



May 23, 2018

## TECHNICAL MEMORANDUM

To: Steve Clough  
Nevada Environmental Response Trust

From: John Pekala, CEM#2347, Expires 9/20/2018, Ramboll  
Elizabeth Miesner, Jessica Donovan, Kun Zhao, and Shuo Yu, Ramboll

Re: **RI Phase 2 Modification No. 11**  
**Recommended Soil Gas Sampling Locations**  
**Nevada Environmental Response Trust Site**  
**Henderson, Nevada**  
**Ramboll Project No. 1690006608-020**

This Technical Memorandum presents Ramboll US Corporation's (Ramboll) recommended Modification No. 11 to the scope of work for the Remedial Investigation (RI) Phase 2 Investigation currently in progress at the Nevada Environmental Response Trust Site (the "Site") located in Henderson, Nevada. This recommended modification proposes soil gas sampling for volatile organic compounds (VOCs) at locations identified in Operable Unit 1 (OU-1)<sup>1</sup> and Operable Unit 2 (OU-2). With respect to OU-1, additional soil gas sampling is proposed in response to comments received from the Nevada Division of Environmental Protection (NDEP)<sup>2</sup> on the Technical Memorandum, Remedial Investigation Data Evaluation (dated May 2, 2016) and the Trust's Response to NDEP Comments<sup>3</sup>, Remedial Investigation Data Evaluation/Phase 2 Work Plan (dated August 12, 2016). With respect to OU-2, additional soil gas sampling is proposed for the Baseline Health Risk Assessment (BHRA). As described in the RI Feasibility Study Work Plan<sup>4</sup>, the BHRA will address the NERT Off-Site Study Area, which is partially located in OU-2, and will focus on the vapor inhalation pathway associated with soil gas and groundwater. As RI Phase 2 data was evaluated in 2017, it became evident that additional soil gas data would be needed to confirm the previous soil gas sampling results and to provide better spatial coverage and characterization of the VOCs in soil gas in the NERT Off-Site Study Area in OU-2.

Soil gas sample results, along with groundwater sample results, will be used in the BHRA evaluation in OU-1 and the NERT Off-Site Study Area in OU-2 to evaluate potential health risk from vapor migration from the subsurface to indoor or ambient air.

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<sup>1</sup> Not including Parcel E which will be addressed separately.

<sup>2</sup> Received on August 23, 2016.

<sup>3</sup> Received on July 13, 2016.

<sup>4</sup> ENVIRON. 2014. Remedial Investigation and Feasibility Study Work Plan, Revision 2, Nevada Environmental Response Trust Site, Henderson Nevada, June 19. NDEP approved July 2, 2014.

### **OU-1 Soil Gas Investigation**

In OU-1, soil gas samples were previously collected by Tronox during the 2008 site-wide soil gas survey. Most of the soil gas samples were collected at a depth of 5 feet below ground surface (bgs) with some at a depth of 20 feet bgs at a few locations near Units 3, 5 and 6, as described in the Phase B Source Area Investigation Work Plan Soil Gas Survey<sup>5</sup> which was approved by NDEP on March 26, 2008. The results are discussed in the 2010 Site-Wide Soil Gas Human Health Risk Assessment Report<sup>6</sup>. The 2008 soil gas samples were collected consistent with current sampling methodology<sup>7</sup> and the data is considered acceptable for use in the BHRA, particularly as the source groundwater plume has been relatively stable over time. The 2008 soil gas sample locations are shown on Figure 1. Recent shallow groundwater samples collected after 2015 in OU-1 are available from the RI Phase 1, RI Phase 2, and annual groundwater monitoring sampling events.

Additional soil gas samples are proposed in OU-1 to fill data gaps for evaluating the human health risks through the vapor intrusion pathway for the BHRA. The reasons for collecting additional soil gas samples in OU-1 are summarized below:

- Verify that the previous high soil gas sampling results collected in 2008 have not significantly changed over time.
- The current vapor intrusion guidance<sup>8</sup> recommends collecting samples from a deeper depth interval closer to the source (i.e., VOCs in shallow groundwater). In OU-1, depth to groundwater ranges from approximately 20 to 60 feet bgs, with the majority of the shallow groundwater samples collected from depths between 30 and 50 feet bgs. Most of the 2008 soil gas samples were from a shallower depth interval (i.e., approximately 5 feet bgs), and only a few soil gas samples were from a deeper depth interval. This proposal includes collecting soil gas samples at both 5 and 15 feet bgs at most proposed locations.
- In addition, relatively higher concentrations of chloroform were detected in recent grab groundwater samples collected by Tetra Tech in 2017<sup>9</sup> near Unit Building 4, where no previous soil gas samples have been collected. This proposal includes collecting soil gas samples from beneath the currently existing basement slab of this building.

As shown on Figure 1, ten soil gas sampling locations are proposed in OU-1 for the reasons listed above. These sample locations are summarized in Table 1 and discussed in further detail below:

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<sup>5</sup> ENSR. 2008. Phase B Source Area Investigation Work Plan, Soil Gas Survey, Tronox LLC Facility, Henderson, Nevada, March. NDEP approved on March 26, 2008.

<sup>6</sup> Northgate and Exponent. 2010. Site-Wide Soil Gas Human Health Risk Assessment, Tronox LLC, Henderson, Nevada, November 22.

<sup>7</sup> USEPA. 2015. OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air. EPA9200.2-154. June.

<sup>8</sup> USEPA. 2015. OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air. EPA9200.2-154. June.

<sup>9</sup> Tetra Tech. 2017. Technical Memorandum: Unit 4 and 5 Buildings Investigation Second Mobilization. May 4. NDEP approved June 8, 2017.

- Three soil gas sample locations (RISG-10, RISG-11, and RISG-12) are proposed to confirm previous soil gas sample locations in the main chloroform groundwater plume area at the western portion of the Site. These locations were selected because they are adjacent to shallow groundwater monitoring wells M-126, M-125 and M-123, respectively. Soil gas samples in these locations were previously collected at 5 feet bgs. It is proposed to collect soil gas samples at both 5 and 15 feet bgs at these locations.
- One soil gas sample location (RISG-13) is proposed in the central portion of the Site based on previous soil gas sampling results (near location SG89, sampled at 5 feet bgs) showing high chloroform concentrations located outside the main chloroform plume area. To verify the previous soil gas sampling results and also to obtain soil gas samples at a deeper depth interval closer to the source (i.e., the underlying groundwater), collection of soil gas samples at 5 and 15 feet bgs are proposed at this location.
- Two soil gas sample locations (RISG-14 and RISG-15) are proposed to confirm previously-reported relatively high concentrations of chloroform in soil gas (at locations SG70 and SG71, sampled at 5 feet bgs) located at the southern edge of the main chloroform plume area near Unit 4 in the southern portion of the Site. M-191 and M-192 are the two shallow groundwater monitoring wells that are co-located with RISG-14 and RISG-15, respectively. To verify the previous soil gas sampling results and also to obtain soil gas samples at a deeper depth interval closer to the source (i.e., the groundwater), it is proposed to collect soil gas samples at both 5 and 15 feet bgs at these two locations.
- Four soil gas samples (RISG-16, RISG-17, RISG-18, and RISG-19) are proposed beneath the currently existing basement slab in the center of Unit Building 4. These locations are proposed based on relatively higher concentrations of chloroform detected in grab groundwater samples collected by Tetra Tech in 2017<sup>10</sup>. Previously no soil gas samples were collected under Unit Building 4. To verify the impact on soil gas from the relatively high chloroform concentrations detected in the shallow groundwater under Building 4, it is proposed to collect soil gas samples beneath the basement slab, which is approximately 15 feet below the adjacent ground surface.

## **OU-2 Soil Gas Investigation**

In the NERT Off-Site Study Area in OU-2, soil gas samples were previously collected in Parcels A, B, I, and J (as shown on Figure 2) at a depth of 5 feet bgs during the 2008 Phase B Source Area Investigation Work Plan Soil Gas Survey<sup>11</sup>. During the RI Phase 1 investigation in 2015, soil gas samples were collected at three locations (RISG-1, RISG-2, and RISG-3) at a depth of 5 feet bgs and 15 feet bgs in the NERT Off-Site Study Area within OU-2, as described in the RI Feasibility Study Work Plan<sup>12</sup>, which was approved by NDEP on

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<sup>10</sup> Tetra Tech. 2017. Technical Memorandum: Unit 4 and 5 Buildings Investigation Second Mobilization. May 4. NDEP approved June 8, 2017.

<sup>11</sup> ENSR. 2008. Phase B Source Area Investigation Work Plan, Soil Gas Survey, Tronox LLC Facility, Henderson, Nevada, March. NDEP approved on March 26, 2008.

<sup>12</sup> ENVIRON. 2014. Remedial Investigation and Feasibility Study Work Plan, Revision 2, Nevada Environmental Response Trust Site, Henderson Nevada, June 19. NDEP approved July 2, 2014.

July 2, 2014. The 2015 soil gas samples were collected consistent with current vapor intrusion guidance<sup>13</sup> and the data is considered acceptable for use in the BHRA.

The average depth to shallow groundwater in the NERT Off-Site Study Area in OU-2 is 25 feet bgs. Shallow groundwater monitoring wells within the NERT Off-Site Study Area in OU-2 are shown on Figure 2. Recent shallow groundwater samples have been collected throughout the NERT Off-Site Study Area in OU-2 since 2015 during the RI Phase 1, RI Phase 2, and the annual groundwater monitoring sampling events.

In order to sufficiently evaluate the vapor intrusion pathway in the planned BHRA, additional soil gas samples are required to better characterize concentrations of VOCs in soil gas within the groundwater chloroform plume downgradient of the Site, or to better understand the lateral extent of VOCs in soil gas downgradient of the Site including samples from a deeper depth interval closer to the source (i.e., VOCs in shallow groundwater). As shown on Figure 2, nine soil gas samples are proposed in the NERT Off-Site Study Area in OU-2. These samples are summarized in Table 2 and discussed in further detail below. It is proposed to collect soil gas samples at both 5 and 15 feet bgs at each of these locations.

- Three soil gas sample locations (RISG-1, RISG-2, and RISG-3) are proposed at the same locations as the previously sampled locations during the RI Phase 1 Investigation in 2015. These three locations are located in the southern, central, and northern portions of the chloroform groundwater plume extending onto the NERT Off-Site Study Area in OU-2. Resampling at these three locations (RISG-1, RISG-2, and RISG-3) is proposed to confirm previously detected concentrations of VOCs in soil gas. The proposed locations are adjacent to shallow groundwater monitoring wells PC-67, PC-24, and PC-21A and are in the public right of way.
- Three soil gas sample locations (RISG-4, RISG-5, and RISG-6) are proposed to better characterize concentrations of VOCs in soil gas within the groundwater chloroform plume downgradient of the Site. The proposed locations are adjacent to shallow groundwater monitoring wells PC-172D, PC-169, and PC-122 and are in the public right of way.
- Three soil gas sample locations (RISG-7, RISG-8, and RISG-9) are proposed to better understand the lateral extent of VOCs in soil gas downgradient of the Site. The proposed locations are adjacent to shallow groundwater monitoring wells PC-167, PC-179, and PC-166 and are in the public right of way.
- In addition, soil physical properties, including soil classification (grain size distribution/Atterberg Limits), total organic carbon, bulk density, water content, and total porosity will be collected at 5 feet bgs, 10 feet bgs, and 15 feet bgs at RISG-1 through RISG-9 where the soil properties have not been collected previously<sup>14</sup>.

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<sup>13</sup> USEPA. 2015. OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air. EPA9200.2-154. June.

<sup>14</sup> Soil classification (grain size distribution/Atterberg Limits), and total organic carbon have previously been collected at PC-172 (co-located with RISG-4, at 13.5 feet bgs), PC-167 (co-located with RISG-7, at 11.0 feet bgs), and PC-166 (co-located with RISG-9, at 11.5 feet bgs) during the RI Phase 2 investigation.

**Laboratory Analysis**

VOCs will be analyzed using USEPA Method TO-15 for the soil gas samples, as described in the 2008 Phase B Source Area Investigation Work Plan, the RI Phase 1 Field Sampling Work Plan<sup>15</sup>, and the NERT RI Quality Assurance Project Plan<sup>16</sup>. The drilling and sampling methods to be used will follow those provided in the RI Phase 1 Field Sampling Work Plan.

**Closing**

This soil gas data will be evaluated in the Soil Gas and Groundwater BHRAs for OU-1 and OU-2 that are currently planned for submittal to NDEP in mid-2019.

Please contact us should you have any questions about the recommended soil gas sampling plan.

**Attachments**

Table 1 Proposed Soil Gas Sampling in OU-1

Table 2 Proposed Soil Gas Sampling in the NERT Off-Site Study Area in OU-2

Figure 1 Proposed Soil Gas Sample Locations in OU-1

Figure 2 Proposed Soil Gas Sample Locations in the NERT Off-Site Study Area in OU-2

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<sup>15</sup> ENVIRON. 2014. Remedial Investigation and Feasibility Study Work Plan, Revision 2, Nevada Environmental Response Trust Site, Henderson Nevada, June 19. NDEP approved July 2, 2014.

<sup>16</sup> Ramboll. 2017. Quality Assurance Project Plan, Revision 2. Nevada Environmental Response Trust Site, Henderson, Nevada. October 26. NDEP approved on November 8, 2017.

**Table 1. Proposed Soil Gas Sampling in OU-1**

RI Phase 2 Modification No. 11

Nevada Environmental Response Trust Site; Henderson, Nevada

<b>Soil Gas Location ID</b>	<b>Status</b>	<b>Notes</b>
RISG-10	Proposed	Co-located with shallow groundwater well M-126; 5 ft bgs and 15 ft bgs.
RISG-11	Proposed	Co-located with shallow groundwater well M-125; 5 ft bgs and 15 ft bgs.
RISG-12	Proposed	Co-located with shallow groundwater well M-123; 5 ft bgs and 15 ft bgs.
RISG-13	Proposed	No co-located groundwater wells; 5 ft bgs and 15 ft bgs.
RISG-14	Proposed	Co-located with shallow groundwater well M-191; 5 ft bgs and 15 ft bgs.
RISG-15	Proposed	Co-located with shallow groundwater well M-192; 5 ft bgs and 15 ft bgs.
RISG-16	Proposed	Sub-slab sample under Unit 4; 15 ft bgs only
RISG-17	Proposed	Sub-slab sample under Unit 4; 15 ft bgs only
RISG-18	Proposed	Sub-slab sample under Unit 4; 15 ft bgs only
RISG-19	Proposed	Sub-slab sample under Unit 4; 15 ft bgs only

**Notes:**

bgs = below ground surface

ft = foot

NERT = Nevada Environmental Response Trust

**Table 2. Proposed Soil Gas Sampling in the NERT Off-Site Study Area in OU-2**

RI Phase 2 Modification No. 11

Nevada Environmental Response Trust Site; Henderson, Nevada

<b>Soil Gas Location ID</b>	<b>Status</b>	<b>Notes</b>
RISG-1	Proposed	Previously sampled in 2015 (RISG-1); co-located with shallow groundwater well PC-67; 5 ft bgs and 15 ft bgs.
RISG-2	Proposed	Previously sampled in 2015 (RISG-2); co-located with shallow groundwater well PC-24; 5 ft bgs and 15 ft bgs.
RISG-3	Proposed	Previously sampled in 2015 (RISG-3); co-located with shallow groundwater well PC-21A; 5 ft bgs and 15 ft bgs.
RISG-4	Proposed	Co-located with deep groundwater well PC-172D; 5 ft bgs and 15 ft bgs.
RISG-5	Proposed	Co-located with shallow groundwater well PC-169; 5 ft bgs and 15 ft bgs.
RISG-6	Proposed	Co-located with shallow groundwater well PC-122; 5 ft bgs and 15 ft bgs.
RISG-7	Proposed	Co-located with shallow groundwater well PC-167; 5 ft bgs and 15 ft bgs.
RISG-8	Proposed	Co-located with shallow groundwater well PC-179; 5 ft bgs and 15 ft bgs.
RISG-9	Proposed	Co-located with shallow groundwater well PC-166; 5 ft bgs and 15 ft bgs.

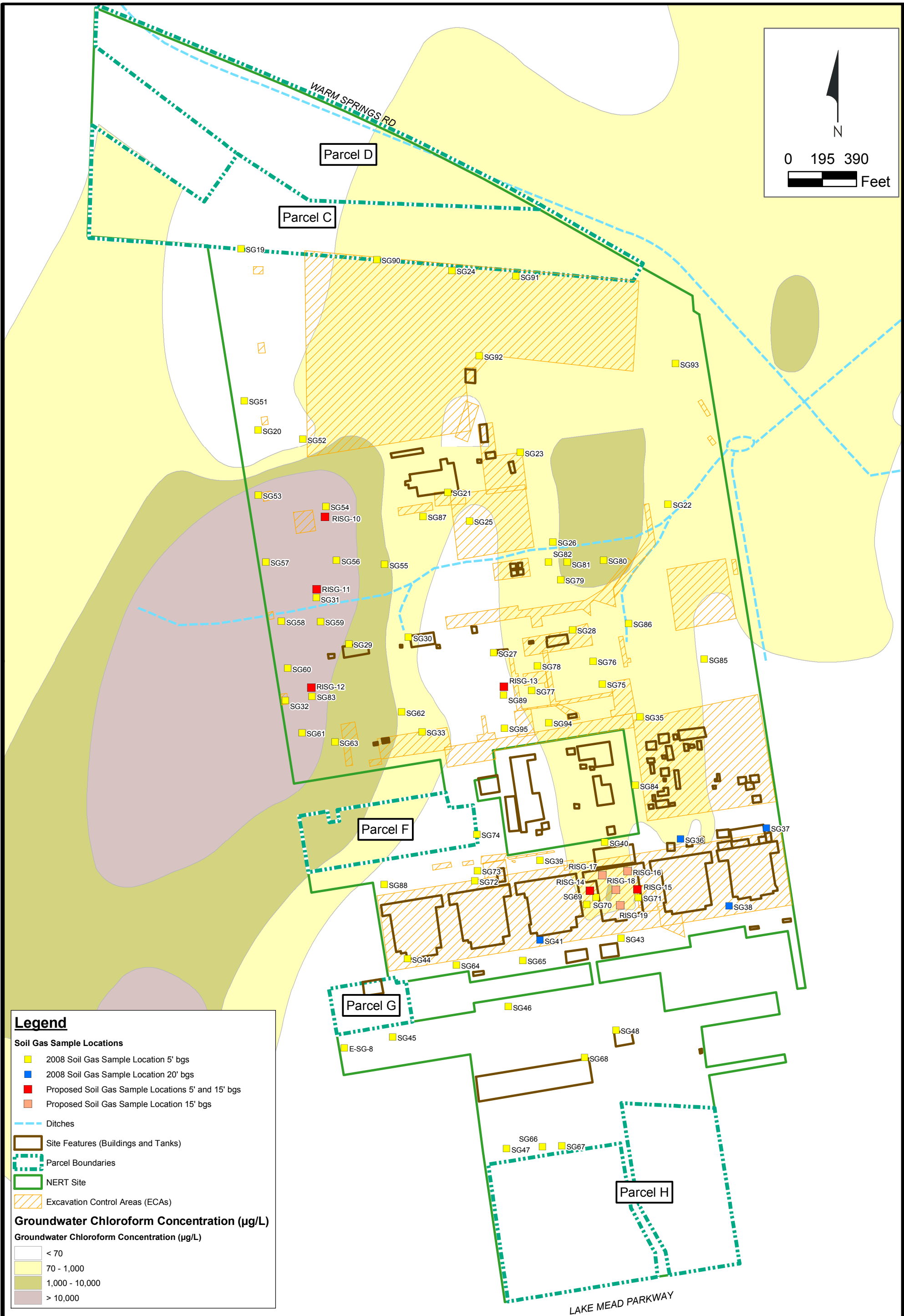
**Notes:**

bgs = below ground surface

ft = foot

NERT = Nevada Environmental Response Trust

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**Legend**

- Soil Gas Sample Locations**
- 2008 Soil Gas Sample Location 5' bgs
  - 2008 Soil Gas Sample Location 20' bgs
  - Proposed Soil Gas Sample Locations 5' and 15' bgs
  - Proposed Soil Gas Sample Location 15' bgs
- Ditches
- ▭ Site Features (Buildings and Tanks)
- ▭ Parcel Boundaries
- ▭ NERT Site
- ▭ Excavation Control Areas (ECAs)
- Groundwater Chloroform Concentration ( $\mu\text{g/L}$ )**
- Groundwater Chloroform Concentration ( $\mu\text{g/L}$ )
- < 70
  - 70 - 1,000
  - 1,000 - 10,000
  - > 10,000














**Proposed Soil Gas Sample Locations in OU-1  
(Chloroform Plume as Depicted in 2017)**  
Nevada Environmental Response Trust Site, Henderson, Nevada

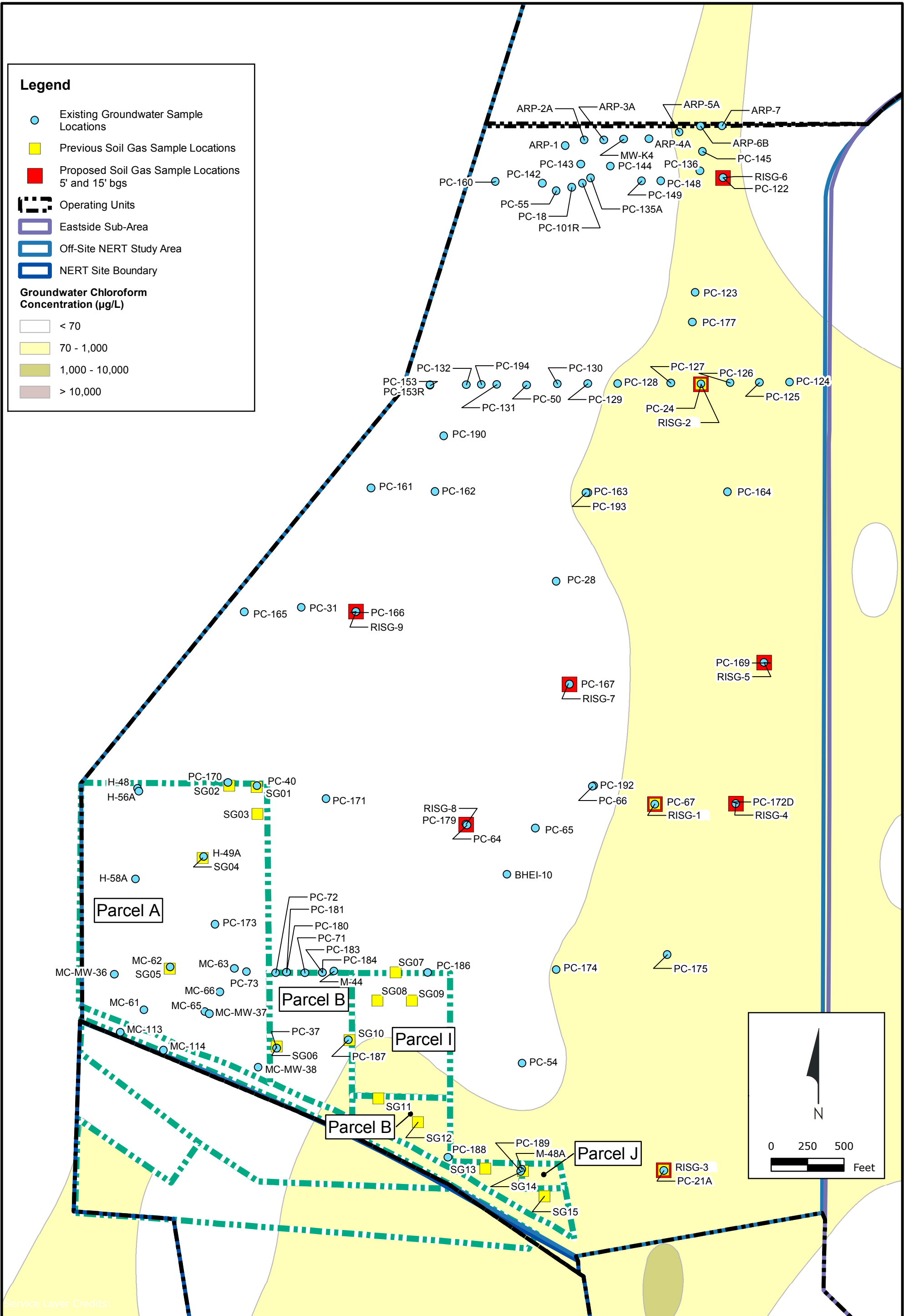
Figure  
**1**

Drafter: RS    Date: 4/13/2018    Contract Number: 169000 6943-012    Approved by:    Revised:



**Legend**

-  Existing Groundwater Sample Locations
  -  Previous Soil Gas Sample Locations
  -  Proposed Soil Gas Sample Locations 5' and 15' bgs
  -  Operating Units
  -  Eastside Sub-Area
  -  Off-Site NERT Study Area
  -  NERT Site Boundary
- Groundwater Chloroform Concentration (µg/L)**
-  < 70
  -  70 - 1,000
  -  1,000 - 10,000
  -  > 10,000



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Service Layer Credits:



**Proposed Soil Gas Sample Locations in the NERT Off-Site Study Area in OU-2 (Chloroform Plume as Depicted in 2017)**  
 Nevada Environmental Response Trust Site, Henderson, Nevada

**Figure 2**

Drafter: RS    Date: 4/13/2018    Contract Number: 169000 6943-012    Approved by:    Revised:

**RI Phase 2 Modification No. 11  
Recommended Soil Gas Sampling Locations**

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

**Nevada Environmental Response Trust (Trust) 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 the Trust. 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

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

**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:** 5/22/18

**RI Phase 2 Modification No. 11  
Recommended Soil Gas Sampling Locations**

**Nevada Environmental Response Trust  
(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.



May 23, 2013

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**John M. Pekala, PG  
Principal**

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**Date**

Certified Environmental Manager  
Ramboll US Corporation  
CEM Certificate Number: 2347  
CEM Expiration Date: September 20, 2018