APPROVED
By Olivia Yu at 1:26 pm, Jun 06, 2018

Soil Remediation Work Plan for Chalupa #4 SWD Release Site
Lea County, New Mexico

NMOCD will approve of the proposed additional investigative activities and remediation plan for 1RP-4632 & 1RP-4633. See email correspondence for conditions.

Prepared for:

Foundation Energy Management, LLC
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Denver, CO 80202

Prepared by:

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Denver, CO 80201

May 9, 2018

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1.0 Introduction

Tasman Geosciences, Inc. (Tasman) has prepared this Soil Remediation Workplan (Workplan) on behalf of Foundation Energy Management, LLC (FEM) to conduct chloride impacted soil remediation operations at the Chalupa #4 SWD Release Site (Site) located in Lea County, New Mexico. The Site is in the west-half of the southwest quarter of Section 13, Township 14 South, Range 33 East (Figure 1). The property is located on New Mexico State Trust Lands, administered by the New Mexico State Land Office (NMSLO), and surface leased to Norman and Elwanda Hahn Ranches, LTD for agricultural use.

2.0 Site History and Initial Assessment

On February 23, 2017, a clamp securing a hose at the wellhead failed and approximately 125 barrels (bbls) of saltwater were released to the ground surface in the Southern Release Area (SRA) as displayed on Figure 2. The release occurred adjacent to and east of the injection well location and FEM was able to recover approximately 25 bbls during initial spill response activities resulting in a net release volume of 100 bbls.

On March 2, 2017 FEM experienced a release of produced water at the Site from a leak that developed in the pipeline connecting FEM's tank battery to the Chalupa #4 injection well. The release occurred in the Northern Release Area (NRA) as displayed on Figure 3, which is approximately 600-feet south of the tank battery location. Approximately 25 bbls of saltwater were released to the ground surface and approximately 15 bbls were recovered.

FEM submitted a Release Notification and Corrective Action Form C-141 to the New Mexico Oil Conservation Division (NMOCD) on March 6, 2017 for the Release Areas. NMOCD assigned case number 1R-4632 (SRA) and 1R-4633 (NRA) to the Site and established a maximum permissible chloride level in soil of 600 milligram per kilogram (mg/kg).

To complete chloride impact delineation at the Site, FEM retained Enviro Clean Cardinal, LLC (ECC) to complete soil borings, collect soil samples, and prepare a Release Characterization Report (Report) for submittal to NMOCD. The Report was submitted to NMOCD on February 16, 2018. Characterization activities included conducting a walkover survey using an EM-38 electrical conductivity meter to determine the horizontal extent of the Release Areas which were found to cover approximately 1.76 acres over the NRA and 0.64 acres over the SRA. Borings advanced in the Release Areas indicated that the maximum vertical depth of chloride impacts extended from 9 to 14 feet bgs under the NRA and 34 feet to 59 feet below ground surface (bgs) under the SRA. The Report compared soil sample results with conductivity readings and concluded that an electrical conductivity of 50 millimhos per meter (mmhos/m) likely contains chloride concentrations greater than 600 mg/kg.

3.0 Additional Site Assessment Activities

This section describes Site assessment activities that will be completed prior to initiation of soil remediation (outlined in Section 4.0). These activities will assist with refining soil remediation plan if

needed and include background soil sample collection, conducting a playa investigation, and installing an additional soil boring to close a data gap present in the NRA.

Results of the Site assessment and any potential variation to this Workplan will be reported to the NMOCD prior to commencement of soil remediation activities.

3.1 Background Sampling

Prior to treatment of chloride impacted soil, the Site will be further characterized by collecting soil samples for cation exchange capacity (CEC), sodium adsorption ratio (SAR), mechanical grain size distribution, and soil classification. These factors may influence the application rate of the soil amendments required during soil treatment.

Furthermore, restoration of the Site for the re-growth of vegetation may require additional nutrients. To support this evaluation, Tasman will conduct background sampling of adjacent non-impacted native soil for analysis of 12-essential plant nutrients (nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, boron, copper, iron, manganese, molybdenum, and zinc). The background soil analysis will be used for comparison to the impacted soil to evaluate if nutrient addition may be needed to promote plant growth during reclamation.

3.2 Playa Investigation

Due to the potential presence of a playa located in the NRA (Figure 3), a survey will be conducted based on the New Mexico Rapid Assessment Method - Playa Wetlands Worksheet. The worksheet involves both GIS and field efforts. The GIS aspect (Level 1 assessment) includes data sourcing, analysis, and figure generation. The Level 1 assessment involves sourcing multiple data sets from the United States Geologic Survey (USGS) and other sources to analyze the potential playa in relation to the Site, surrounding land use, water source augmentation and connectivity, and regional topography.

The field aspect (Level 2 assessment) of the survey involves an inventory of site vegetation, configuration, soil conditions, stressors, and hydrologic modifications. The soil assessment entails collecting three (3) cores down to 20-inches bgs and logging the lithology. Once the field aspect has been completed, a photo log will be compiled to include within the survey. The results of the survey will be submitted to New Mexico Environment Department – Surface Water Quality Bureau (NMED-SWQB). The Workplan may need to be amended pending the results of the survey and development of protective measures which may be necessary to preserve the playa.

3.3 Additional Soil Investigation

To address NMOCD comments provided via e-mail on March 15, 2018, an additional boring is proposed to further delineate the area south of boring HA-1. The new boring will be advanced to 5-feet bgs utilizing a hand auger or excavator. The boring will be located approximately 30-feet south of the HA-1 location (Figure 3). Soil samples will be collected at 1-foot bgs intervals, field screened for chlorides, and submitted to Cardinal Laboratories (Cardinal) in Hobbs, New Mexico for laboratory analysis of chlorides using Environmental Protection Agency (EPA) method 300. Pending the results of the soil samples, the soil

remediation area in the NRA may be adjusted and additional boring may be installed based on field observations.

4.0 Remediation Workplan

The primary objective of the remediation activities outlined in this Workplan is to remove chloride impacts from affected soil to levels below the NMOCD cleanup threshold of 600 mg/kg. Remediation efforts are anticipated to include a soil washing process that incorporates a combination of soil amendments and soil rinsing with fresh and recycled water. The soil washing process will enable leaching and free draining of chloride impacts from the soil to a subsurface, impervious liner where free liquid will be collected by an underdrain system. The underdrain system will convey chloride-impacted fluid to a collection sump where it will be pumped to a water distillation treatment system for removal of chlorides. Distilled water will then be reused in the soil washing process. The cycle will be repeated until chloride levels are in compliance with NMOCD standards. The following sections outline the tasks proposed for implementation for this Workplan.

4.1 Liner/Underdrain System Installation and Soil Amendment

In order to install the underdrain system, chloride impacted soil will be excavated to a depth of four feet and stockpiled adjacent to the excavation areas. The combined excavation extent of the Release Areas covers 2.4 acres and represents a total soil remediation volume of 15,500 bank cubic yards (cy). The excavation areas for the SRA and NRA are illustrated on Figures 2 and 3, respectively. A 20-mil linear low-density polyethylene (LLDPE) liner (Attachment 1) manufactured by Raven Industries, Inc will be installed at the base of the excavation. Above the liner an underdrain system will be constructed which will follow the natural contour of the site topography and consist of either HDPE drain tile, hay, or a combination of both. A water collection sump will be installed at the low point of each excavation area. The sumps will be constructed using pea gravel or equivalent high porosity drainage material and polyvinyl chloride (PVC) 0.020 inch slotted well casing. Once the underdrain system has been completed, the stockpiled chloride-impacted soil will be amended with materials that enhance the mobility of chloride from the soil colloids. The result will be displacement of the chloride ions in the soil, which are then free to be flushed out of the growth zone. The specific amendment to be employed will be DeSalt Plus™ amendment containing stabilized calcium, ammonium, potassium cations with special surfactants that will allow the chloride contamination to be flushed away during the soil washing process. In addition, hay will be added to the impacted soil as a bulking agent and to increase permeability.

4.2 Soil Washing

The Release Areas will be irrigated using freshwater to start the soil washing process. As freshwater percolates through the impacted material it will pick up soluble salts and gravity drain to the impervious liner where it will be conveyed through the underdrain system to the collection sumps. A sump pump will be used to pump recovered chloride impacted water back to a mechanical vapor recompression (MVR) distiller manufactured by Epiphany Environmental, LLC (Epiphany). The MVR distiller will remove chloride contamination from the water through distillation. The distillation process will generate approximately 90 percent (%) or more (contingent on chloride concentration) distilled water and 10% or less concentrate brine. Distilled water will be introduced back into the soil washing process to supplement the rinse water

volume and the concentrate brine will be pumped to the on-site SWD tank battery for disposal at the Chalupa #4 injection well. The water treatment unit is anticipated to supplement approximately half of the rinse water needed for the soil washing process. In the event that excess water is generated during a high precipitation period or in the unlikely event of a treatment system malfunction, chloride-impacted water will be pumped to the SWD tank battery for subsequent injection at the Chalupa #4 injection well or it may be hauled off site to a licensed produced water disposal facility.

4.3 Confirmation Sampling

Confirmation soil samples will be collected once per calendar quarter from the Release Areas to monitor soil remediation progress. Samples will be collected at 1 and 3-foot bgs intervals from proposed sample grid areas in the SRA and NRA as illustrated on Figures 4 and 5, respectively. Soil samples will consist of a 5-part composite collected from the center and four corners of each grid. Samples will be submitted to Cardinal and analyzed for chlorides using EPA method 300. The soil washing remediation effort will be concentrated on grids that continue to exhibit chloride concentrations in excess of 600 mg/kg. FEM will provide an e-mail update to NMOCD each quarter with a summary of the confirmation data collected and remedial activities completed.

4.4 Site Reclamation

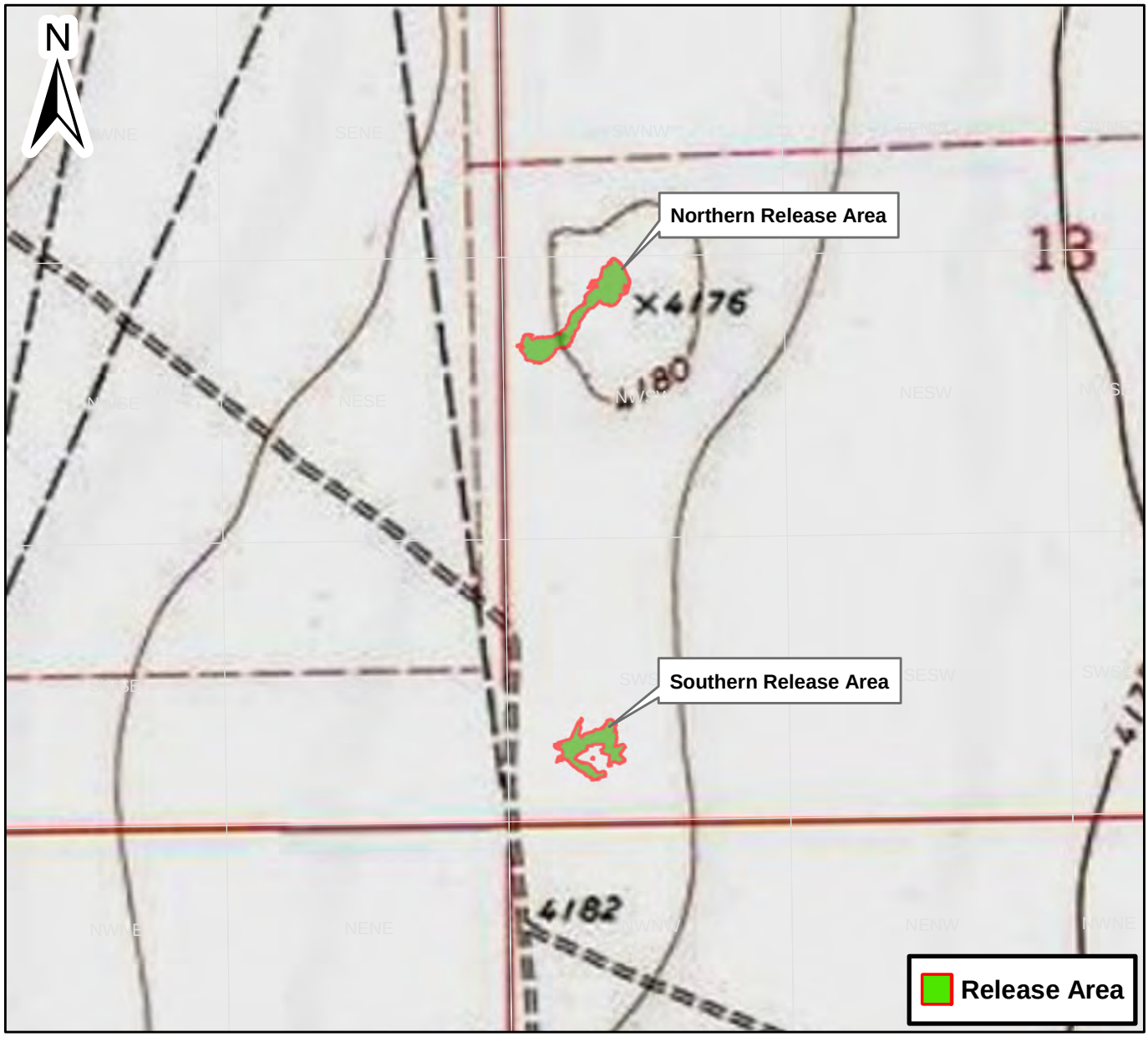
Once all the grids are in compliance with State standards, the Release Areas will be fertilized as necessary based upon the results of the background sampling described in Section 3.1.

Decommissioning will include removal of the water collection sump and any above ground piping and equipment associated with water treatment system. The Release Areas will then be revegetated in accordance with the New Mexico State Land Office (NMSLO) Surface Reclamation and Remediation guidance document. The irrigation system will remain in place to provide up to 3-months of irrigation water to newly reclaimed areas.

5.0 Closure Reporting

A closure report will be prepared for NMOCD summarizing soil remediation activities completed at the Site. The report will also include tabulated analytical data from confirmation sampling, details on equipment and water system decommissioning, a photograph log, and status on land reclamation.

Figures



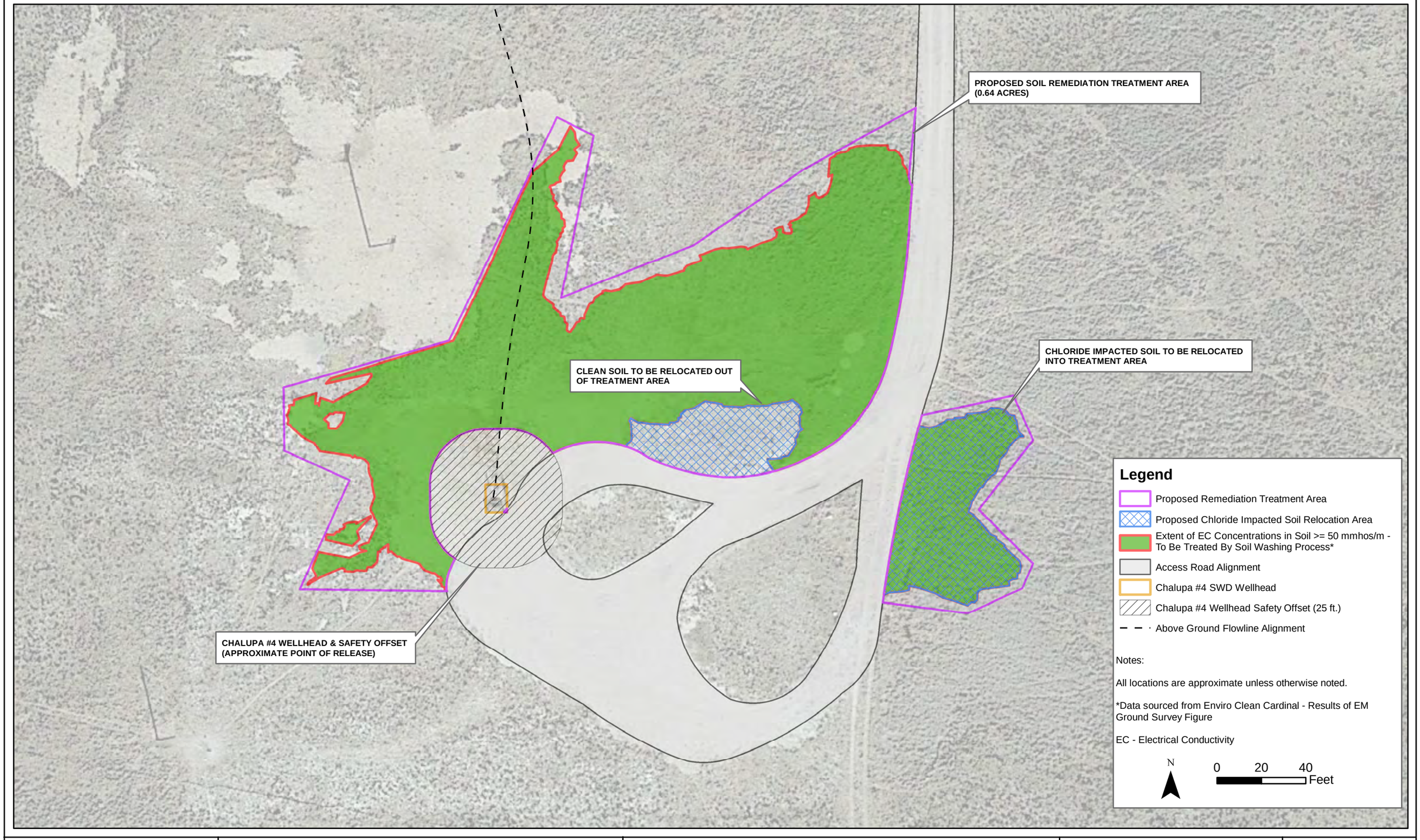
0 750 1,500 Feet

Figure 1

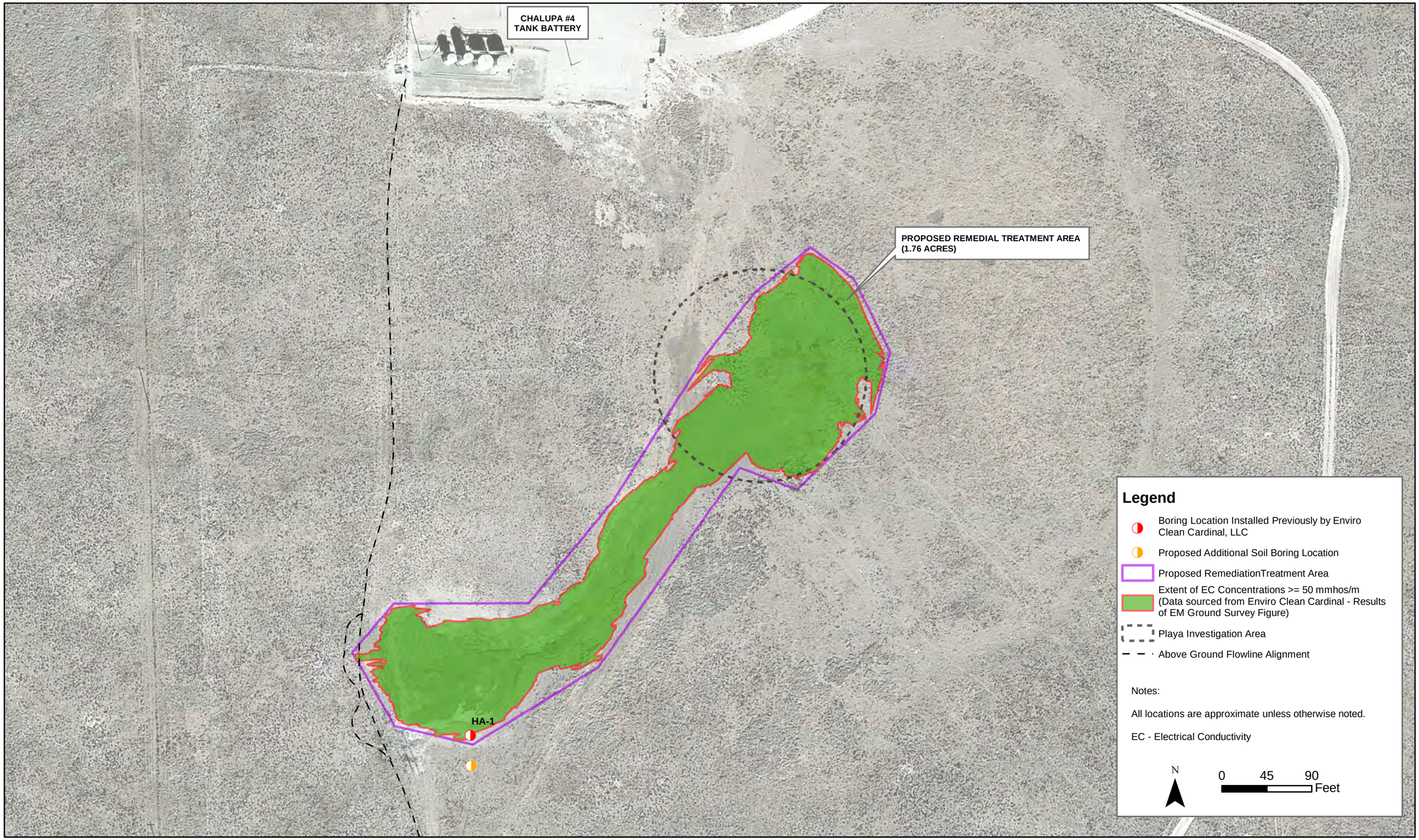
Site Location Map
Chalupa #4 SWD Well Site
S13 T14S R33E
Lea County, New Mexico

TASMAN GEOSCIENCES

Drawn By: DBA
Date: 5/8/2018



DATE: May 2018 DESIGNED BY: M. Lindstrom DRAWN BY: D. Arnold	TASMAN GEOSCIENCES **Tasman Geosciences, Inc.** **6899 Pecos Street - Unit C** **Denver, CO 80221**	**Foundation Energy Management, LLC** **Chalupa #4 SWD Well Site** Section 13, Township 14 South, Range 33 East Lea County, New Mexico	Southern Release Area Proposed Soil Remediation Layout Map	Figure 2



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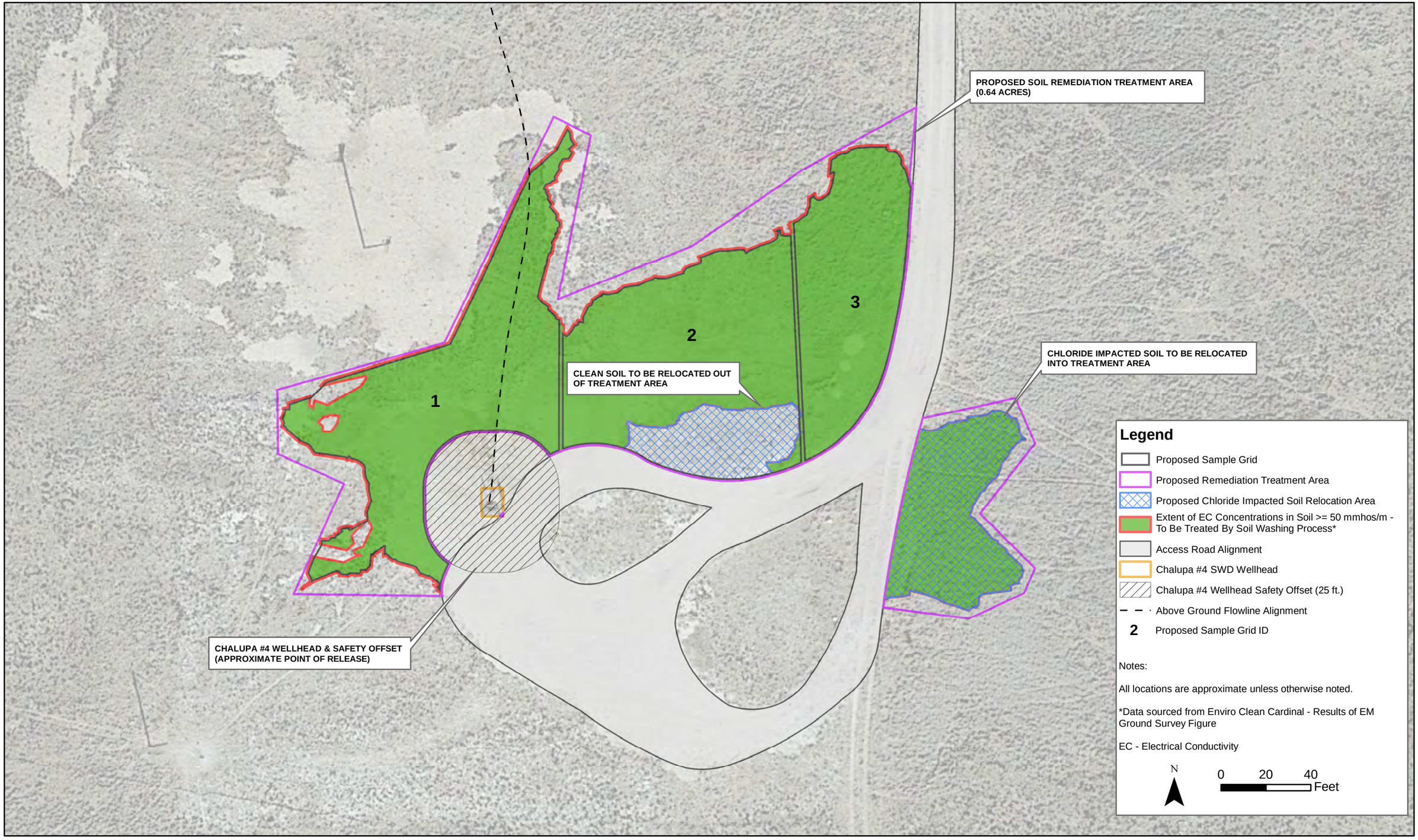

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PROPOSED REMEDIAL TREATMENT AREA
(1.76 ACRES)

5

4

3

2

1

Legend

- Proposed Sample Grid
- Proposed Remediation Treatment Area
- Extent of EC Concentrations >= 50 mmhos/m (Data sourced from Enviro Clean Cardinal - Results of EM Ground Survey Figure)
- Above Ground Flowline Alignment
- 2 Proposed Sample Grid ID

Notes:

All locations are approximate unless otherwise noted.

Acre-feet calculated based on a depth of 4' bgs

EC - Electrical Conductivity

N

0 30 60 Feet

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Attachment

HYDRAFLEX™ H20B

LINEAR BLACK POLYETHYLENE

RAVEN

PRODUCT DESCRIPTION

HydraFlex™ H20B is a coextruded geomembrane consisting of outer layers of virgin linear-low density polyethylene and an inner core of virgin and select reprocessed resins. HydraFlex™ H-Series membranes are stabilized with carbon black and antioxidants designed for an economical solution for near to midterm applications. The premium quality LLDPE contained in the H-Series product line offers exceptional value including ease of welding along with high impact and tear resistance.

PRODUCT USE

HydraFlex™ H20B is used in applications requiring an economical geomembrane with excellent durability including high impact strength and tear resistance. HydraFlex™ H20B has excellent flexibility and will conform to a variety of irregular surfaces. HydraFlex™ H-Series geomembranes are commonly used in a variety of remediation and lining applications and general covers, where high performance is required and general specifications may exist.

SIZE & PACKAGING

HydraFlex™ H20B is available in up to 75,000 square foot panels. Pre-fabricated, stepped panels are produced in our quality controlled factory environment; all panels are accordion folded and tightly rolled onto a heavy duty core for ease of handling and time saving installation.

HydraFlex™ CONTAINMENT SOLUTIONS

Reservoir Liner

PRODUCT	PART #
HYDRA FLEX™	H20B

APPLICATIONS

- Interim Landfill Covers
- Decorative Ponds
- Outdoor Coverings
- Brine Ponds
- Fire Ponds
- Remediation Liners
- Farm Ponds
- Oil Field Pit Liners

HYDRAFLEX™ H20B

LINEAR BLACK POLYETHYLENE

		HYDRA FLEX™ H20B			
		IMPERIAL		METRIC	
PROPERTIES	TEST METHOD	MINIMUM	TYPICAL	MINIMUM	TYPICAL
Appearance		Black		Black	
Thickness, Average	ASTM D5199	18 Mils	19 Mil	0.46 mm	0.48 mm
Weight		93.4 lbs/msf		456 g/m^2	
Tensile Strength at Break	ASTM D6693	68 ppi	96 ppi	119 N/cm	168 N/cm
Tensile Elongation at Break	ASTM D6693	700 %	900 %	700 %	900 %
Tear Resistance	ASTM D1004	10 lbs	12 lbs	44 N	53 N
Puncture Resistance	ASTM D4833	24 lbs	40 lbs	107 N	178 N
Oxidation Induction Time (OIT)	ASTM D3895	50 min	100 min	50 min	100 min
Carbon Black	ASTM D4218	1.6 %	2.4 %	1.6 %	2.4 %
2% Secant Modulus (maximum)	ASTM D5323	60,000 psi Maximum	30,000 psi	414 Mpa Maximum	207 Mpa
Hydraulic Conductivity		3.30 x 10^{-10} cm/sec			
Maximum Static Use Temperature		180° F		82° C	
Minimum Static Use Temperature		-70° F		-57° C	
FACTORY SEAM REQUIREMENTS					
Bonded Seam Strength	ASTM D6392	30 lbf/in width	38 lbf/in width	133 N/cm width	169 N/cm width
Seam Peel Adhesion	ASTM D6392	25 lbf/in width	32 lbf/in width	111 N/cm width	142 N/cm width

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Scan QR Code to download technical data sheets.

Note: To the best of our knowledge, unless otherwise stated, these are typical property values and are intended as guides only, not as specification limits. Chemical resistance, odor transmission, longevity as well as other performance criteria is not implied or given and actual testing must be performed for applicability in specific applications and/or conditions. RAVEN INDUSTRIES MAKES NO WARRANTIES AS TO THE FITNESS FOR A SPECIFIC USE OR MERCHANTABILITY OF PRODUCTS REFERRED TO, no guarantee of satisfactory results from reliance upon contained information or recommendations and disclaims all liability for resulting loss or damage. Limited Warranty available at www.ravenefd.com

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