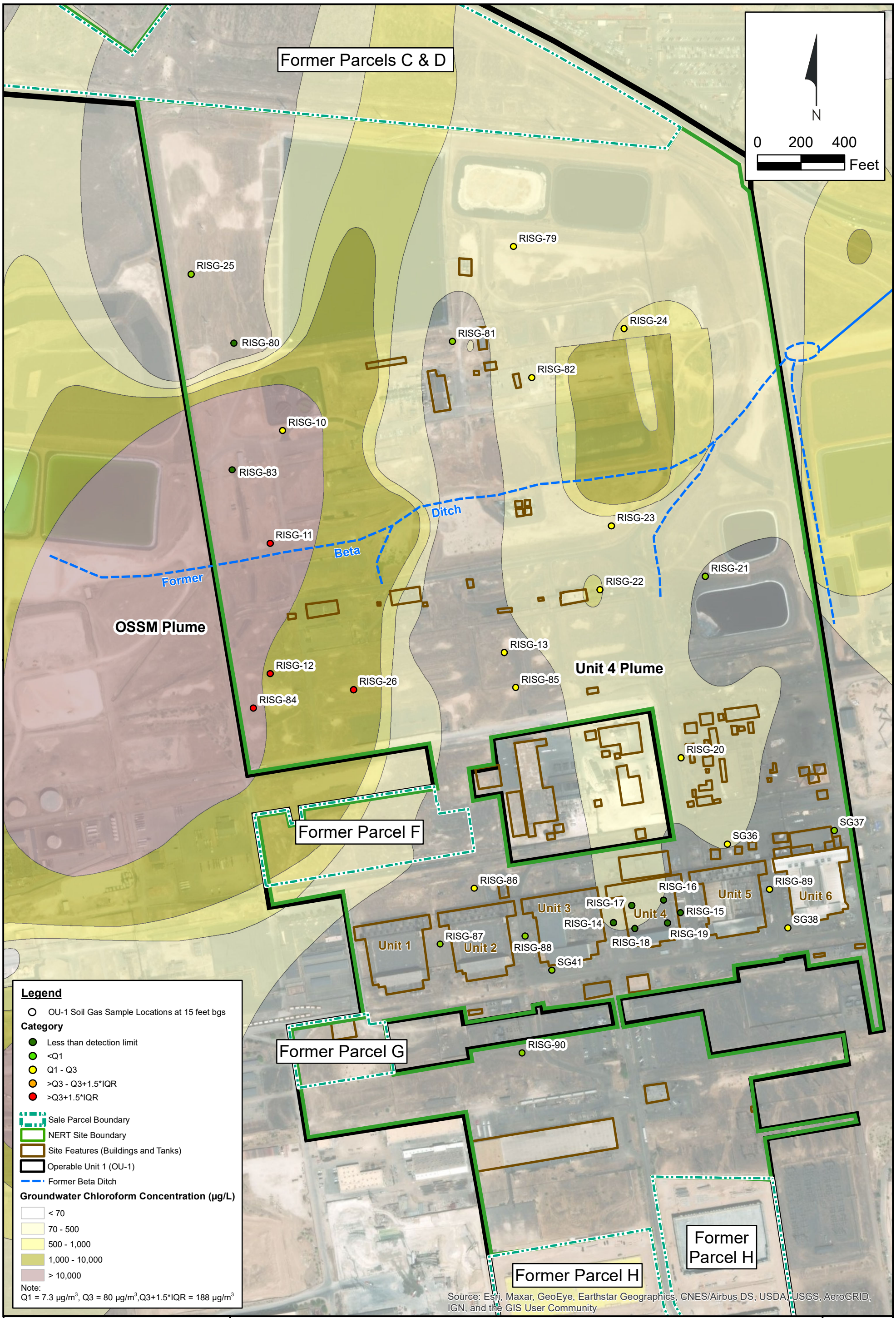
RAMBOLL

Spatial Quartile Plot for Chloroform in Soil Gas Samples at or around 15 feet bgs (Chloroform Plumes as Depicted in the RI Report for OU-1 and OU-2)
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
4-4

Drafter: JA	Date: 10/31/2023	Contract Number: 1690029369-006	Approved by:	Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Fig 4-4 SG Chloroform quartile plot - 15 ft bgs.mxd



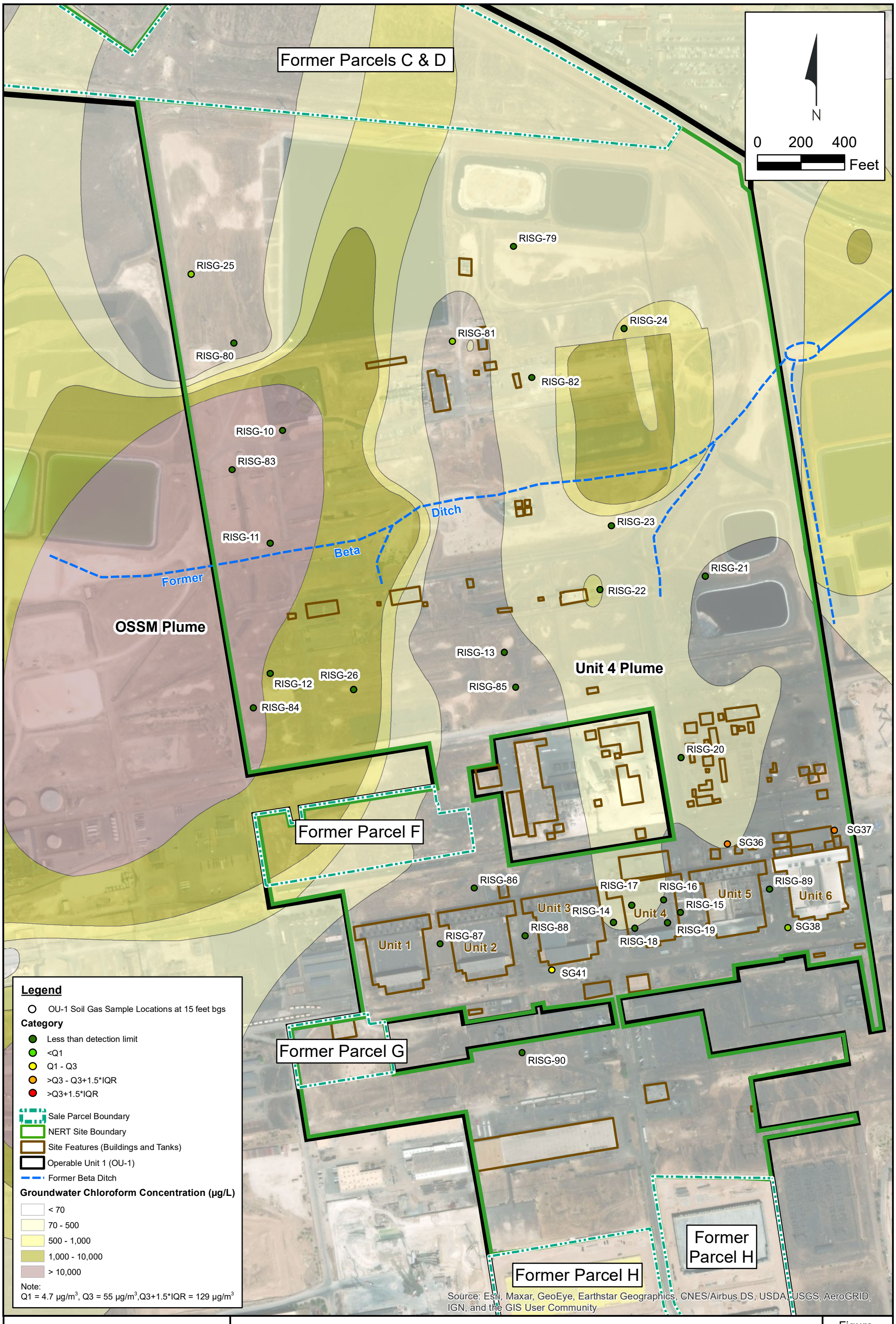
RAMBOLL

Spatial Quartile Plot for Carbon Tetrachloride in Soil Gas Samples at or around 15 feet bgs (Chloroform Plumes as Depicted in the RI Report for OU-1 and OU-2)
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
4-5

Drafter: JA | Date: 10/31/2023 | Contract Number: 1690029369-006 | Approved by: | Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Fig 4-5 SG Carbon Tetrachloride quartile plot - 15 ft bgs.mxd



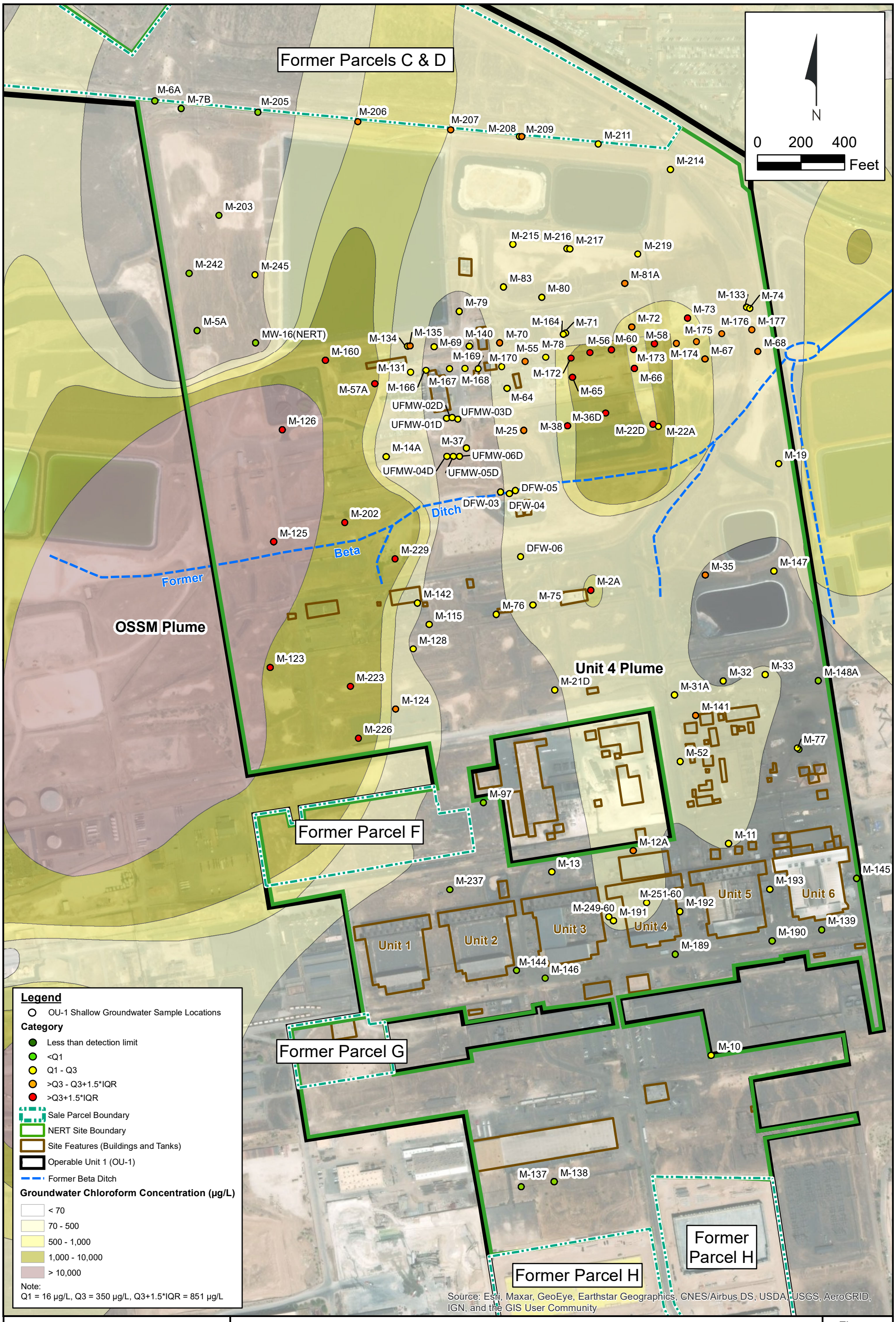
RAMBOLL

Spatial Quartile Plot for 1,4-Dichlorobenzene in Soil Gas Samples at or around 15 feet bgs (Chloroform Plumes as Depicted in the RI Report for OU-1 and OU-2)
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **4-6**

Drafter: JA	Date: 10/31/2023	Contract Number: 1690029369-006	Approved by:	Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Fig 4-6 SG 14-Dichlorobenzene quartile plot - 15 ft bgs.mxd



Legend

- OU-1 Shallow Groundwater Sample Locations

Category

- Less than detection limit
- <Q1
- Q1 - Q3
- >Q3 - Q3+1.5*IQR
- >Q3+1.5*IQR
- Sale Parcel Boundary
- NERT Site Boundary
- Site Features (Buildings and Tanks)
- Operable Unit 1 (OU-1)
- Former Beta Ditch

Groundwater Chloroform Concentration (µg/L)

- < 70
- 70 - 500
- 500 - 1,000
- 1,000 - 10,000
- > 10,000

Note:
Q1 = 16 µg/L, Q3 = 350 µg/L, Q3+1.5*IQR = 851 µg/L

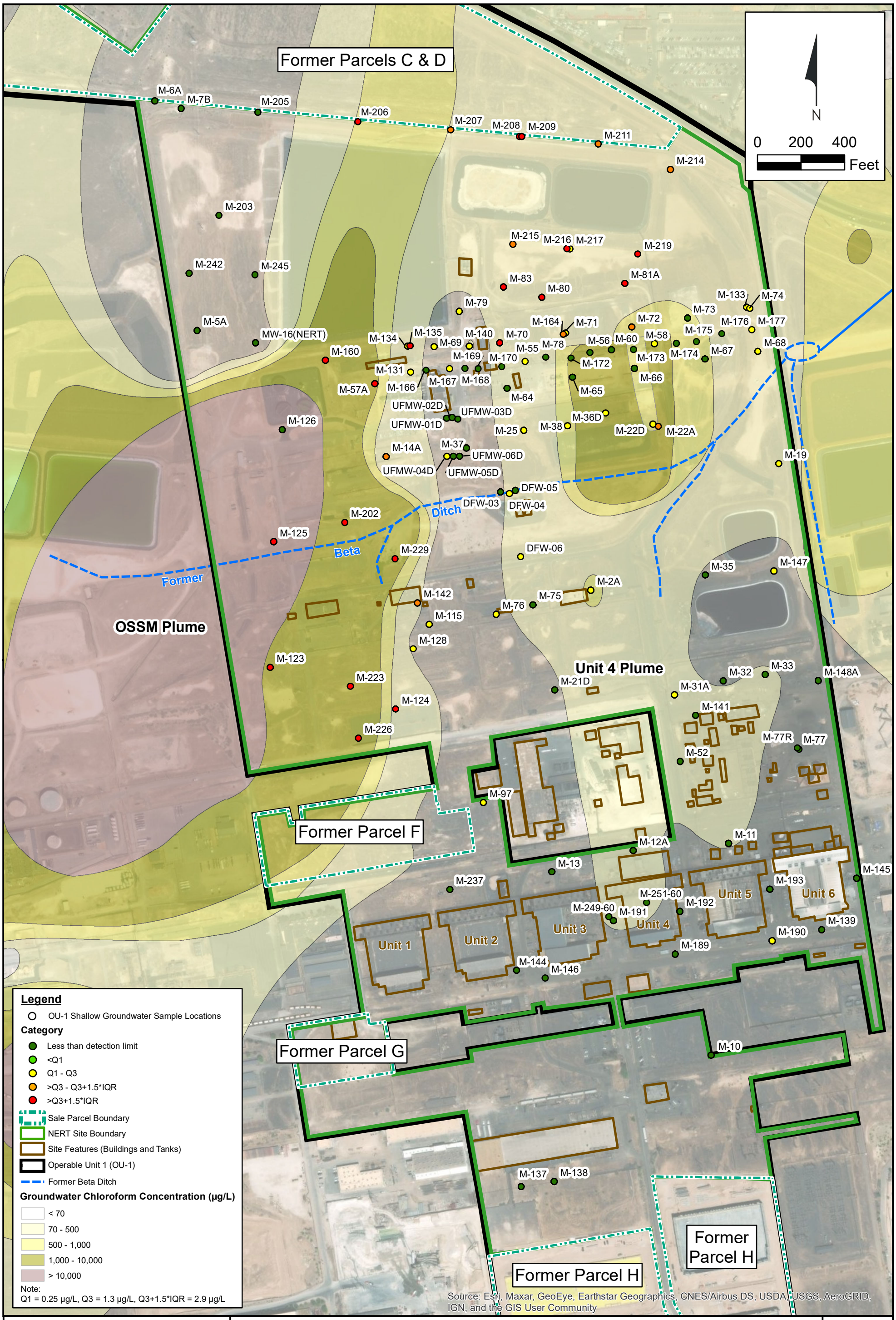
RAMBOLL

Spatial Quartile Plot for Chloroform in Groundwater Samples (Chloroform Plumes as Depicted in the RI Report for OU-1 and OU-2)
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **4-7**

Drafter: SS	Date: 10/31/2023	Contract Number: 1690029369-006	Approved by:	Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Fig 4-7 GW Chloroform quartile plot.mxd



RAMBOLL

Spatial Quartile Plot for Carbon Tetrachloride in Groundwater Samples (Chloroform Plumes as Depicted in the RI Report for OU-1 and OU-2)
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **4-8**

Drafter: SS	Date: 10/31/2023	Contract Number: 1690029369-006	Approved by:	Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Fig 4-8 GW carbon tetrachloride quartile plot.mxd

Former Parcels C & D

N

0 200 400

Feet

M-6A M-7B M-205 M-206 M-207 M-208 M-209 M-211 M-214

M-203 M-242 M-245 M-5A MW-16(NERT) M-160

M-215 M-216 M-217 M-219 M-83 M-80 M-81A M-79

M-164 M-71 M-72 M-73 M-133 M-74 M-176 M-177 M-175 M-58 M-56 M-60 M-68 M-174 M-67 M-55 M-78 M-70 M-140 M-135 M-134 M-69 M-169 M-170 M-172 M-173 M-66 M-131 M-167 M-168 M-166 M-57A M-64 M-65

UFMW-02D UFMW-03D UFMW-01D M-126 M-25 M-38 M-36D M-22D M-22A

M-14A M-37 UFMW-06D UFMW-04D UFMW-05D M-19

DFW-05 DFW-03 DFW-04 Ditch

M-202 M-125 Beta M-229 DFW-06 M-35 M-147 Former

M-2A M-142 M-75 M-76 M-115 M-128

OSSM Plume

M-123 M-223 M-124 M-226

Unit 4 Plume

M-32 M-33 M-148A M-21D M-31A M-141 M-77R M-77 M-52

M-97

Former Parcel F

M-12A M-11 M-13 M-145 M-237 M-193 M-251-60 M-192 M-249-60 M-191 M-139 M-190 M-189 M-144 M-146

Unit 1 Unit 2 Unit 3 Unit 4 Unit 5 Unit 6

Former Parcel G

M-10

M-137 M-138

Former Parcel H

Former Parcel H

Legend

OU-1 Shallow Groundwater Sample Locations

Category

- Less than detection limit
- <Q1
- Q1 - Q3
- >Q3 - Q3+1.5*IQR
- >Q3+1.5*IQR

Sale Parcel Boundary

NERT Site Boundary

Site Features (Buildings and Tanks)

Operable Unit 1 (OU-1)

Former Beta Ditch

Groundwater Chloroform Concentration (µg/L)

- < 70
- 70 - 500
- 500 - 1,000
- 1,000 - 10,000
- > 10,000

Note:
Q1 = 0.25 µg/L, Q3 = 1.0 µg/L, Q3+1.5*IQR = 2.1 µg/L

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

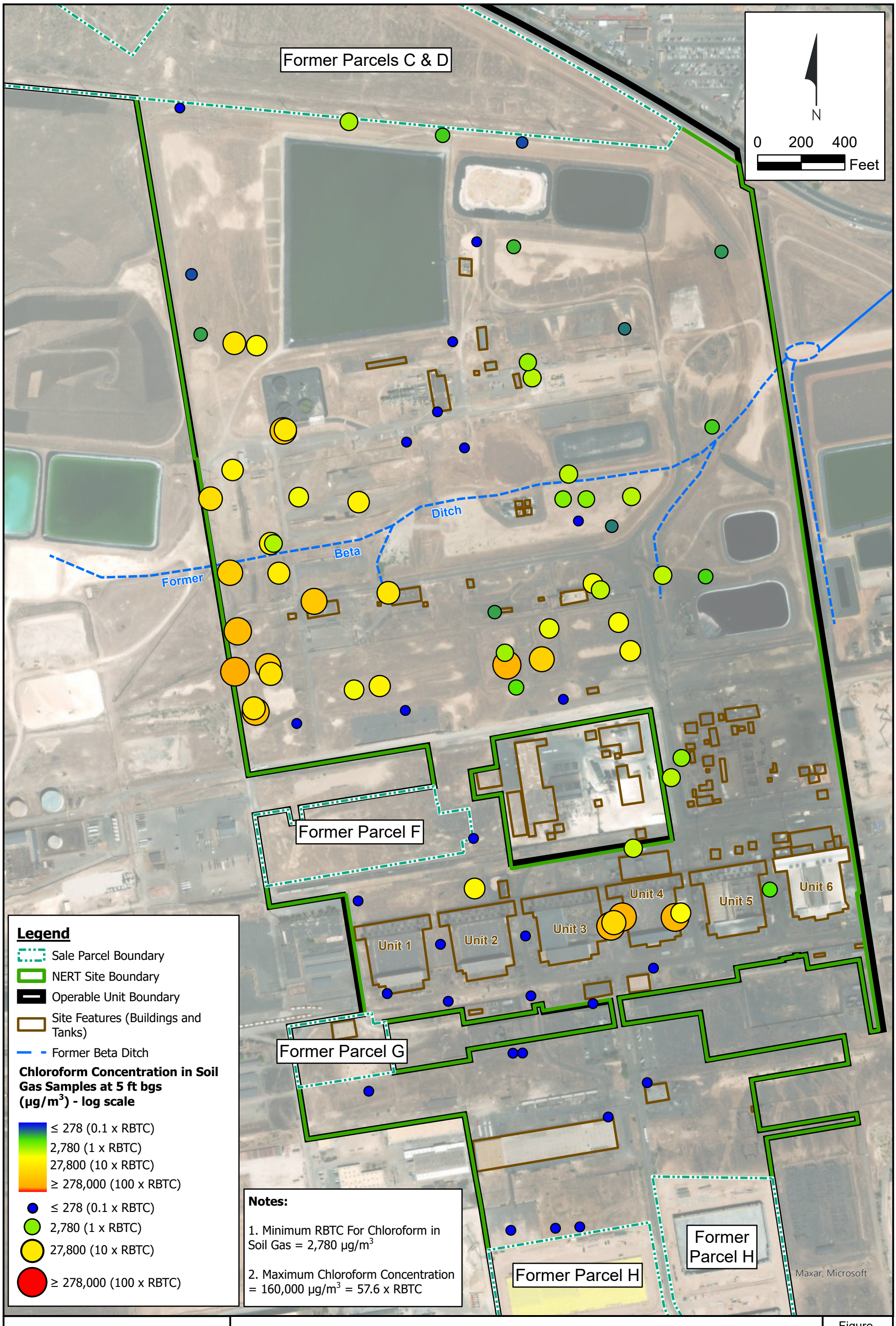
RAMBOLL

Spatial Quartile Plot for 1,4-Dichlorobenzene in Groundwater Samples (Chloroform Plumes as Depicted in the RI Report for OU-1 and OU-2)
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
4-9

Drafter: SS | Date: 10/31/2023 | Contract Number: 1690029369-006 | Approved by: | Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Fig 4-9 GW 14-dichlorobenzene quartile plot.mxd



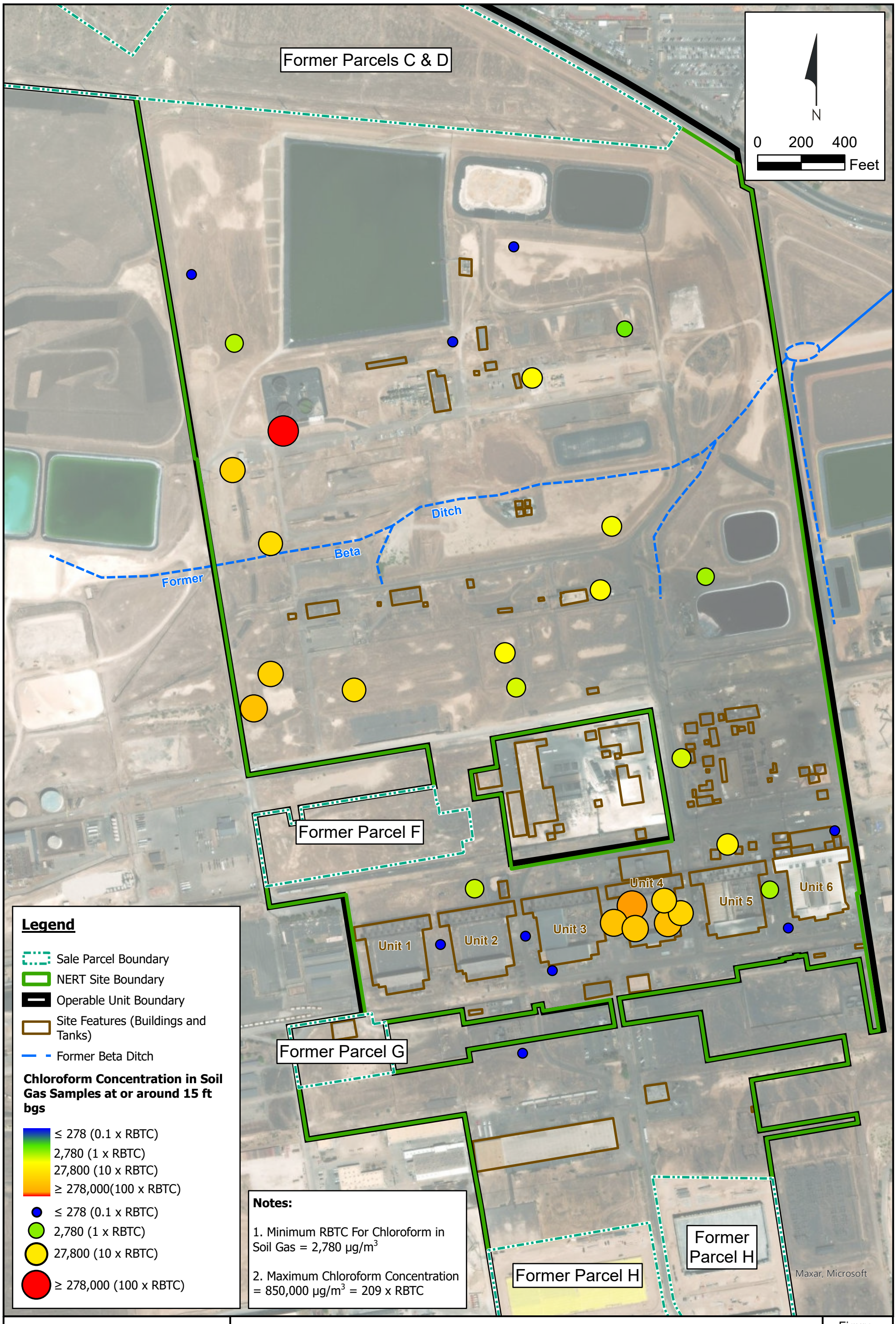
RAMBOLL

Spatial Concentration Plot for Chloroform in Soil Gas Samples at 5 feet bgs
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
4-10

Drafter: JC | Date: 10/31/2023 | Contract Number: 16900209369-006 | Approved by: | Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\bubble_plots.aprx



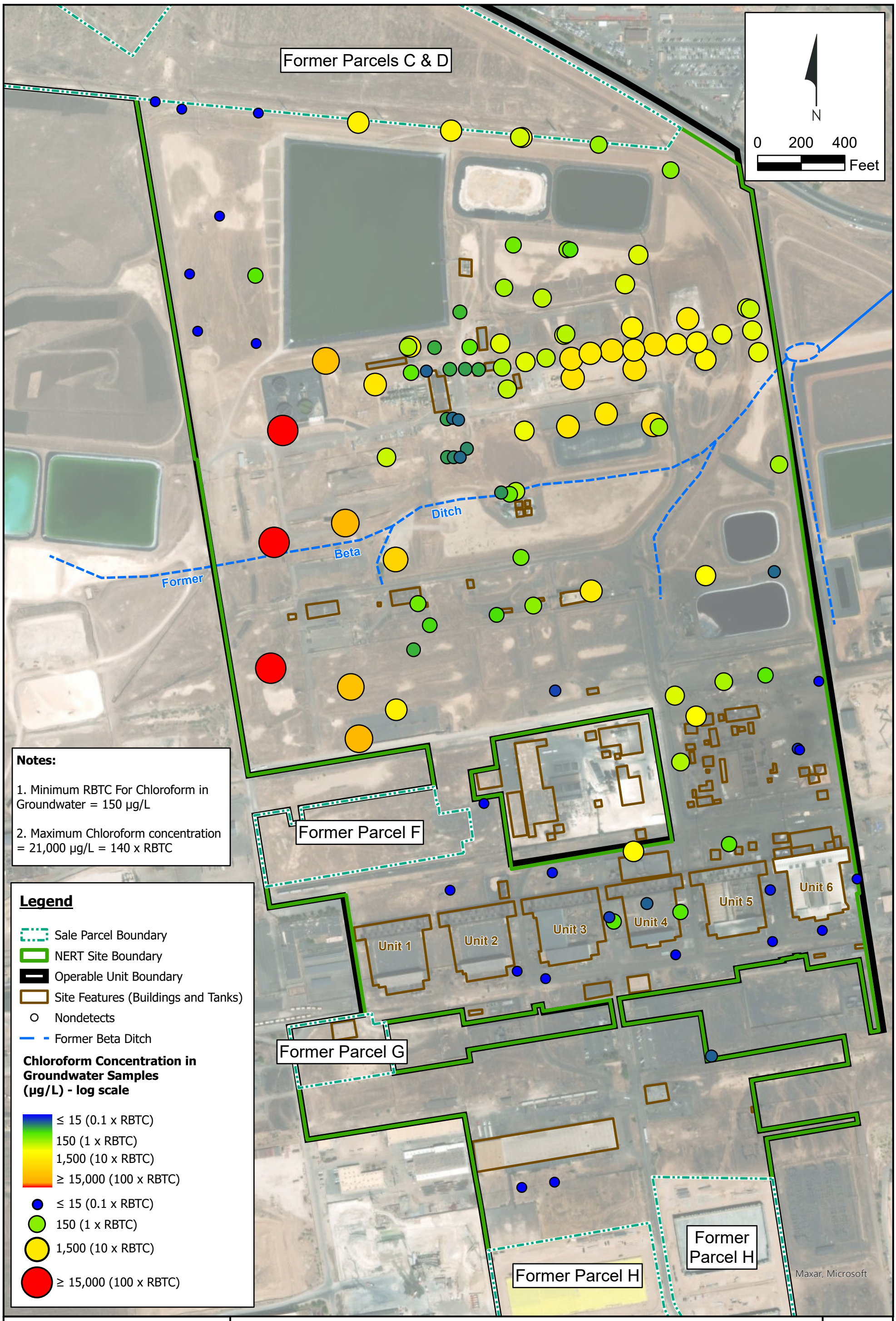
Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\bubble_plots.aprx

RAMBOLL

Spatial Concentration Plot for Chloroform in Soil Gas Samples at or around 15 feet bgs
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
4-11

Drafter: JC	Date: 10/31/2023	Contract Number: 16900209369-006	Approved by:	Revised:



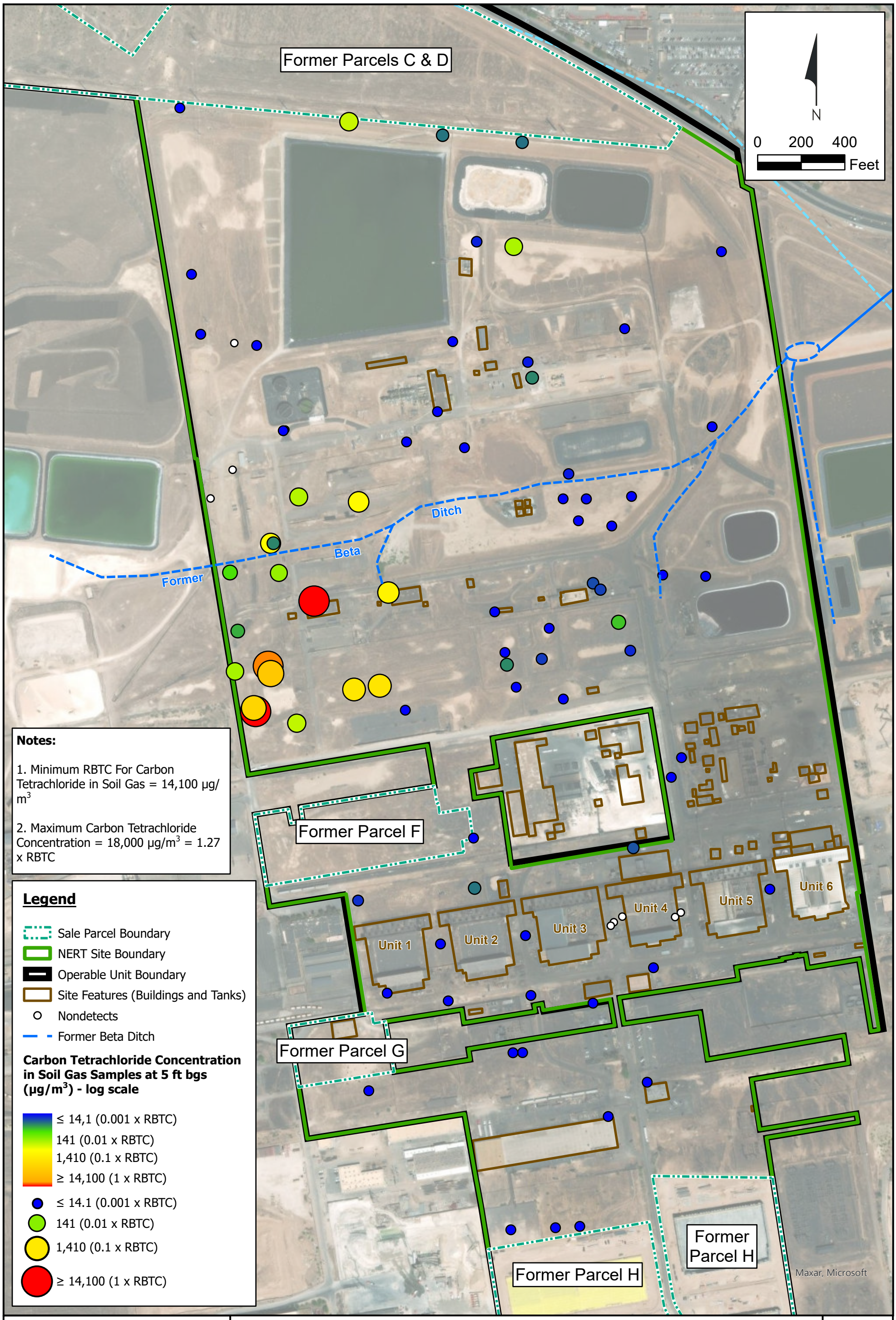
RAMBOLL

Spatial Concentration Plot for Chloroform in Groundwater Samples
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
4-12

Drafter: JC	Date: 10/31/2023	Contract Number: 16900209369-006	Approved by:	Revised:

Path: \\WCEVLFPS1\eng\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\bubble_plots.aprx



Notes:

1. Minimum RBTC For Carbon Tetrachloride in Soil Gas = 14,100 µg/m^3

2. Maximum Carbon Tetrachloride Concentration = 18,000 µg/m^3 = 1.27 x RBTC

Legend

- Sale Parcel Boundary
- NERT Site Boundary
- Operable Unit Boundary
- Site Features (Buildings and Tanks)
- Nondetects
- Former Beta Ditch

Carbon Tetrachloride Concentration in Soil Gas Samples at 5 ft bgs (µg/m^3) - log scale

- ≤ 14,1 (0.001 x RBTC)
- 141 (0.01 x RBTC)
- 1,410 (0.1 x RBTC)
- ≥ 14,100 (1 x RBTC)

- ≤ 14.1 (0.001 x RBTC)
- 141 (0.01 x RBTC)
- 1,410 (0.1 x RBTC)
- ≥ 14,100 (1 x RBTC)

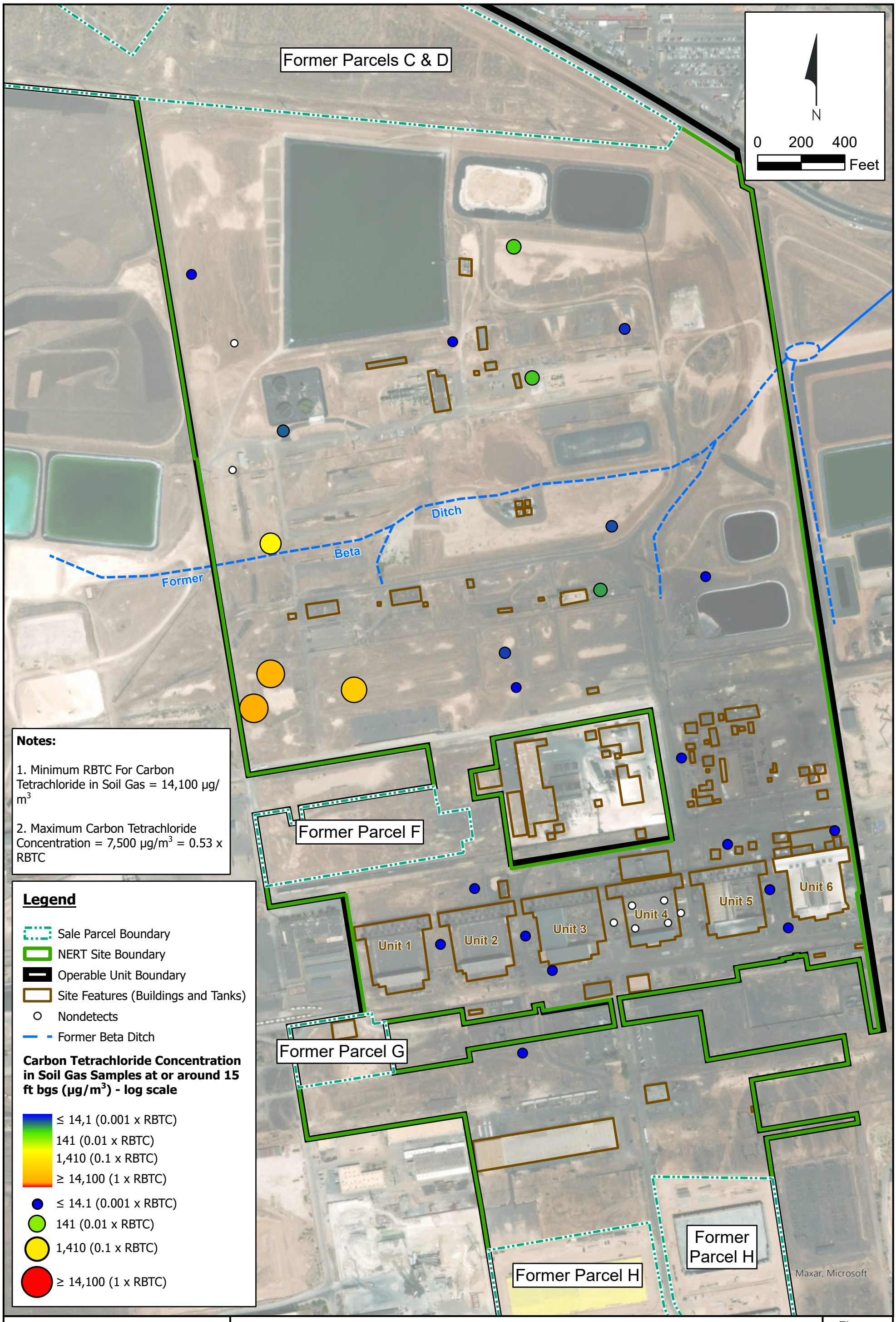
RAMBOLL

Spatial Concentration Plot for Carbon Tetrachloride in Soil Gas Samples at 5 feet bgs
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **4-13**

Drafter: JC | Date: 10/31/2023 | Contract Number: 16900209369-006 | Approved by: | Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\bubble_plots.aprx



Notes:

1. Minimum RBTC For Carbon Tetrachloride in Soil Gas = 14,100 µg/m^3

2. Maximum Carbon Tetrachloride Concentration = 7,500 µg/m^3 = 0.53 x RBTC

Legend

- Sale Parcel Boundary
- NERT Site Boundary
- Operable Unit Boundary
- Site Features (Buildings and Tanks)
- Nondetects
- Former Beta Ditch

Carbon Tetrachloride Concentration in Soil Gas Samples at or around 15 ft bgs (µg/m^3) - log scale

- ≤ 14,1 (0.001 x RBTC)
- 141 (0.01 x RBTC)
- 1,410 (0.1 x RBTC)
- ≥ 14,100 (1 x RBTC)

- ≤ 14.1 (0.001 x RBTC)
- 141 (0.01 x RBTC)
- 1,410 (0.1 x RBTC)
- ≥ 14,100 (1 x RBTC)

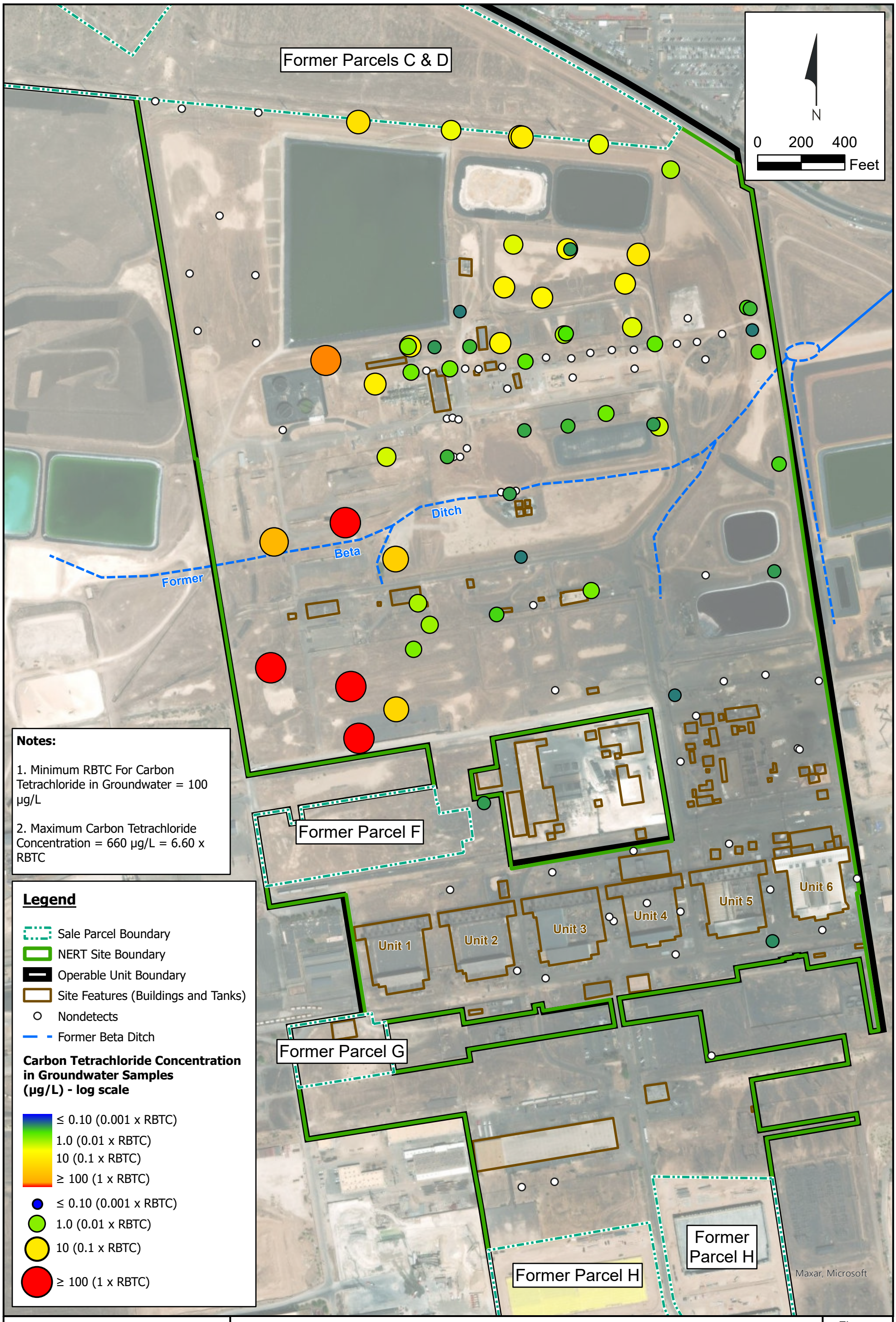
RAMBOLL

Spatial Concentration Plot for Carbon Tetrachloride in Soil Gas Samples at or around 15 feet bgs
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **4-14**

Drafter: JC | Date: 10/31/2023 | Contract Number: 16900209369-006 | Approved by: | Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\bubble_plots.aprx



Notes:

1. Minimum RBTC For Carbon Tetrachloride in Groundwater = 100 µg/L

2. Maximum Carbon Tetrachloride Concentration = 660 µg/L = 6.60 x RBTC

Legend

- Sale Parcel Boundary
- NERT Site Boundary
- Operable Unit Boundary
- Site Features (Buildings and Tanks)
- Nondetects
- Former Beta Ditch

Carbon Tetrachloride Concentration in Groundwater Samples (µg/L) - log scale

- ≤ 0.10 (0.001 x RBTC)
- 1.0 (0.01 x RBTC)
- 10 (0.1 x RBTC)
- ≥ 100 (1 x RBTC)

- ≤ 0.10 (0.001 x RBTC)
- 1.0 (0.01 x RBTC)
- 10 (0.1 x RBTC)
- ≥ 100 (1 x RBTC)

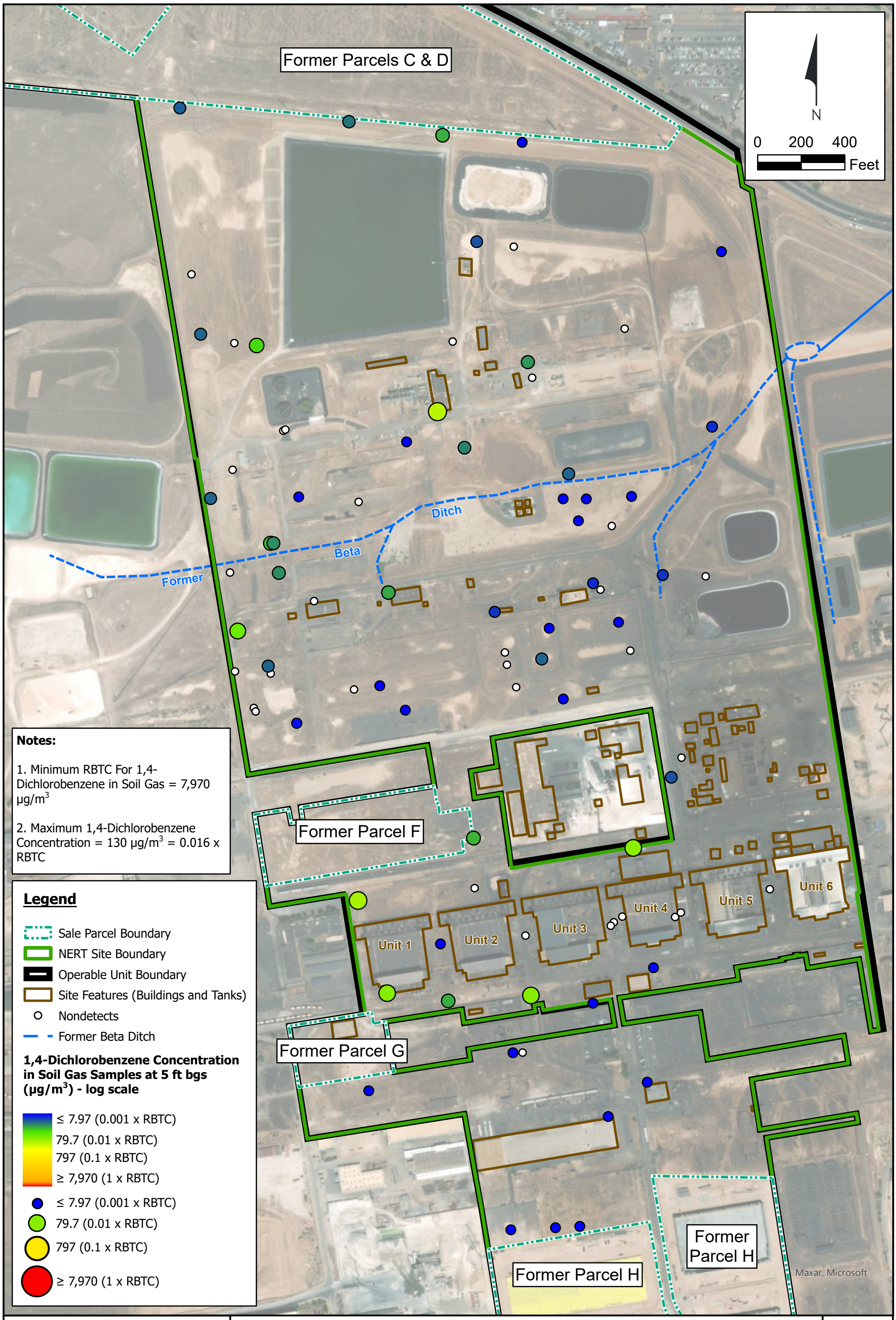
RAMBOLL

Spatial Concentration Plot for Carbon Tetrachloride in Groundwater Samples
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **4-15**

Drafter: JC | Date: 10/31/2023 | Contract Number: 16900209369-006 | Approved by: | Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\bubble_plots.aprx



Notes:

1. Minimum RBTC For 1,4-Dichlorobenzene in Soil Gas = 7,970 µg/m^3

2. Maximum 1,4-Dichlorobenzene Concentration = 130 µg/m^3 = 0.016 x RBTC

Legend

- Sale Parcel Boundary
- NERT Site Boundary
- Operable Unit Boundary
- Site Features (Buildings and Tanks)
- Nondetects
- Former Beta Ditch

1,4-Dichlorobenzene Concentration in Soil Gas Samples at 5 ft bgs (µg/m^3) - log scale

- ≤ 7.97 (0.001 x RBTC)
- 79.7 (0.01 x RBTC)
- 797 (0.1 x RBTC)
- ≥ 7,970 (1 x RBTC)

- ≤ 7.97 (0.001 x RBTC)
- 79.7 (0.01 x RBTC)
- 797 (0.1 x RBTC)
- ≥ 7,970 (1 x RBTC)

RAMBOLL

Spatial Concentration Plot for 1,4-Dichlorobenzene in Soil Gas Samples at 5 feet bgs
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **4-16**

Drafter: JC | Date: 10/31/2023 | Contract Number: 16900209369-006 | Approved by: | Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\bubble_plots.aprx

Former Parcels C & D

N

0 200 400

Feet

Ditch

Beta

Former

Former Parcel F

Former Parcel G

Former Parcel H

Former Parcel H

Unit 1

Unit 2

Unit 3

Unit 4

Unit 5

Unit 6

Maxar, Microsoft

Notes:

1. Minimum RBTC For 1,4-Dichlorobenzene in Soil Gas = 7,970 µg/m^3

2. Maximum 1,4-Dichlorobenzene Concentration = 65 µg/m^3 = 0.0082 x RBTC

Legend

- Sale Parcel Boundary
- NERT Site Boundary
- Operable Unit Boundary
- Site Features (Buildings and Tanks)
- Nondetects
- Former Beta Ditch

1,4-Dichlorobenzene Concentration in Soil Gas Samples at or around 15 ft bgs (µg/m^3) - log scale

- ≤ 7.97 (0.001 x RBTC)
- 79.7 (0.01 x RBTC)
- 797 (0.1 x RBTC)
- ≥ 7,970 (1 x RBTC)

- ≤ 7.97 (0.001 x RBTC)
- 79.7 (0.01 x RBTC)
- 797 (0.1 x RBTC)
- ≥ 7,970 (1 x RBTC)

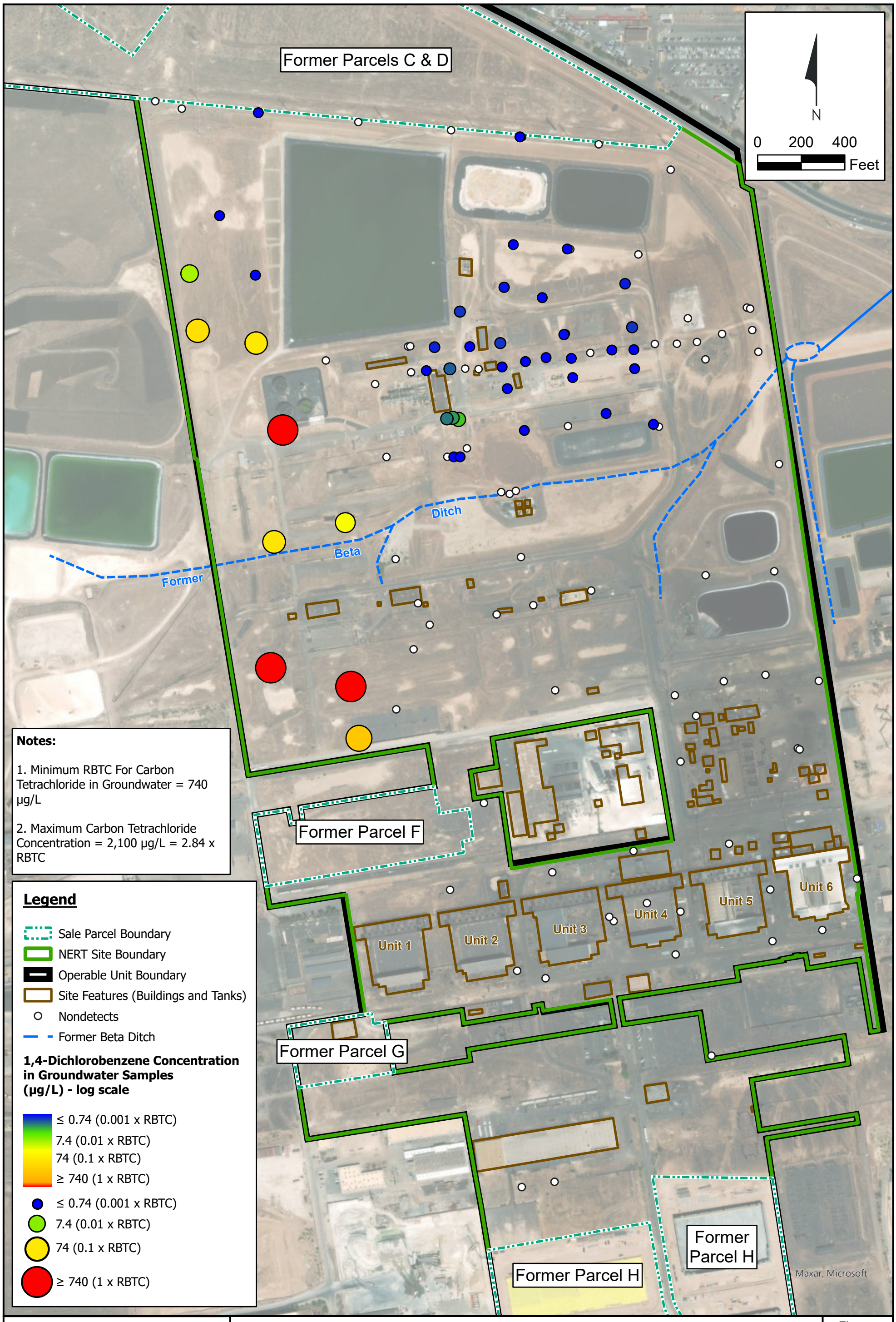
RAMBOLL

Spatial Concentration Plot for 1,4-Dichlorobenzene in Soil Gas Samples at or around 15 feet bgs
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
4-17

Drafter: JC | Date: 10/31/2023 | Contract Number: 16900209369-006 | Approved by: | Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\bubble_plots.aprx



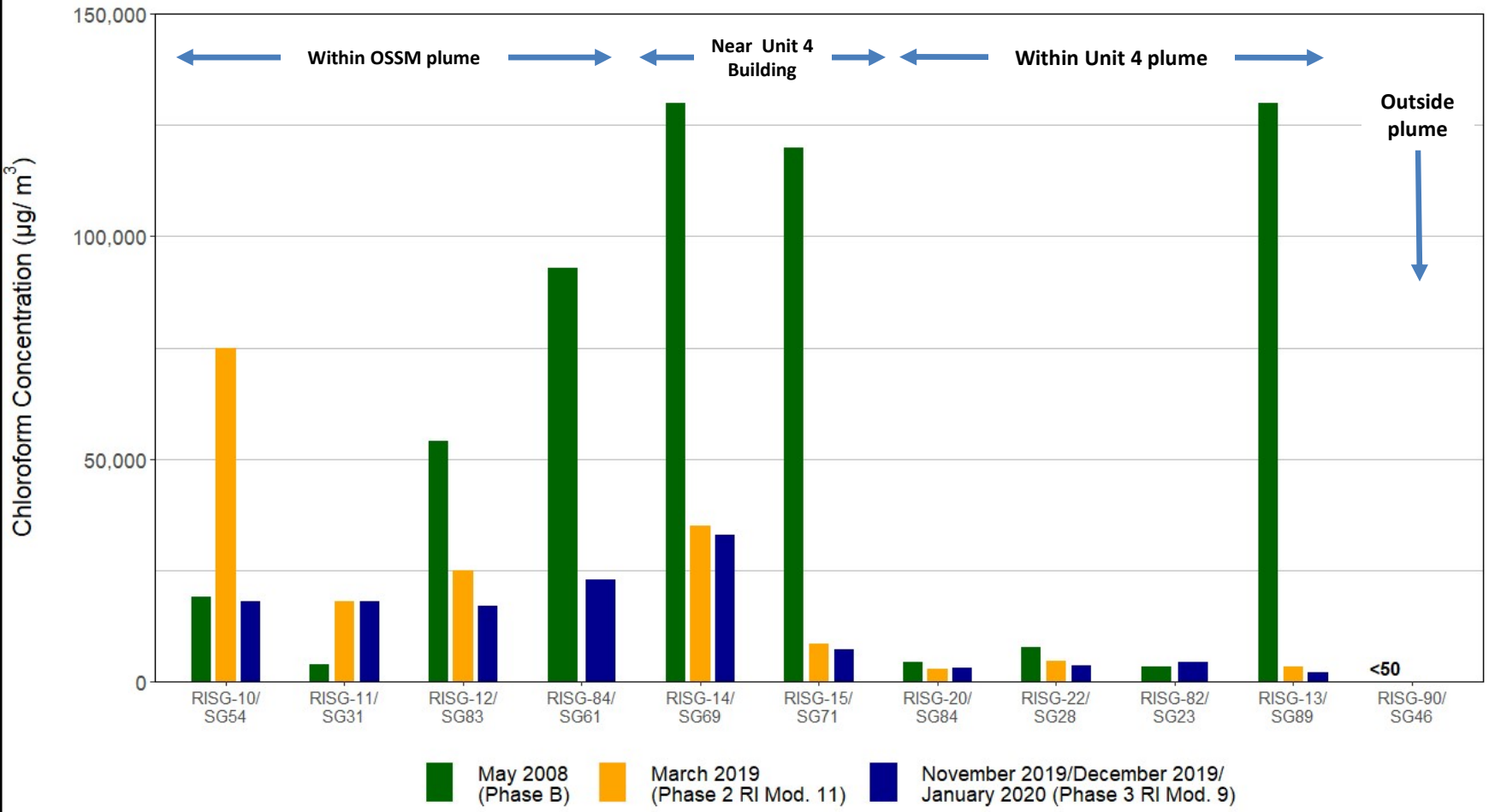
RAMBOLL

Spatial Concentration Plot for 1,4-Dichlorobenzene in Groundwater Samples
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
4-18

Drafter: JC | Date: 10/31/2023 | Contract Number: 16900209369-006 | Approved by: | Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\bubble_plots.aprx



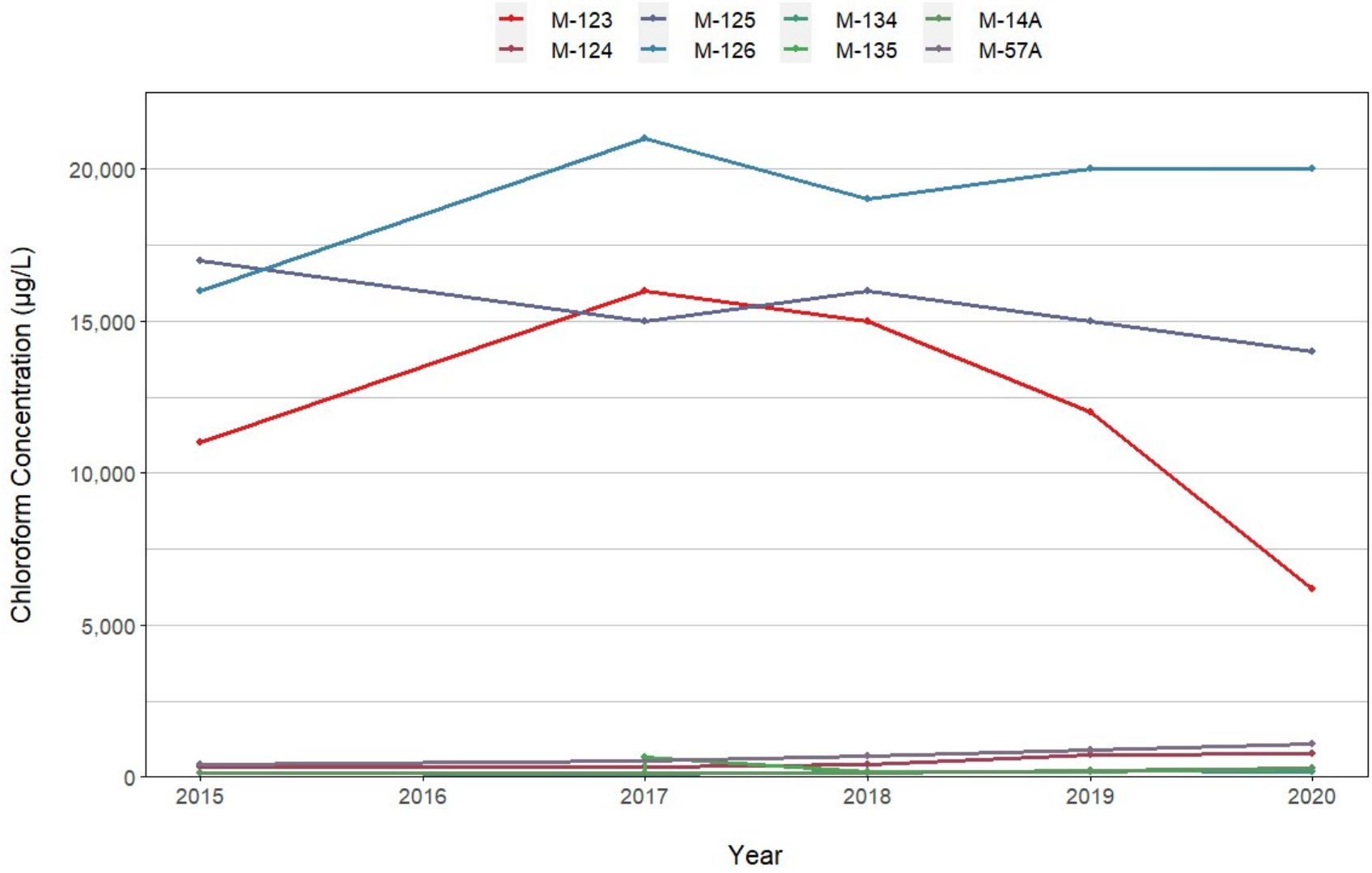
RAMBOLL

Temporal Distribution of Chloroform Concentrations at Selected Soil Gas Sample Locations at 5 feet bgs

Nevada Environmental Response Trust Site, Henderson, Nevada

4-19

Drafter: WF Date: 10/27/2023 Contract Number: 1690029369-006 Approved by: Revised:



RAMBOLL

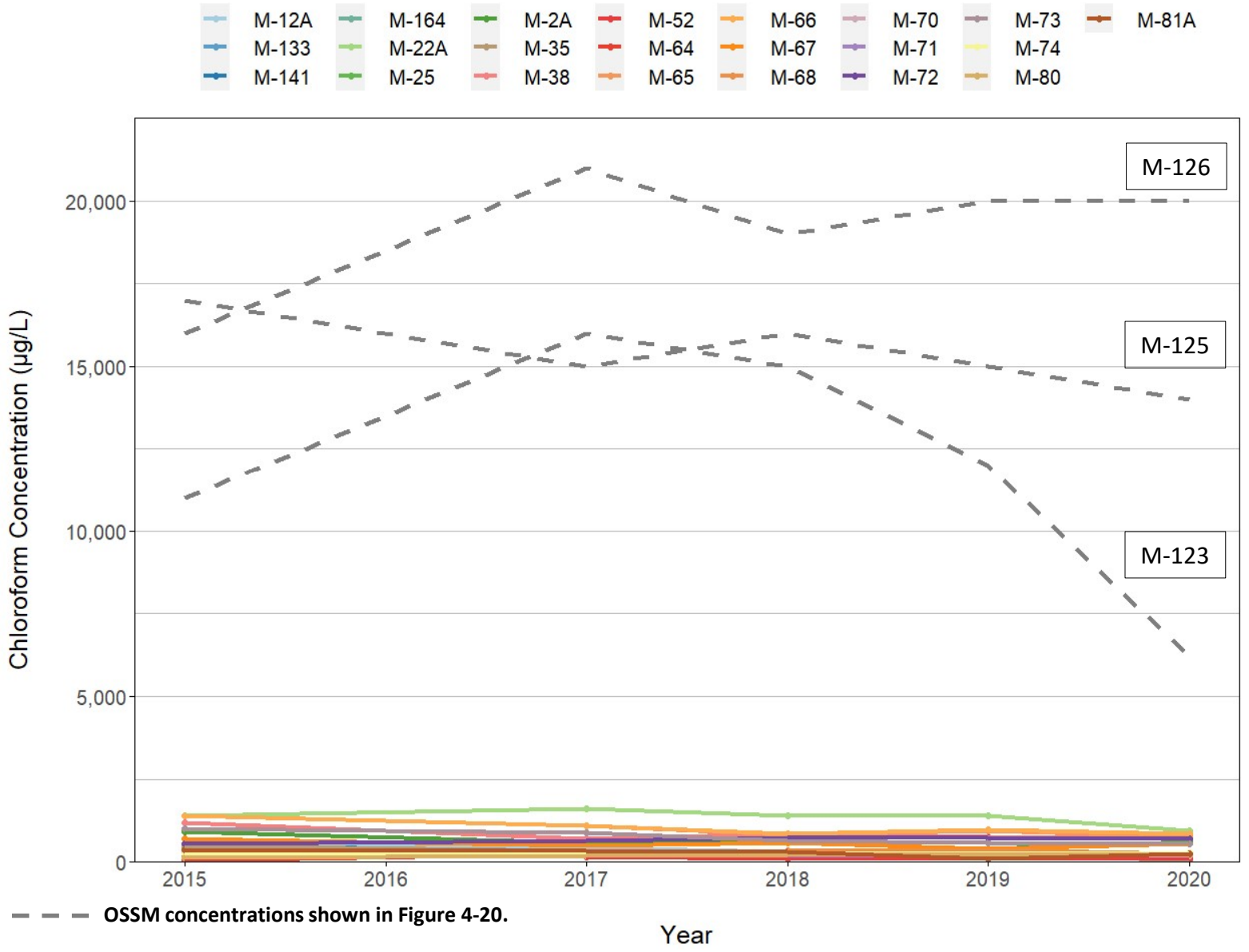
Temporal Distribution of Chloroform Concentrations in Selected Shallow Groundwater Wells within the trespassing OSSM Plume

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure

4-20

Drafter: WF Date: 5/13/2023 Contract Number: 1690029369-006 Approved by: Revised:



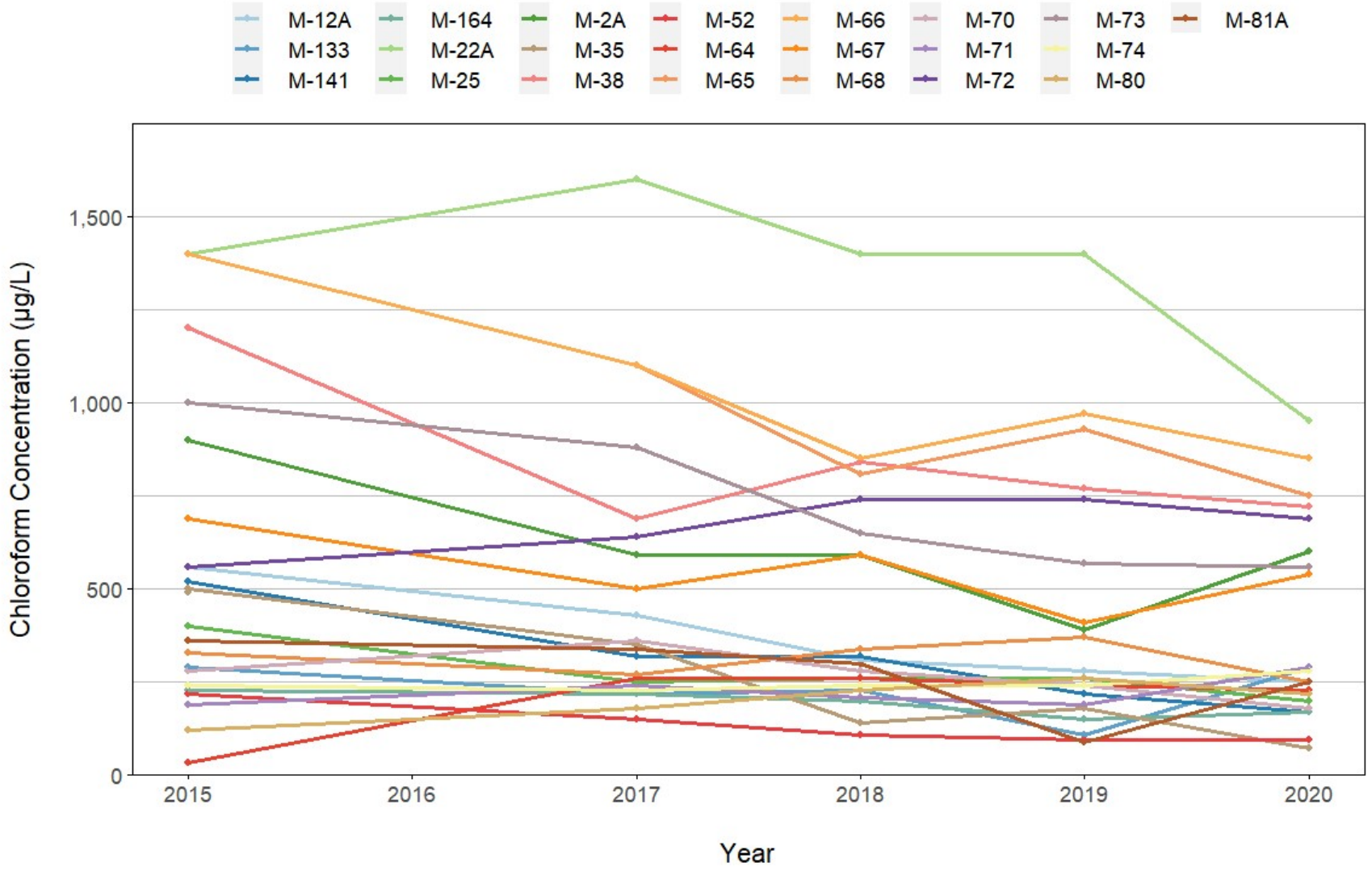
RAMBOLL

Temporal Distribution of Chloroform Concentrations in Selected Shallow Groundwater Wells within the Unit 4 Plume (large scale)

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **4-21a**

Drafter: WF | Date: 5/13/2023 | Contract Number: 1690029369-006 | Approved by: | Revised:



RAMBOLL

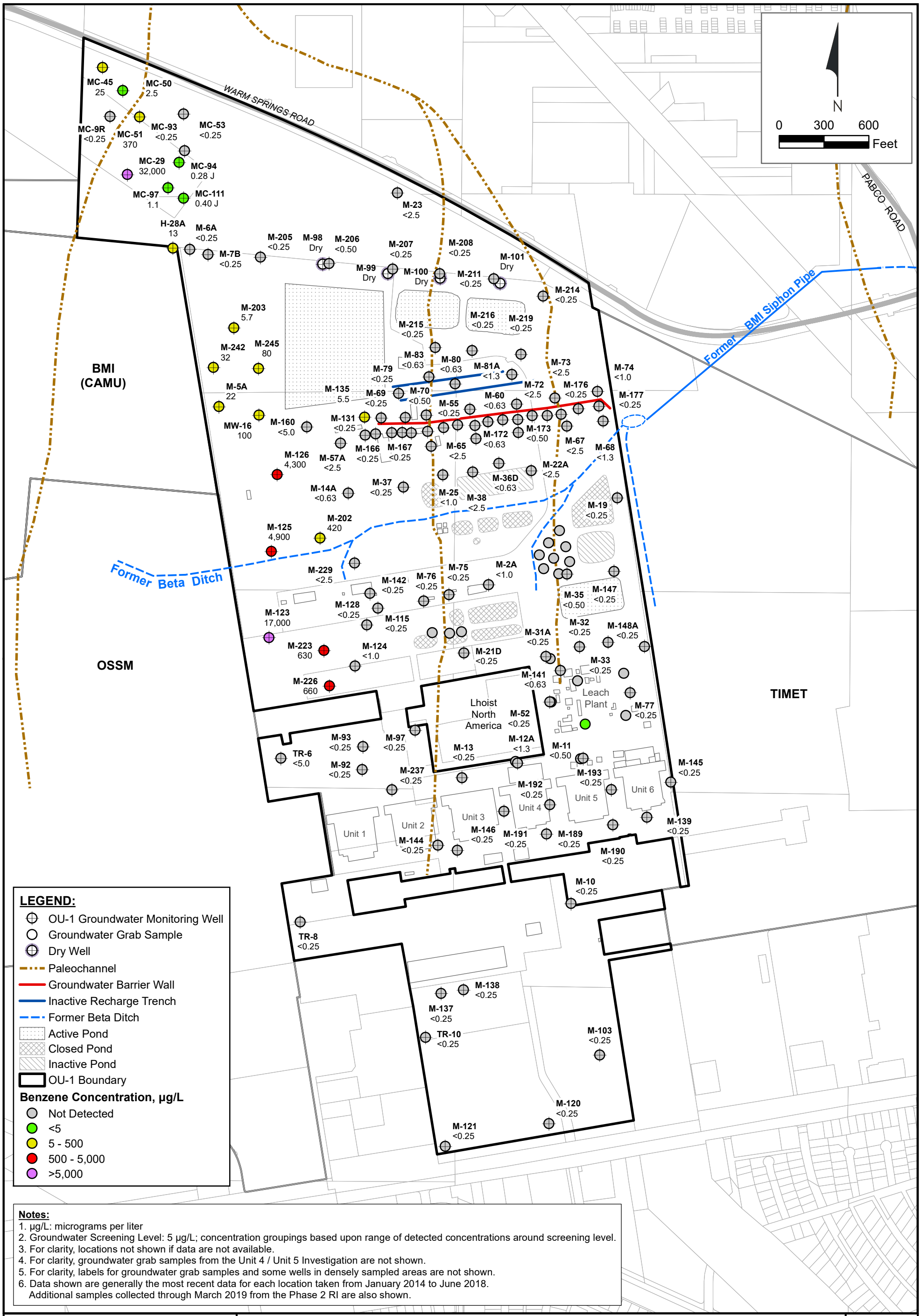
Temporal Distribution of Chloroform Concentrations in Selected Shallow Groundwater Wells within the Unit 4 Plume (small scale)

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure

4-21b

Drafter: WF | Date: 5/13/2023 | Contract Number: 1690029369-006 | Approved by: | Revised:



Notes:

1. µg/L: micrograms per liter
2. Groundwater Screening Level: 5 µg/L; concentration groupings based upon range of detected concentrations around screening level.
3. For clarity, locations not shown if data are not available.
4. For clarity, groundwater grab samples from the Unit 4 / Unit 5 Investigation are not shown.
5. For clarity, labels for groundwater grab samples and some wells in densely sampled areas are not shown.
6. Data shown are generally the most recent data for each location taken from January 2014 to June 2018. Additional samples collected through March 2019 from the Phase 2 RI are also shown.

RAMBOLL

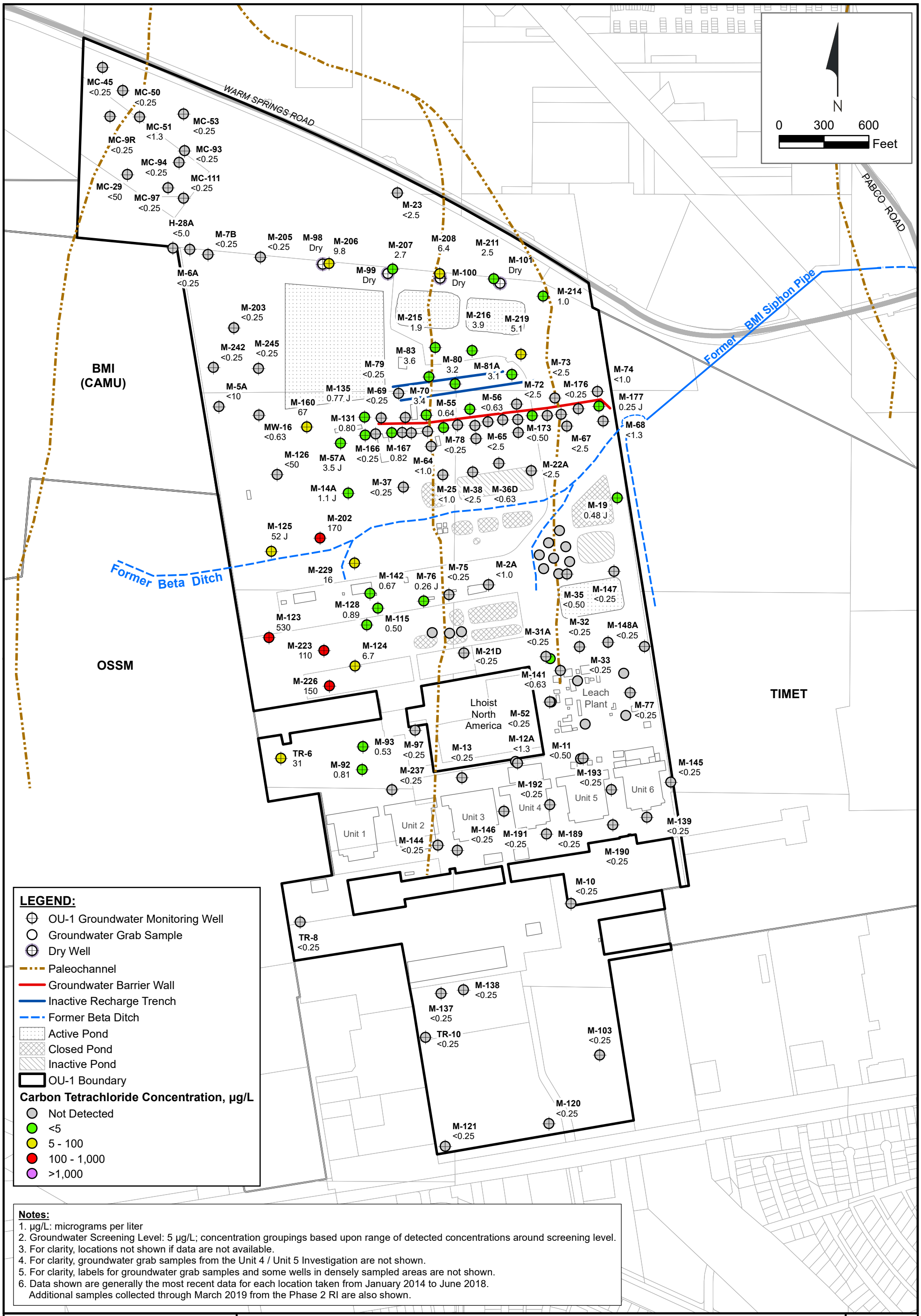
Concentrations of Benzene - Groundwater (0-55 feet bgs)

Nevada Environmental Response Trust Site
Henderson, Nevada

Figure **4-22a**

Drafter: JH | Date: 9/7/2023 | Contract Number: 169002 9369-006 | Approved by: | Revised:

Path: \\WCEVILFPS1\engLePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Figure 4-22a Benzene_Upper Shallow.mxd



LEGEND:

- OU-1 Groundwater Monitoring Well
- Groundwater Grab Sample
- Dry Well
- Paleochannel
- Groundwater Barrier Wall
- Inactive Recharge Trench
- Former Beta Ditch
- Active Pond
- Closed Pond
- Inactive Pond
- OU-1 Boundary

Carbon Tetrachloride Concentration, µg/L

- Not Detected
- <5
- 5 - 100
- 100 - 1,000
- >1,000

Notes:

1. µg/L: micrograms per liter
2. Groundwater Screening Level: 5 µg/L; concentration groupings based upon range of detected concentrations around screening level.
3. For clarity, locations not shown if data are not available.
4. For clarity, groundwater grab samples from the Unit 4 / Unit 5 Investigation are not shown.
5. For clarity, labels for groundwater grab samples and some wells in densely sampled areas are not shown.
6. Data shown are generally the most recent data for each location taken from January 2014 to June 2018. Additional samples collected through March 2019 from the Phase 2 RI are also shown.

RAMBOLL

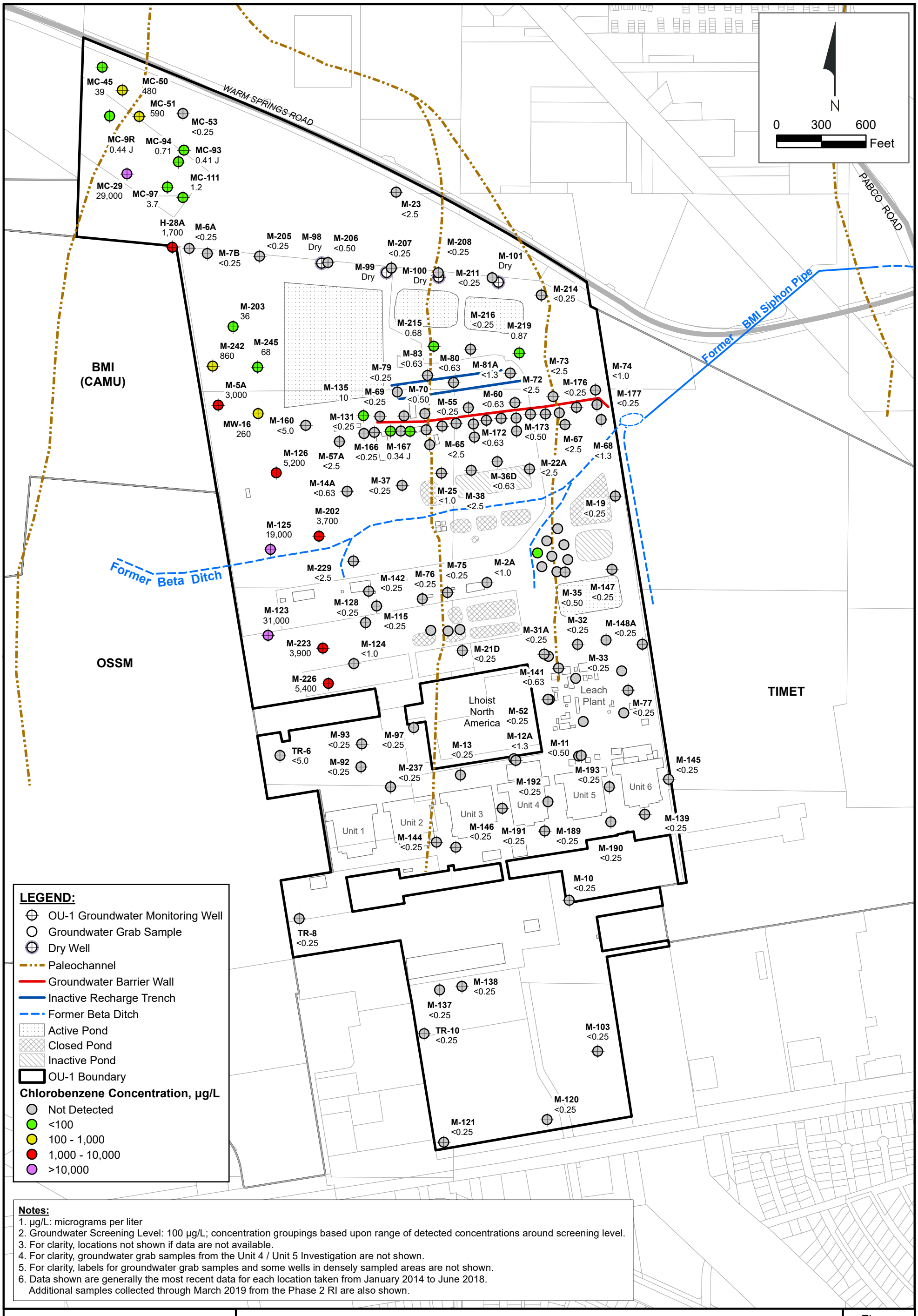
Concentrations of Carbon Tetrachloride - Groundwater (0-55 feet bgs)

Nevada Environmental Response Trust Site
Henderson, Nevada

Figure **4-22b**

Drafter: JH	Date: 9/7/2023	Contract Number: 169002 9369-006	Approved by:	Revised:

Path: \\WCEVILFPS1\engLePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Figure 4-22b_Carbon tetrachloride_Upper Shallow.mxd



LEGEND:

- OU-1 Groundwater Monitoring Well
- Groundwater Grab Sample
- Dry Well
- Paleochannel
- Groundwater Barrier Wall
- Inactive Recharge Trench
- Former Beta Ditch
- Active Pond
- Closed Pond
- Inactive Pond
- OU-1 Boundary

Chlorobenzene Concentration, µg/L

- Not Detected
- <100
- 100 - 1,000
- 1,000 - 10,000
- >10,000

Notes:

1. µg/L: micrograms per liter
2. Groundwater Screening Level: 100 µg/L; concentration groupings based upon range of detected concentrations around screening level.
3. For clarity, locations not shown if data are not available.
4. For clarity, groundwater grab samples from the Unit 4 / Unit 5 Investigation are not shown.
5. For clarity, labels for groundwater grab samples and some wells in densely sampled areas are not shown.
6. Data shown are generally the most recent data for each location taken from January 2014 to June 2018. Additional samples collected through March 2019 from the Phase 2 RI are also shown.

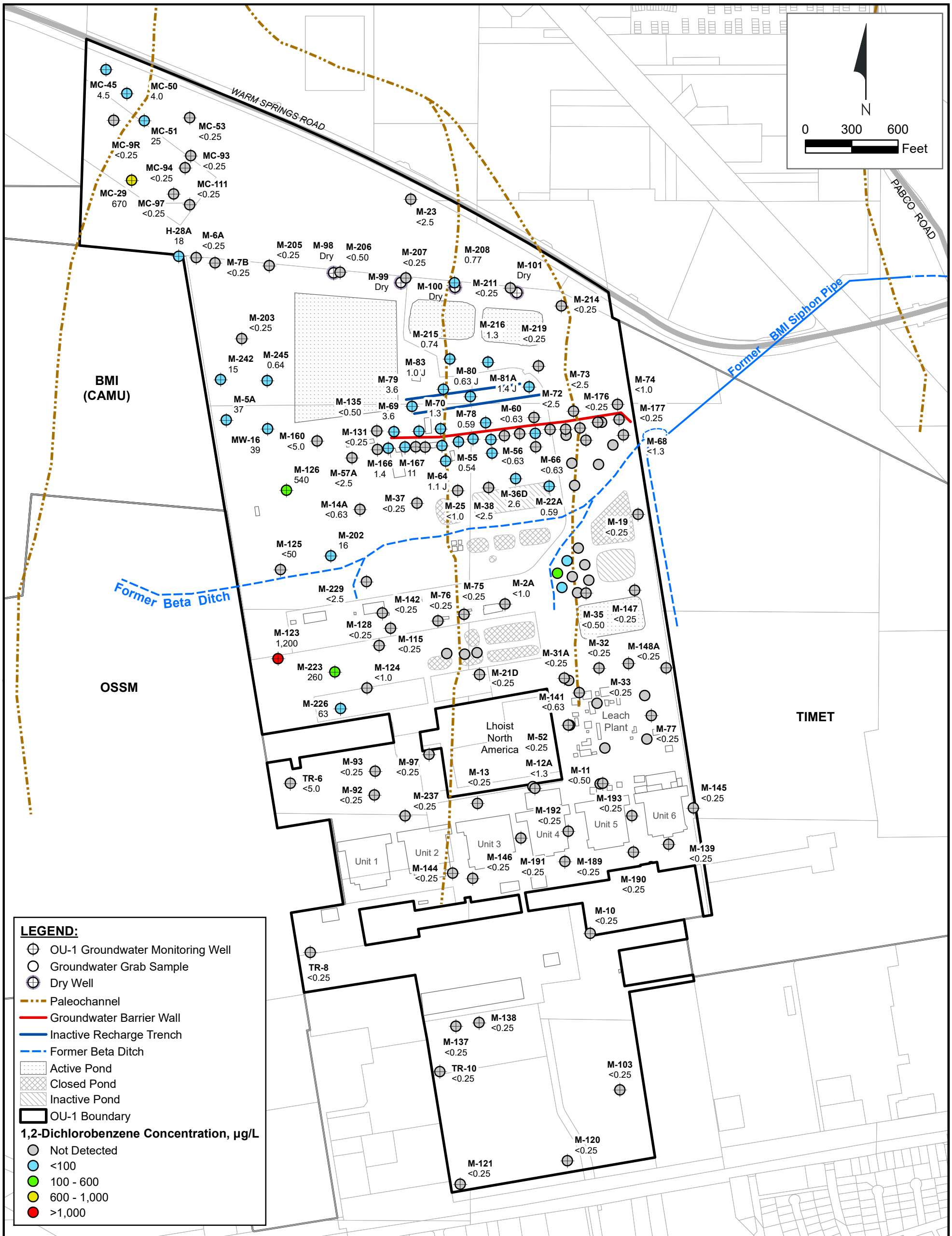
RAMBOLL

Concentrations of Chlorobenzene - Groundwater (0-55 feet bgs)
Nevada Environmental Response Trust Site
Henderson, Nevada

Figure
4-22c

Drafter: JH | Date: 9/7/2023 | Contract Number: 169002 9369-006 | Approved by: | Revised:

Path: \\WCEVILFPS1\engLePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Figure 4-22c_Chlorobenzene_Upper Shallow.mxd



LEGEND:

- OU-1 Groundwater Monitoring Well
- Groundwater Grab Sample
- Dry Well
- Paleochannel
- Groundwater Barrier Wall
- Inactive Recharge Trench
- Former Beta Ditch
- Active Pond
- Closed Pond
- Inactive Pond
- OU-1 Boundary

1,2-Dichlorobenzene Concentration, µg/L

- Not Detected
- <100
- 100 - 600
- 600 - 1,000
- >1,000

Notes:

1. µg/L: micrograms per liter
2. Groundwater Screening Level: 600 µg/L;concentration groupings based upon range of detected concentrations around screening level.
3. For clarity, locations not shown if data are not available.
4. For clarity, groundwater grab samples from the Unit 4 / Unit 5 Investigation are not shown.
5. For clarity, labels for groundwater grab samples and some wells in densely sampled areas are not shown.
6. Data shown are generally the most recent data for each location taken from January 2014 to June 2018. Additional samples collected through March 2019 from the Phase 2 RI are also shown.

RAMBOLL

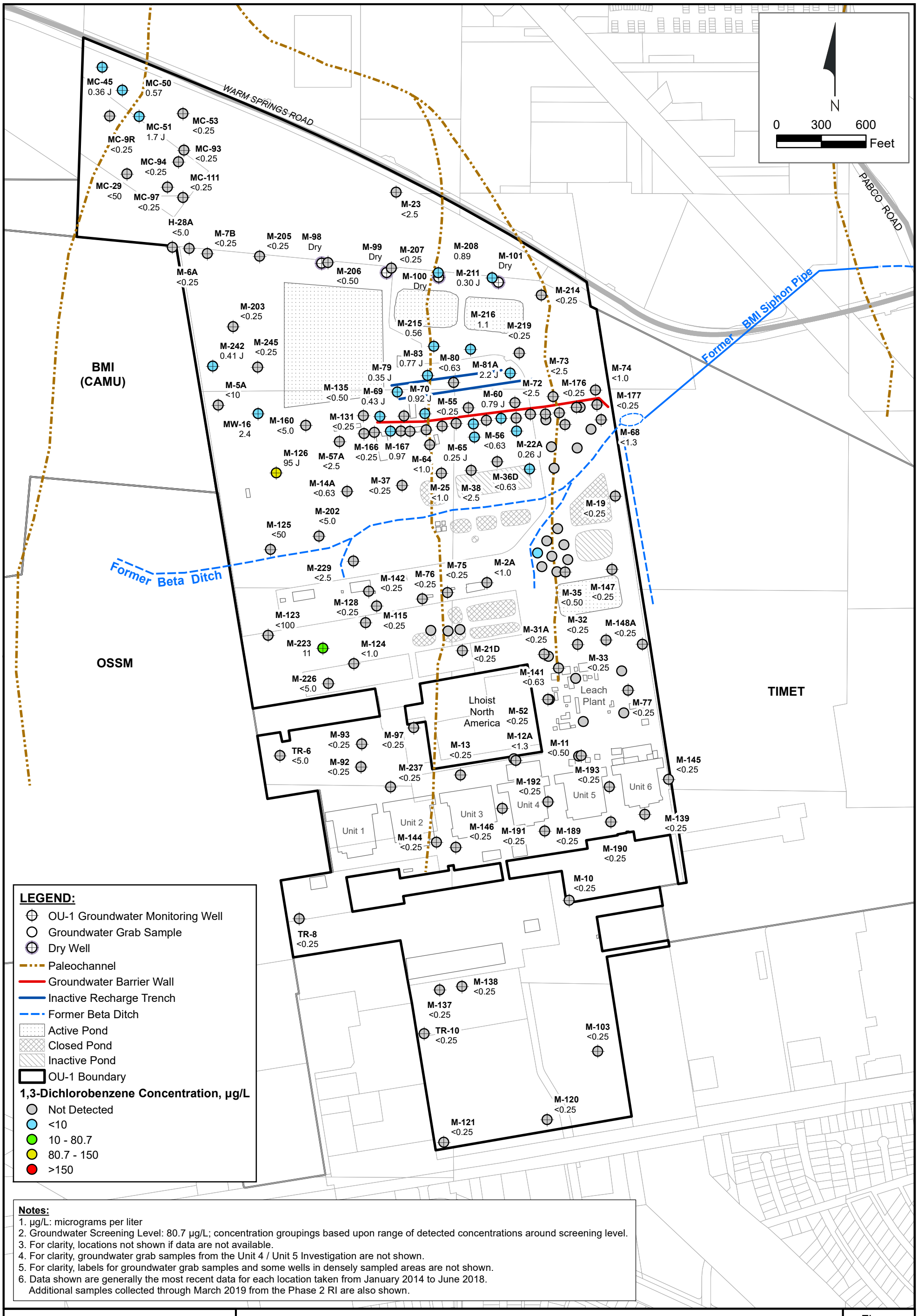
Concentrations of 1,2-Dichlorobenzene - Groundwater (0-55 feet bgs)

Nevada Environmental Response Trust Site
Henderson, Nevada

Figure **4-22d**

Drafter: JH | Date: 9/7/2023 | Contract Number: 169002 0169 | Approved by: | Revised:

Path: \\WCEVILFPS1\engLePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Figure 4-22d 1,2-Dichlorobenzene_Upper Shallow.mxd



LEGEND:

- OU-1 Groundwater Monitoring Well
- Groundwater Grab Sample
- Dry Well
- Paleochannel
- Groundwater Barrier Wall
- Inactive Recharge Trench
- Former Beta Ditch
- Active Pond
- Closed Pond
- Inactive Pond
- OU-1 Boundary

1,3-Dichlorobenzene Concentration, µg/L

- Not Detected
- <10
- 10 - 80.7
- 80.7 - 150
- >150

Notes:

1. µg/L: micrograms per liter
2. Groundwater Screening Level: 80.7 µg/L; concentration groupings based upon range of detected concentrations around screening level.
3. For clarity, locations not shown if data are not available.
4. For clarity, groundwater grab samples from the Unit 4 / Unit 5 Investigation are not shown.
5. For clarity, labels for groundwater grab samples and some wells in densely sampled areas are not shown.
6. Data shown are generally the most recent data for each location taken from January 2014 to June 2018. Additional samples collected through March 2019 from the Phase 2 RI are also shown.

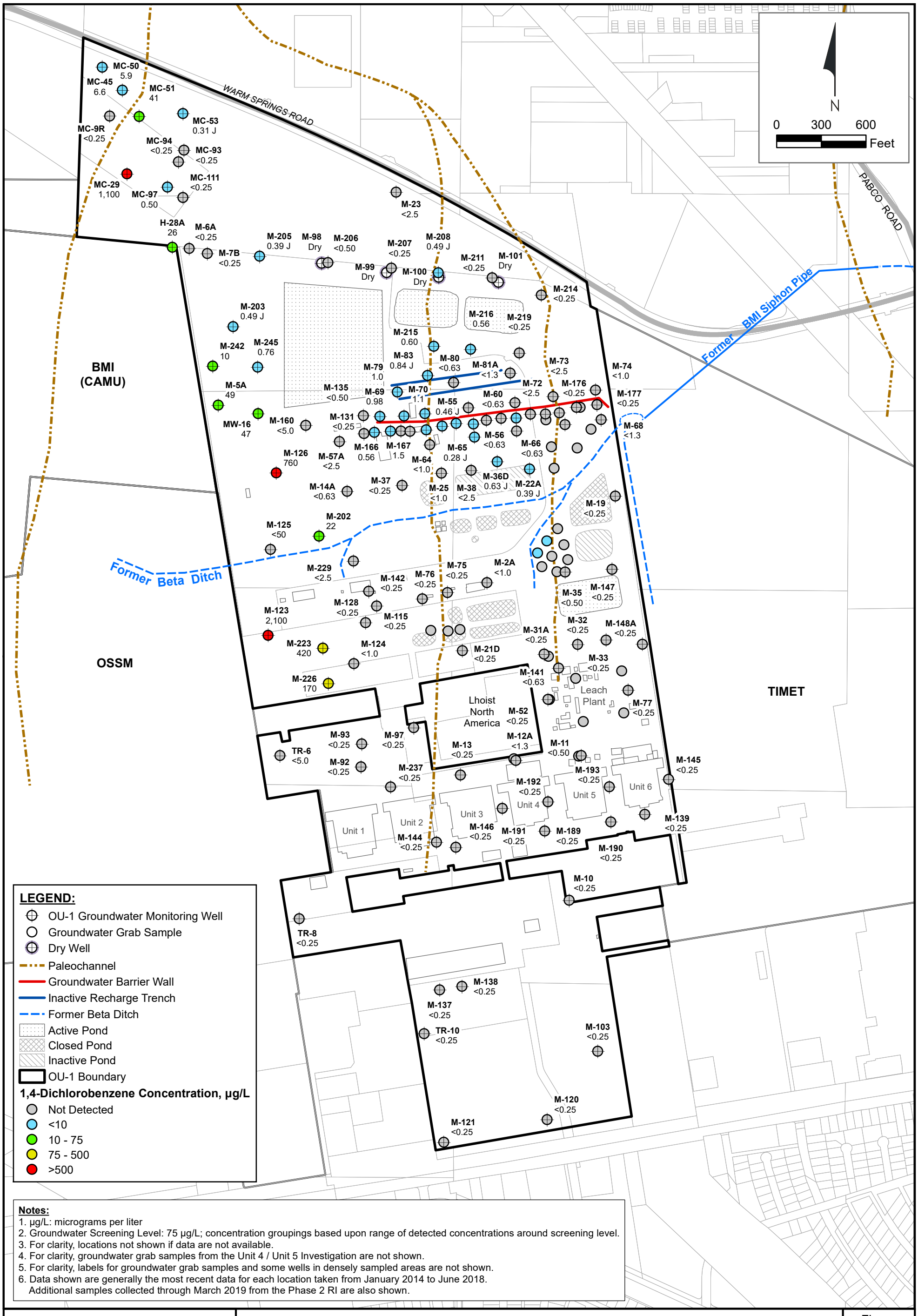
RAMBOLL

Concentrations of 1,3-Dichlorobenzene - Groundwater (0-55 feet bgs)
Nevada Environmental Response Trust Site
Henderson, Nevada

Figure **4-22e**

Drafter: JH | Date: 9/7/2023 | Contract Number: 169002 9369-006 | Approved by: | Revised:

Path: \\WCEVILFPS1\engLePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Figure 4-22e_1,3-Dichlorobenzene_Upper Shallow.mxd



LEGEND:

- OU-1 Groundwater Monitoring Well
- Groundwater Grab Sample
- Dry Well
- Paleochannel
- Groundwater Barrier Wall
- Inactive Recharge Trench
- Former Beta Ditch
- Active Pond
- Closed Pond
- Inactive Pond
- OU-1 Boundary

1,4-Dichlorobenzene Concentration, µg/L

- Not Detected
- <10
- 10 - 75
- 75 - 500
- >500

Notes:

1. µg/L: micrograms per liter
2. Groundwater Screening Level: 75 µg/L; concentration groupings based upon range of detected concentrations around screening level.
3. For clarity, locations not shown if data are not available.
4. For clarity, groundwater grab samples from the Unit 4 / Unit 5 Investigation are not shown.
5. For clarity, labels for groundwater grab samples and some wells in densely sampled areas are not shown.
6. Data shown are generally the most recent data for each location taken from January 2014 to June 2018. Additional samples collected through March 2019 from the Phase 2 RI are also shown.

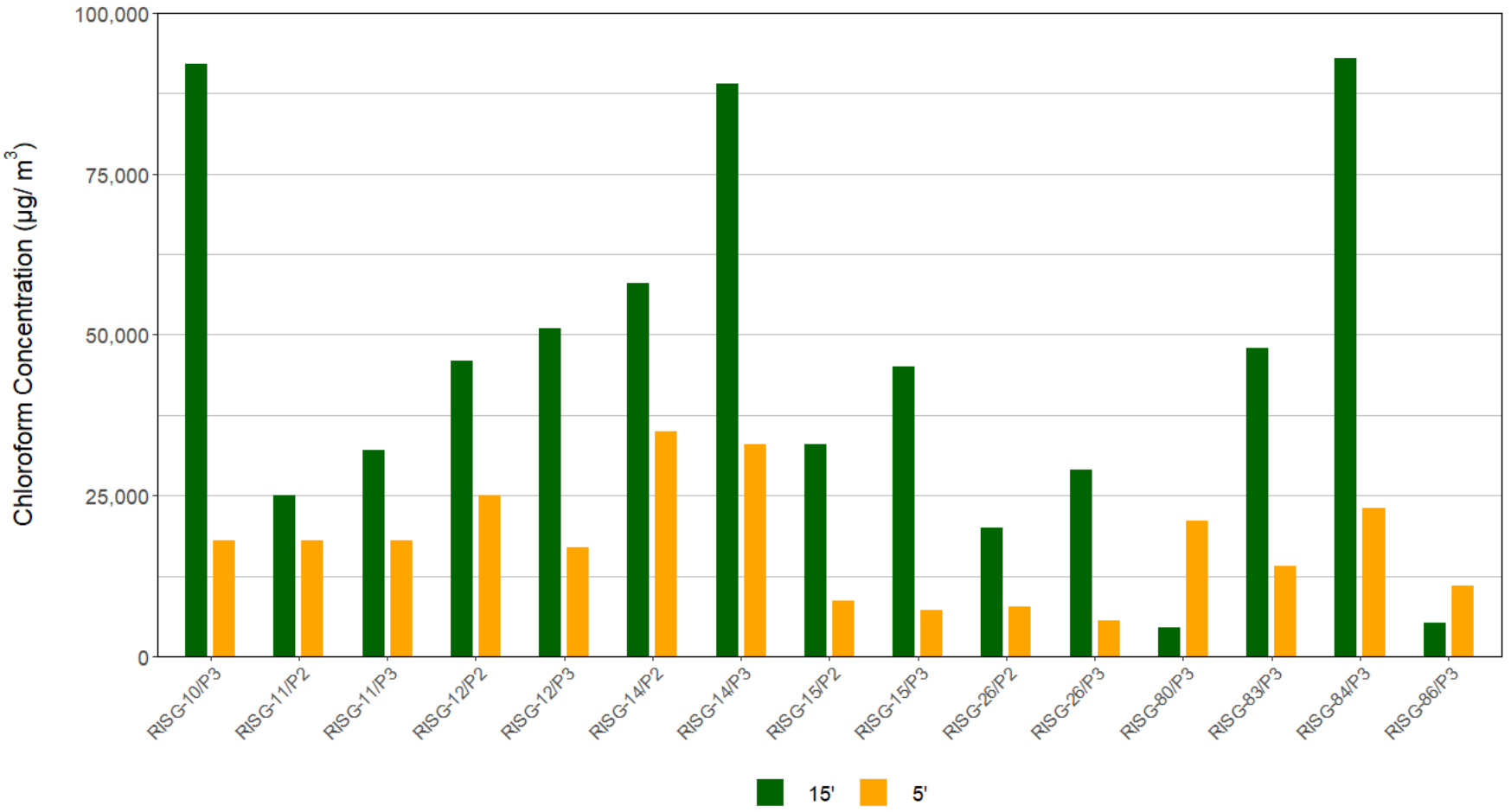
RAMBOLL

Concentrations of 1,4-Dichlorobenzene - Groundwater (0-55 feet bgs)
Nevada Environmental Response Trust Site
Henderson, Nevada

Figure **4-22f**

Drafter: JH | Date: 9/7/2023 | Contract Number: 169002 9369-006 | Approved by: | Revised:

Path: \\WCEVILFPS1\engLePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Figure 4-22f_1,4-Dichlorobenzene_Upper Shallow.mxd



All samples were 15 ft bgs except RISG-86 (14') for Phase 3 (P3).

RAMBOLL

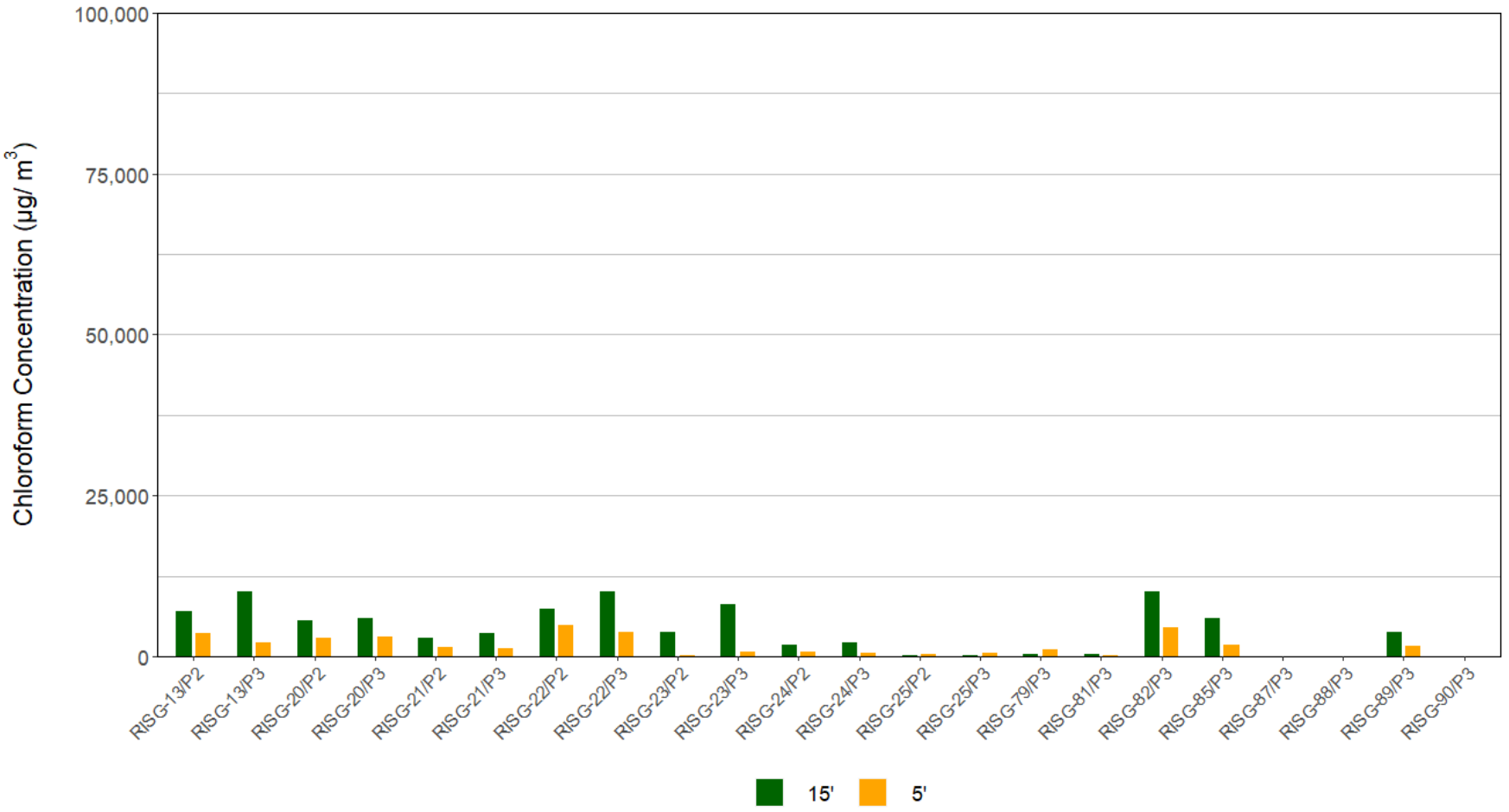
Distribution of Chloroform Concentrations in Co-located Soil Gas 5 feet bgs and 15 feet bgs (Concentrations > 10,000 µg/m³)

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure

4-23a

Drafter: WF Date: 5/13/2023 Contract Number: 1690029369-006 Approved by: Revised:



All samples were 15 ft bgs except RISG-22 (12.4'), RISG-81 (14'), and RISG-85 (14') for Phase 3 (P3).

RAMBOLL

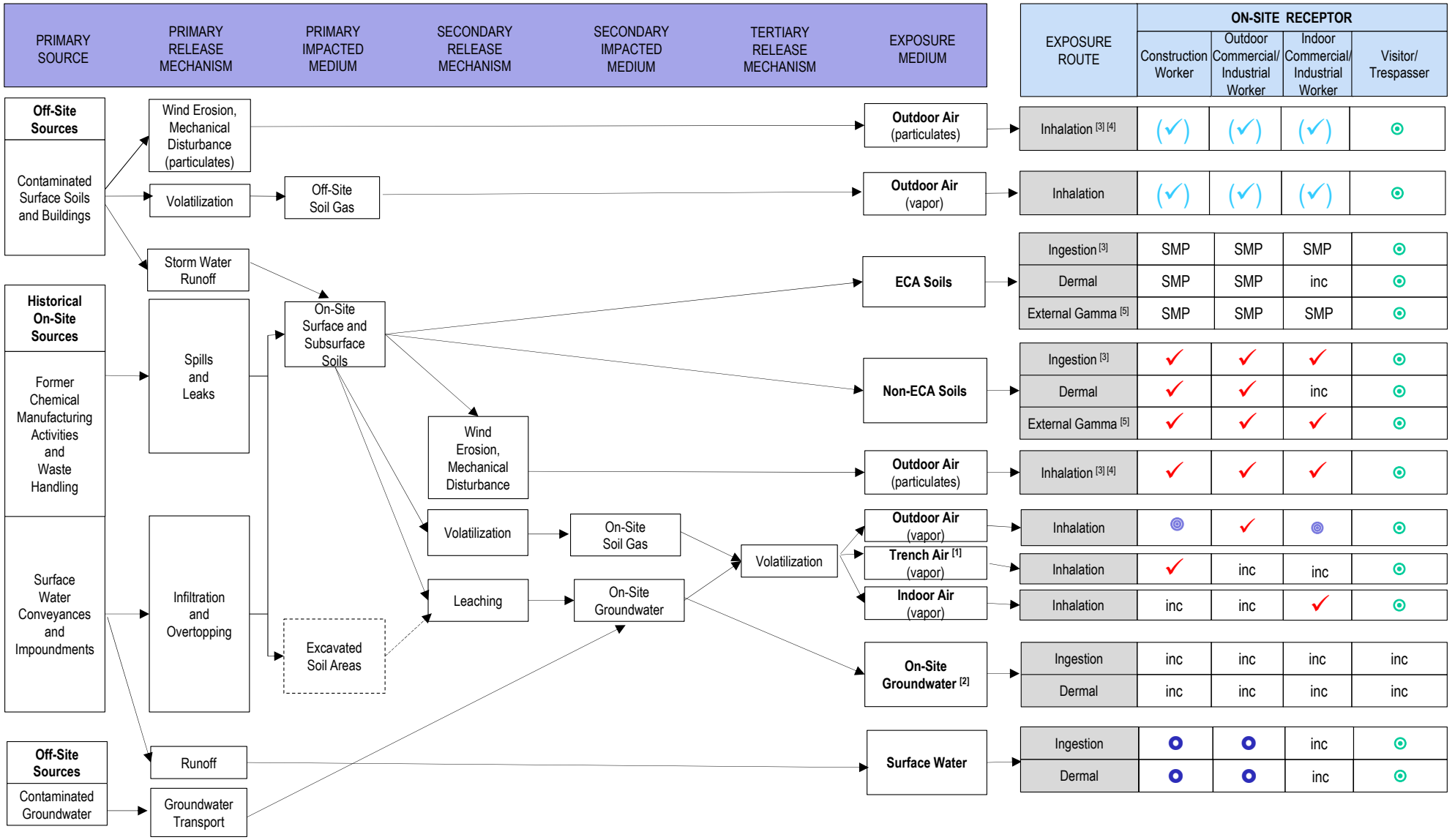
Distribution of Chloroform Concentrations in Co-located Soil Gas 5 feet bgs and 15 feet bgs (Concentrations ≤ 10,000 µg/m³)

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure

4-23b

Drafter: WF | Date: 5/13/2023 | Contract Number: 1690029369-006 | Approved by: | Revised:



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RAMBOLL

Conceptual Site Model for OU-1 Operations Area
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
5-1

Drafter: EL Date: 5/31/2023 Contract Number: 1690029369-006 Approved by: Revised:

Notes:

BHRA	Baseline health risk assessment
ECA	Excavation control area
NDEP	Nevada Division of Environmental Protection
OSHA	Occupational Safety and Health Administration
OU	Operable unit
VOC	Volatile organic compound
[1]	To be conservative, construction workers are assumed to be exposed to vapors migrating from soil/soil gas/groundwater while standing in a 10-foot trench in the unsaturated zone, placing them closer to the potential sources.
[2]	Exposure via domestic use of groundwater is not evaluated because on-site groundwater is not and will not be used as a source of drinking water. Incidental ingestion of and dermal contact with groundwater by on-site construction workers are considered to be incomplete exposure pathways because depth to groundwater is >10 feet below ground surface.
[3]	Includes radionuclide exposures, if applicable.
[4]	Includes asbestos exposures.
[5]	Only radionuclide exposures, if applicable.

Key:

inc	Incomplete exposure pathway
SMP	Site Management Plan -- potential exposures via direct-contact pathways are managed through the SMP.
✓	Complete exposure pathway; evaluated quantitatively in the BHRA.
(✓)	Complete exposure pathway. Ramboll understands that exposures of on-site receptors to airborne releases from neighboring properties would be evaluated in the risk assessments being prepared for those properties, under the oversight of NDEP. The results of these off-site risk assessments are discussed quantitatively in the BHRA.
◎	The exposure to VOCs in outdoor air is not quantitatively evaluated for construction workers and indoor commercial/industrial workers because it is expected to be much lower than the exposure to VOCs in trench air and indoor air.
●	Potentially complete, but insignificant exposure pathway; not evaluated quantitatively because such exposures would be intermittent and of short duration or regulated under OSHA.
◉	Potentially complete exposure pathway; not evaluated quantitatively because public access is generally restricted at industrial sites and potential exposures of a visitor/trespasser would be less than exposures of an on-site worker; the visitor/trespasser is discussed qualitatively.

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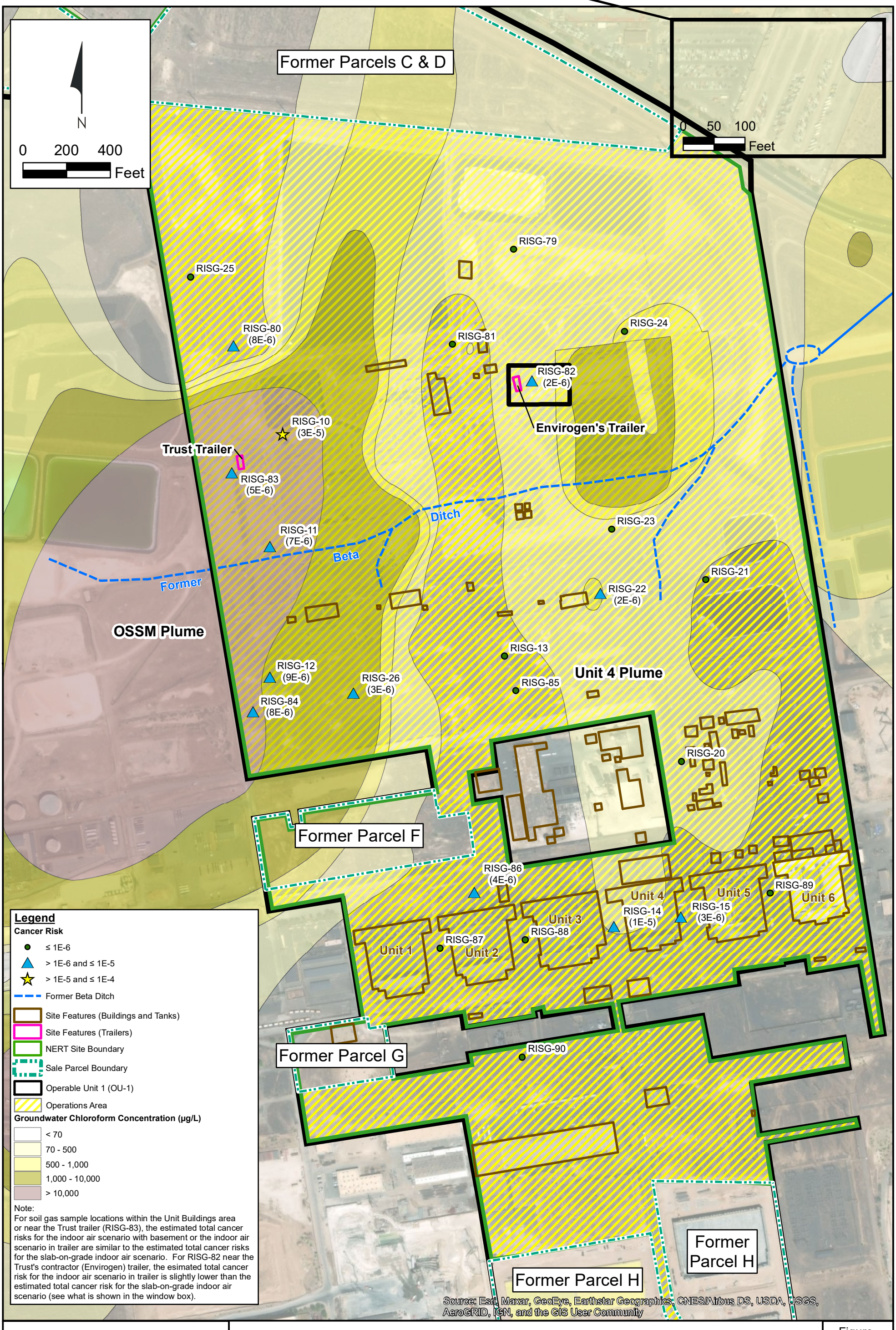
RAMBOLL

Conceptual Site Model for OU-1 Operations Area
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
5-1

Drafter: EL Date: 5/31/23 Contract Number: 1690029369-006 Approved by: Revised:



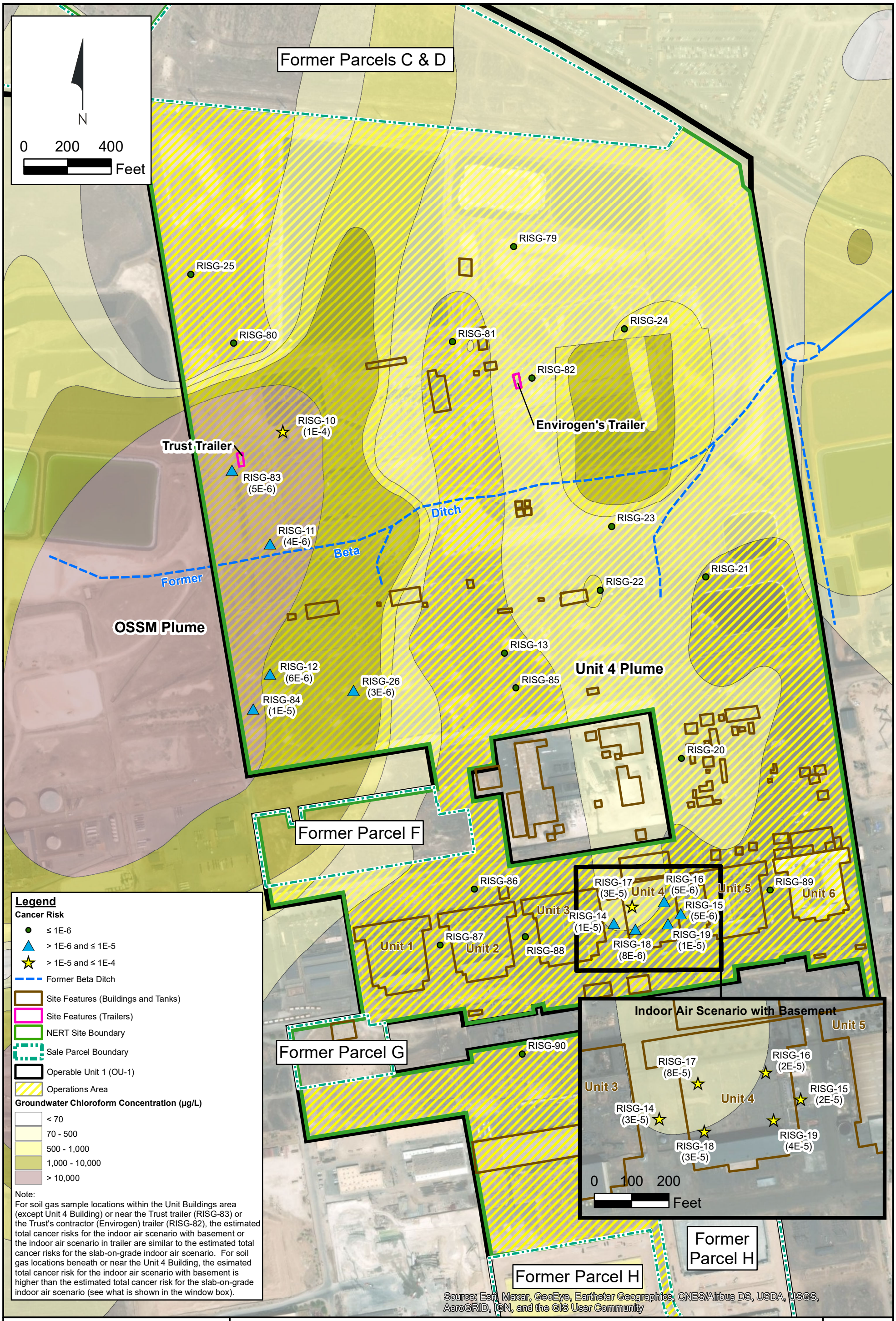
RAMBOLL

Estimated Total Cancer Risk for Indoor Commercial/Industrial Workers - Soil Gas at 5 feet bgs (Chloroform Plumes as Depicted in the RI Report for OU-1 and OU-2)
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
5-2

Drafter: JA | Date: 10/31/2023 | Contract Number: 1690029369-006 | Approved by: | Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Fig 5-2 Cancer Risk IA 5 ft SG.mxd



RAMBOLL

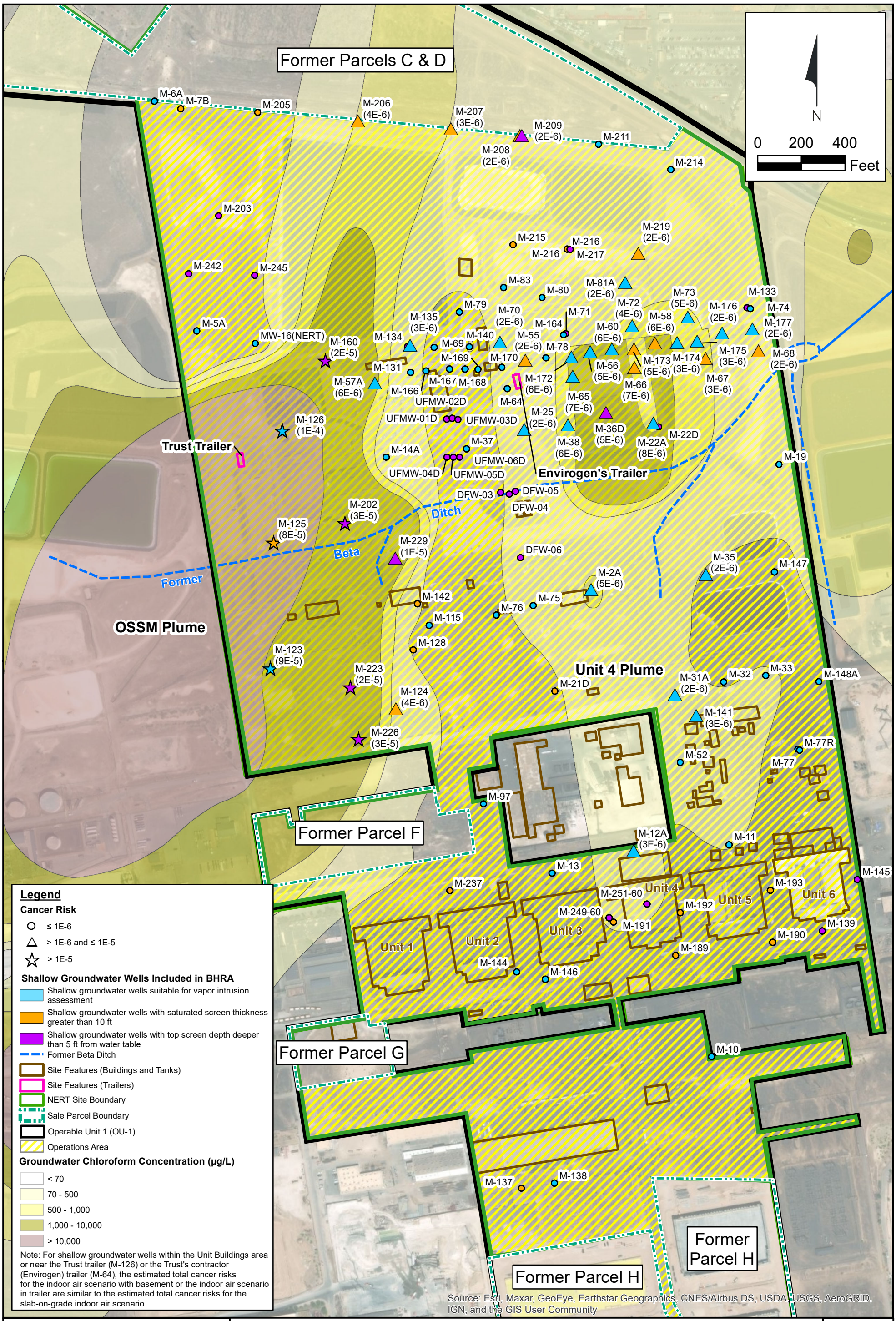
Estimated Total Cancer Risk for Indoor Commercial/Industrial Workers - Soil Gas at or around 15 feet bgs (Chloroform Plumes as Depicted in the RI Report for OU-1 and OU-2)

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **5-3**

Drafter: JA | Date: 10/31/2023 | Contract Number: 1690029369-006 | Approved by: | Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Fig 5-3 Cancer Risk IA 15 ft SG.mxd



Legend

Cancer Risk

- ○ ≤ 1E-6
- △ > 1E-6 and ≤ 1E-5
- ☆ > 1E-5

Shallow Groundwater Wells Included in BHRA

- Shallow groundwater wells suitable for vapor intrusion assessment
- Shallow groundwater wells with saturated screen thickness greater than 10 ft
- Shallow groundwater wells with top screen depth deeper than 5 ft from water table
- Former Beta Ditch
- Site Features (Buildings and Tanks)
- Site Features (Trailers)
- NERT Site Boundary
- Sale Parcel Boundary
- Operable Unit 1 (OU-1)
- Operations Area

Groundwater Chloroform Concentration (µg/L)

- < 70
- 70 - 500
- 500 - 1,000
- 1,000 - 10,000
- > 10,000

Note: For shallow groundwater wells within the Unit Buildings area or near the Trust trailer (M-126) or the Trust's contractor (Envirogen) trailer (M-64), the estimated total cancer risks for the indoor air scenario with basement or the indoor air scenario in trailer are similar to the estimated total cancer risks for the slab-on-grade indoor air scenario.

RAMBOLL

Estimated Total Cancer Risk for Indoor Commercial/Industrial Workers - Shallow Groundwater (Chloroform Plumes as Depicted in the RI Report for OU-1 and OU-2)
Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **5-4**

Drafter: JA	Date: 10/31/2023	Contract Number: 1690029369-006	Approved by:	Revised:

Path: H:\LePetomane\NERT\Risk Assessment-Human Health\2018 BHRAs\OU-1 Soil Gas and Groundwater BHRA\GIS\Fig 5-4 Cancer Risk Indoor Worker_GW.mxd

APPENDIX A
ZONE OF INFLUENCE FOR REMEDIAL INVESTIGATION SOIL GAS SAMPLES (PROVIDED ELECTRONICALLY)

APPENDIX B
DATA VALIDATION SUMMARY REPORTS AND TABLES – SOIL GAS (PROVIDED ELECTRONICALLY)

APPENDIX C
DATA VALIDATION SUMMARY REPORTS AND TABLES – SHALLOW GROUNDWATER (PROVIDED ELECTRONICALLY)

APPENDIX D
SOIL GAS BHRA DATA SET (PROVIDED ELECTRONICALLY)

APPENDIX E
SHALLOW GROUNDWATER BHRA DATA SET (PROVIDED ELECTRONICALLY)

APPENDIX F
SOIL PROPERTY SAMPLING LOCATIONS AND BORING LOGS (PROVIDED ELECTRONICALLY)

APPENDIX G
SUPPORTING DOCUMENTATION FOR VAPOR INTRUSION MODELING AND RISK ASSESSMENT CALCULATIONS (PROVIDED ELECTRONICALLY)

APPENDIX H
UCL INPUT AND OUTPUT FILES (PROVIDED ELECTRONICALLY)