1RP-4789
RELEASE DELINEATION PLAN
EMSU B Produced Water Release

Lea County, New Mexico

Latitude: N32° 34' 03.40"
Longitude: W103° 19' 13.08"

LAI Project No. 17-0176-01

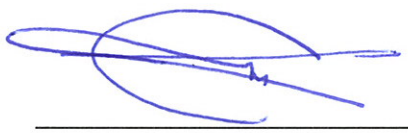
August 22, 2017

Prepared for:

XTO Energy, Inc.
810 Houston Street
Fort Worth, Texas 76102-6298

Prepared by:

Larson & Associates, Inc.
507 North Marienfeld Street, Suite 205
Midland, Texas 79701



Mark J. Larson, P.G.
Certified Professional Geologist #10490

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1.0 INTRODUCTION

This delineation plan is submitted to the New Mexico Oil Conservation Division (OCD) District 1 and U.S. Bureau of Land Management (BLM), as surface and mineral owner, on behalf of XTO Energy, Inc. (XTO) for a produced water release (Site) from a ten (10) inch cement-lined steel line associated with the Eunice Monument South Unit (EMSU) B in Lea County, New Mexico. The release occurred in Unit P (SE/4, SE/4), Section 14, Township 20 South and Range 36 East in Lea County, New Mexico. The Site is located approximately 500 feet southeast of EMSU B Well No. 890 (API 30-025-04266). The geodetic position is North 32° 34' 03.40" and West 103° 19' 13.08". Figure 1 presents a location and topographic map.

1.1 Background

On June 9 and July 27, 2017[1], XTO verbally reported the release to OCD District 1 in Hobbs, New Mexico. The release was caused by internal corrosion in the bottom of the 10 inch cement-lined steel line. The release was discovered by the lease operator on June 9, 2017. XTO personnel shut-in the wells, isolated the line and replaced the line segment. Vacuum trucks were dispatched to recover water that had accumulated on the surface and in the excavation where the line was replaced. A total of 11,689 barrels (bbl) of water was recovered from the surface and the excavation. The water recovered from the surface is believed to be produced water while the water recovered from the excavation is believed to be a mixture of both produced and fresh water. XTO estimated the affected area at 227,205 square feet (405 feet by 561 feet) or about 5.21 acres. On August 10, 2017, LAI personnel used a Trimble sub-meter handheld global position system (GPS) receiver to map the area of distressed vegetation and calculated the affected area at about 121,628 square feet or approximately 2.79 acres. On August 11, 2017, XTO submitted the initial C-141 and stated LAI would perform an initial evaluation and electromagnetic (EM) terrain conductivity surveys to assess the release and update the estimated loss volume. OCD assigned the release remediation permit number 1RP-4789. Figure 2 presents an aerial map showing the estimated affected area. Appendix A presents the initial C-141. Attachment B presents photographs.

1.2 Physical Setting

The physical setting is as follows:

- Elevation is approximately 3,765 feet above mean sea level (amsl);
- Topography slopes gently toward the east;

1. XTO's form C-141, submitted on August 11, 2017, specifies that verbal notifications of the release were made by XTO on June 9 and June 28. The June 28th date is incorrect. The verbal notifications were made on June 9 and July 27th.

- The nearest surface water feature is a seasonal playa located about 1,200 feet southwest of the Site;
- There is no direct connection with the Site to the seasonal playa;
- The soils are designated "Kermit soils and dune land, 0 to 12 percent slopes" and "Kermit-Palomas fine sands, 0 to 12 percent slopes". The soils originated from calcareous sandy eolian deposits derived from reworking the underlying Pliocene-age Blackwater Draw and Ogallala formation formations, in descending order;
- The soils consist of a surface layer of fine sand about 8 inches thick underlain by fine sand to about 60 inches or about 5 feet and developed over cemented material (caliche);
- The description matches the soil observed at the Site;
- The upper geological unit is the Tertiary-age Blackwater Draw and Ogallala formations, in descending order, comprised of very fine to medium-grained quartz sand and gravel, with minor amount of silt and clay with indistinct to massive crossbeds;
- The Ogallala formation is underlain by clay, silty clay, shale and sandstone of the Chinle formation (Triassic) and is about 300 feet thick;
- The Chinle formation occurs at depths between about 75 and 100 feet below ground surface (bgs);
- According to the U.S. Geological Survey 7.5 minute series topographic map the nearest fresh water well is a windmill located about 2,000 feet northeast (hydraulically up gradient) in Unit I (NE/4, SE/4), Section 14, Township 20 South, Range 36 East;
- The well is used for livestock watering and has a reported depth to groundwater of approximately 30 feet bgs (1981);
- The windmill/well was not observed during a reconnaissance visit on August 21, 2017;
- The regional groundwater flow direction is east to southeast.

1.3 Remediation Action Levels

Remediation action levels (RRAL) were calculated for benzene, BTEX and TPH based on the following criteria established by the OCD in "*Guidelines for Remediation of Leaks, Spills and Releases, August 13,* 1993":

Criteria	*Result*	*Score*
Depth-to-Groundwater	<50 feet	20
Wellhead Protection Area	No	0
Distance to Surface Water Body	>1000 Horizontal Feet	0

The following RRAL apply to the release for ranking score: 20

- Benzene 10 mg/Kg
- BTEX 50 mg/Kg
- TPH 100 mg/Kg

Depth to groundwater less than 50 feet bgs will require delineation for chloride to 250 milligrams per kilogram.

2.0 DELINEATION PLAN

2.1 EM Terrain Conductivity Surveys

On August 10, 2017, LAI personnel conducted preliminary (pilot) electromagnetic (EM) terrain conductivity surveys using EM-31 and EM-34 instruments manufactured by Geonics Ltd., Mississauga, Ontario, Canada. The purpose of the EM-31 and EM-34 pilot surveys was to established viability for the instruments to detect elevated conductivity in soil and groundwater relative to background which corresponds to elevated chloride in soil and groundwater. The EM method measures the electrical properties of soil and rock, which is influenced by the total dissolved solids (TDS) concentration of formation pore water and groundwater. The EM method utilizes current flow induced into the subsurface by a surface transmitter. The current generates an alternating magnetic field which creates a secondary magnetic field that is sensed by a receiver coil. The depth of exploration is determined by the spatial separation between the transmitter and receiver coils and the orientation of the coils (i.e., horizontal (HD) or vertical dipole (VD)). The EM-31 has maximum depth of exploration capabilities from 0 to about 9.8 feet bgs in the HD mode and 0 to 19.7 feet bgs in the VD mode. The EM-31 HD and VD readings from the Site represent conductivity values in unsaturated soil except near the release point where groundwater may be mounded. The EM-34 has maximum depth of exploration capabilities of 0 to 24.6 feet bgs (HD) and 0 to 49.2 feet bgs (VD) with the 10-meter coil separation and 0 to 49.2 feet (HD) and 0 to 98.4 feet (VD) with the 20-meter coil spacing. The maximum response of the EM-34 in the HD mode occurs near the surface and decreases with depth. The maximum response of the EM-34 in the VD mode occurs at a depth equal to approximately 75 percent of the exploration depth or about 36.9 and 73.8 feet bgs in the 10 and 20 meter coil separations, respectively.

The EM pilot survey consisted of two (2) transects (north to south and east to west) established with a Nikon Model DTM 310 total station system. The east to west transect was approximately 600 feet in length whereas the north to south transect was about 1,000 feet in length. EM measurement stations were spaced about 100 feet apart and documented with the Trimble handheld GPS receiver. A background station was established about 300 feet northwest (hydraulically up gradient) to the Site where EM-31, EM-34 10m and EM-34 20m readings were collected in the VD and HD modes.

Referring to Figure 3, the background EM-31HD reading was 27.5 millimhos per meter (mmhos/m) in the HD mode. EM-31HD readings were greater than 5 times background in the vicinity of release. The EM-31HD values decrease to near the background level about 100 and 200 feet west of the Site and increase to greater than 5 times background which may be interference from underground piping. The EM-31HD readings decrease to within about 1.5 to 2 times background. EM-31HD readings are about 4 times background near the east end of the transect or about 300 feet east of the Site concluding that water in the area is mounded and moving to the east. The mounding is supported by a shallow depression about 200 feet of the Site that had water exposed in the bottom of the depression.

Referring to Figure 4, the EM-31VD conductivity readings are similar to the EM-31HD readings and show conductivity values east of the release about 9 times greater than values recorded north, west and south of the release. The readings reflect possible groundwater mounding in the vicinity of the release and migrating east. The background reading (57.7 mmhos/m) showed possible metallic interference.

Referring to Figure 5, the background EM-34 10m HD conductivity reading was 30.3 mmhos/m and represents conductivity in groundwater. The EM-34 10m HD readings decrease to near background north, south and west of the release and are greater than 5 times background in the vicinity of the

release. The EM-34 10m HD readings remain about 4 times background near the east end of the transect concluding that groundwater containing elevated chloride and TDS relative to background is migrating east from the release.

Referring to Figure 6, the maximum response in the EM-34 20m VD mode occurs at about 73.8 feet bgs and suggests that a possible barrier (shale) is present in the subsurface as interpreted from the decrease in EM-34 20m VD conductivity values in the vicinity of the release compared to the EM-34 20m HD values.

XTO proposes to expand the EM-34 10m (HD and VD) and EM-34 20m (HD and VD) survey to include an area measuring about 300 feet north and 300 feet south of the release and extending west approximately 300 feet and east about 1,200 feet from the release for a total area of about 1,050,000 square feet or about 24 acres. EM-34 10m (HD and D) and EM-34 20m (HD and VD) readings will be collected until values decrease near the background levels. Figure 7 presents the proposed EM-34 10m and EM-34 20m survey area.

2.2 Temporary Monitoring Well

XTO will submit an application to the State of New Mexico Office of the State Engineer (OSE) to obtain a permit to install a temporary monitoring well approximately 250 feet west (up gradient) of the release. The purpose of the monitoring well will be to confirm depth to groundwater and to collect groundwater samples for laboratory analysis. A State of New Mexico licensed water well drill will use a truck mounted air rotary rig or equivalent drill a boring to the top of the lower confining unit (Dockum Group) or about 30 feet into groundwater observed during drilling if the confining unit is not encountered before about 65 feet bgs. The boring will be plugged with bentonite if the lower confining unit is encountered and groundwater is not present. Drill cuttings will be placed on the ground adjacent to the boring. The well will be constricted with 2 inch schedule 40 threaded PVC casing and 20 feet of 0.010 inch factory slotted screen. The well screen will be placed above and below the groundwater level observed during drilling. The well screen will be surrounded with graded silica sand compatible with the screen slot size. The sand will be placed around the screen to a depth about 2 feet above the screen. The annulus above the sand to ground surface will be filled with bentonite chips and hydrated with potable water. The well will be secured with a locking cap. The well will be developed by pumping with an electric submersible pump until at least 3 casing volumes of groundwater have been removed and groundwater is visibly clear of suspended solids. The purged water will be contained in a 55 gallon drum or in a portable tank and disposed in an OCD permitted disposal well. Figure 7 presents the proposed location for the monitoring well.

2.3 Groundwater Samples

Groundwater samples will be collected from the well following well development. The groundwater samples will be collected in laboratory containers by carefully pouring the sample aliquot from a dedicated polyethylene bailer into the sample containers. The sample containers will be labeled, chilled in an ice filled chest and delivered under preservation and chain of custody to a National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory for analysis by EPA methods for BTEX (benzene, toluene, ethylbenzene and xylenes), dissolved (filtered) metals (arsenic, barium, cadmium, chromium, lead, mercury, silver and selenium), cations (calcium, magnesium, potassium and sodium), anions (alkalinity, chloride and sulfate) and TDS. The metals samples will be filtered in the field or by the laboratory within 24 hours following sample collection. The laboratory results will be compared to the

New Mexico Water Quality Control Commission (WQCC) human health and domestic water quality standards (Title 20 Chapter 6 Part 2 Subpart III 3103 NMAC) if the background TDS concentration is less than 10,000 milligrams per liter (mg/L).

2.4 Soil Samples

Soil samples will be collected from six (6) locations within 20 feet of the cement-lined steel line in the area of the release to assess impacts to soil. Soil samples will be collected at three (3) locations on the west side of the release and at three (3) locations on the east side of the release. The soil samples will be collected with the air rotary rig and jam tube sampler to approximately the groundwater level observed during drilling. Samples will be collected at 0, 3, 5, 7, 10 and every 5 feet thereafter to total depth (TD). The soil samples will be collected in laboratory containers and delivered under preservation and chain of custody to a qualified laboratory which will analyze the samples for BTEX, total petroleum hydrocarbons (TPH) and chloride. The laboratory analysis will be compared to the OCD recommended remediation action levels (RRAL) presented in OCD publication *"Guidelines for Remediation of Leaks, Spills and Releases, August 13, 1993"*.

3.0 REPORT

XTO will submit a report to the OCD within 45 days following receipt of the final laboratory report. The report will include a summary of the investigations presented above including the results of the EM-34 10m (HD and VD) and EM-34 20m (HD and VD) surveys, monitoring well drilling and completion details and laboratory analysis of soil and groundwater samples. The report will include the EM-34 10m and EM-34 20m field sheets, compilation of EM-34 survey results, color coded contoured drawings for the EM-34 10m (HD and VD) and EM-34 20m (HD and VD) results, monitoring wells drilling and completion diagram and laboratory reports. XTO will provide recommendations for monitoring well locations and remediation options for soil contaminants exceeding the RRAL.

FIGURES

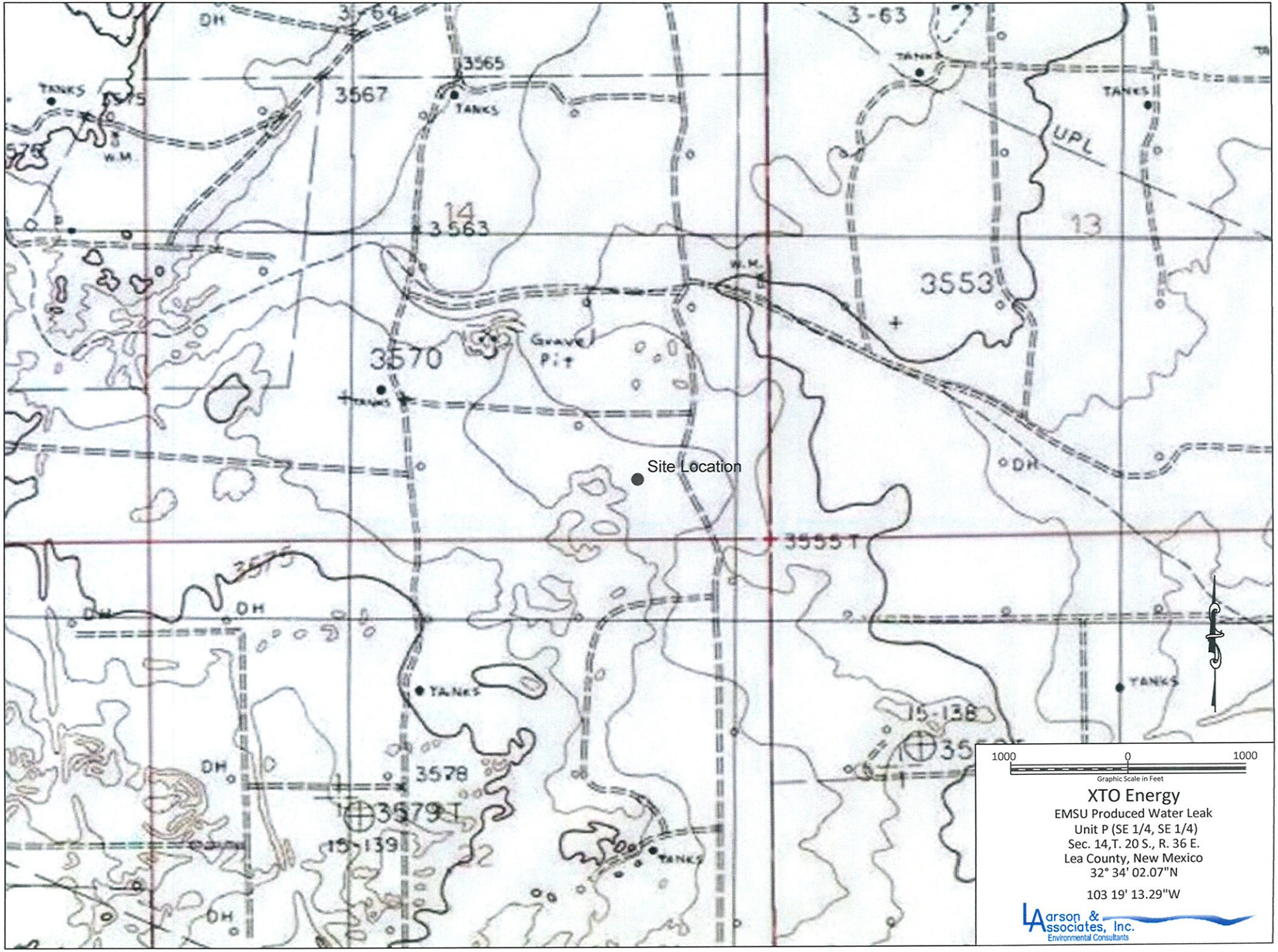


Figure 1 - Topographic Map

Figure 2 - Aerial Map

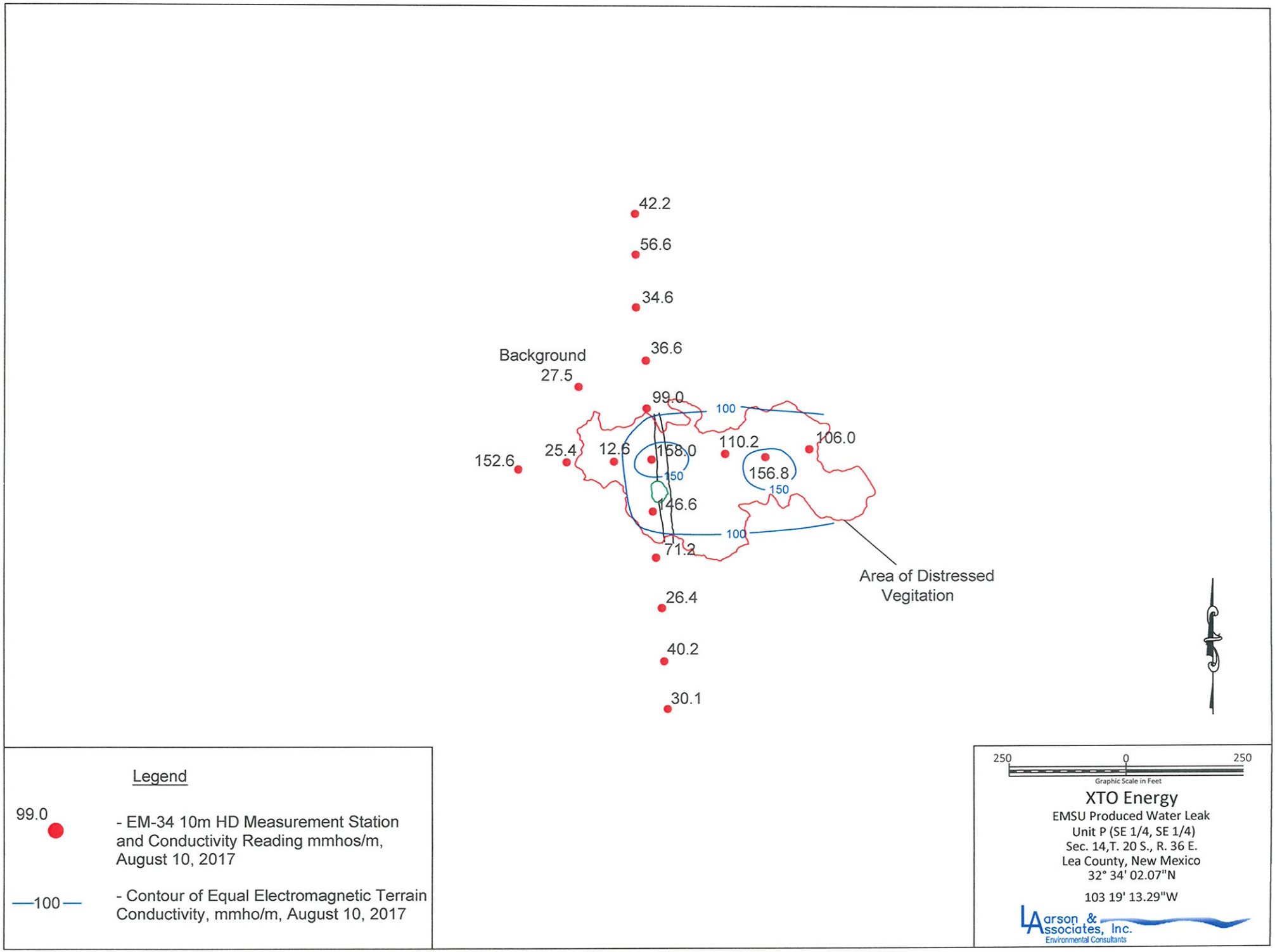
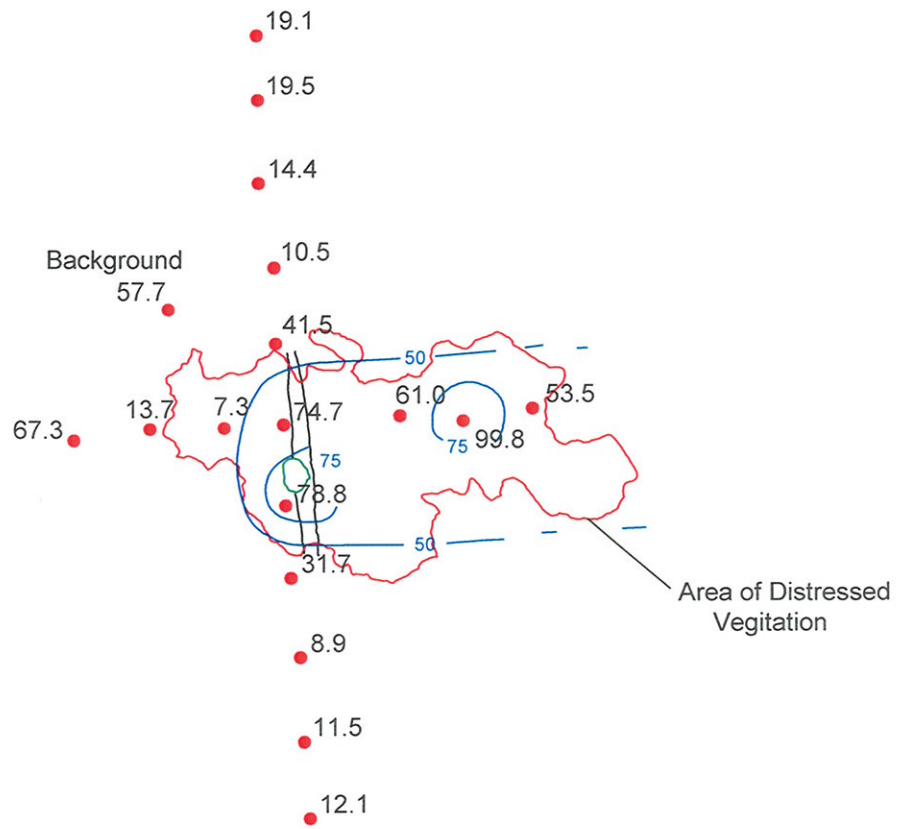


Figure 3 - EM-34 10m HD Pilot Survey Map, 0-24.6 Feet, August 10, 2017



Legend

41.5 - EM-34 10m VD Measurement Station and Conductivity Reading mmhos/m, August 10, 2017

50 - Contour of Equal Electromagnetic Terrain Conductivity, mmho/m, August 10, 2017

250 0 250

Graphic Scale in Feet

XTO Energy

EMSU Produced Water Leak

Unit P (SE 1/4, SE 1/4)

Sec. 14,T. 20 S., R. 36 E.

Lea County, New Mexico

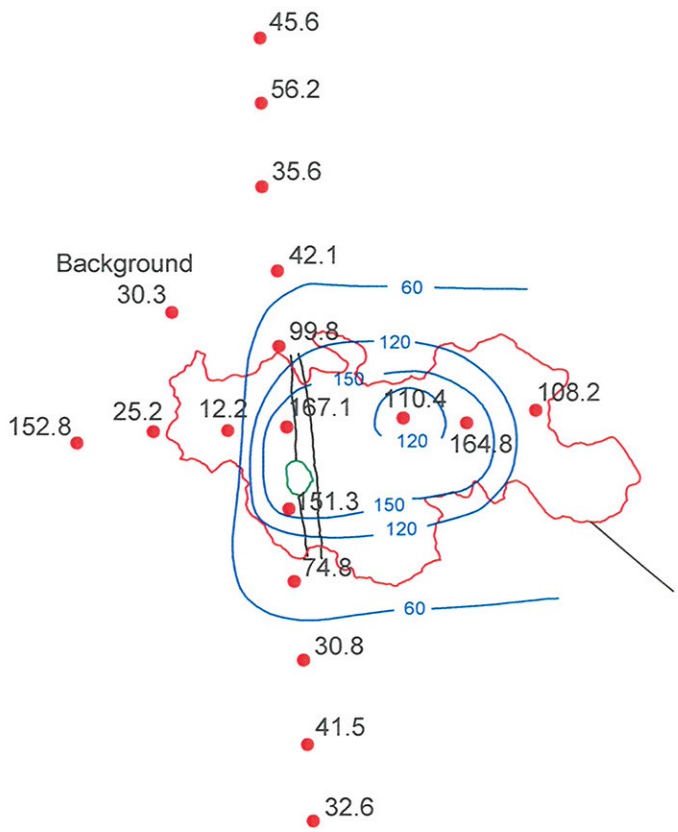
32° 34' 02.07"N

103 19' 13.29"W

Larson & Associates, Inc.

Environmental Consultants

Figure 4 - EM-34 10m VD Pilot Survey Map, 0-49.2 Feet, August 10, 2017



Legend

99.8 - EM-34 20m HD Measurement Station and Conductivity Reading mmhos/m, August 10, 2017

60 - Contour of Equal Electromagnetic Terrain Conductivity, mmho/m, August 10, 2017

Area of Distress Vegitation

250 0 250

Graphic Scale in Feet

XTO Energy, Inc.

EMSU B Produced Water Release

Unit P (SE 1/4, SE 1/4)

Sec. 14,T. 20 S., R. 36 E.

Lea County, New Mexico

32° 34' 02.07"N

103 19' 13.29"W

Larson & Associates, Inc.

Environmental Consultants

Figure 5 - EM-34 20m HD Pilot Survey Map, 0-49.2 Feet, August 10, 2017

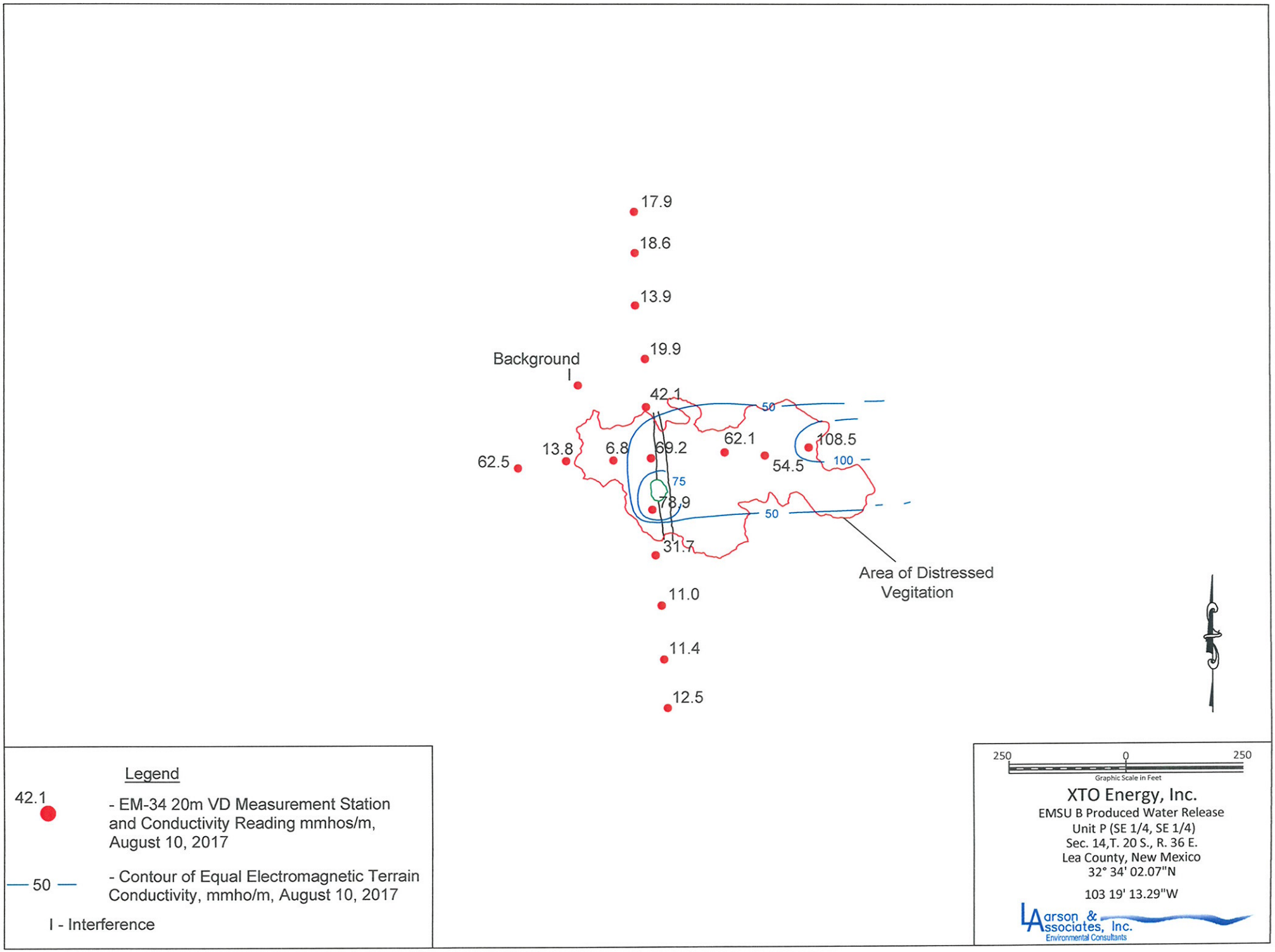


Figure 6 - EM-34 20m VD Pilot Test Map, 0-98.4 Feet, August 10, 2017

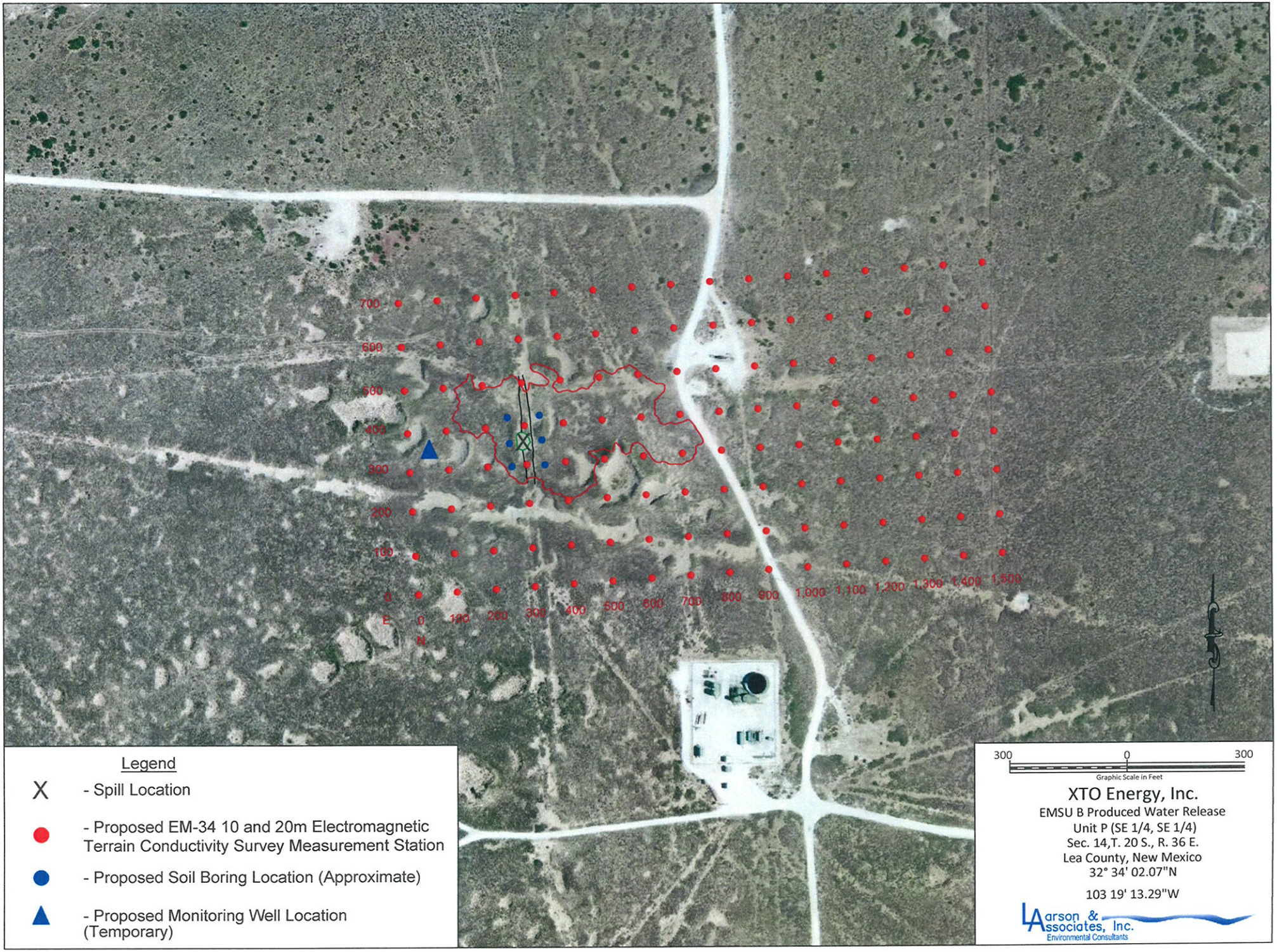


Figure 7 - Site Map Showing Proposed EM-34 10m and 20m Survey Measurement Stations

APPENDIX A

Initial C-141

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First St., Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-141
Revised April 3, 2017

Submit 1 Copy to appropriate District Office in accordance with 19.15.29 NMAC.

Release Notification and Corrective Action

OPERATOR

☒ Initial Report ☐ Final Report

Name of Company: XTO Energy	Contact: Shannon Walker
Address 500 W. Illinois Suite 100 Midland, TX 79701	Telephone No. : 432-661-4649
Facility Name: EMSU B Injection System	Facility Type: Water Injection

Surface Owner: BLM		Mineral Owner BLM		API No.

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County
P	14	20 S	36 E					

Latitude 32°34'03.40"N **Longitude** 103°19'13.08"W NAD83

NATURE OF RELEASE

Type of Release: Produced Water	Volume of Release: Not Yet Determined [see comment below]	Volume Recovered: 11,689 bbls [see comment below]
Source of Release: Injection Line	Date and Hour of Occurrence: Unknown	Date and Hour of Discovery: 6/9/2017
Was Immediate Notice Given? ☒ Yes ☐ No ☐ Not Required	If YES, To Whom? On Call Line	
By Whom? Shannon Walker	Date and Hour: 6/9/2017 ~ 1800 hrs MST and again on 6/28/2017	
Was a Watercourse Reached? ☐ Yes ☒ No	If YES, Volume Impacting the Watercourse.	

If a Watercourse was Impacted, Describe Fully.*

RECEIVED
By Olivia Yu at 4:08 pm, Aug 11, 2017

Describe Cause of Problem and Remedial Action Taken.* 10" cement lined steel line, corrosion. Shut field in to isolate leak point. XTO provided immediate verbal notification of the release on 6/9/17 and began recovering water with vacuum trucks. Affected area measures ~405' x 561'. XTO provided updated verbal notification on June 28, 2017, that it had increased its estimate of the release volume to 1,655 bbls. Contacted Mark Larson w/ Larson & Associates to perform initial evaluation and EM surveys of the area. XTO and Larson & Associates are working to update the estimated volume of the release. XTO will submit delineation plan for OCD approval.

Describe Area Affected and Cleanup Action Taken.*

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to NMOCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the NMOCD marked as "Final Report" does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Signature: Patricia Donald	OIL CONSERVATION DIVISION
Printed Name: Patricia Donald	Approved by Environmental Specialist:
Title: Regulatory Analyst	Approval Date: 8/11/2017 Expiration Date:
E-mail Address: Patricia_Donald@xtoenergy.com	Conditions of Approval: see attached directive Attached ☑
Date: 8/11/2017 Phone: (432) 571-8220	

* Attach Additional Sheets If Necessary

1RP-4789 fOY1722358348 nOY1722358518

pOY1722358879

Operator/Responsible Party,

The OCD has received the form C-141 you provided on _8/11/2017_ regarding an unauthorized release. The information contained on that form has been entered into our incident database and remediation case number _1RP-4789__ has been assigned. **Please refer to this case number in all future correspondence.**

It is the Division's obligation under both the Oil & Gas Act and Water Quality Act to provide for the protection of public health and the environment. Our regulations (19.15.29.11 NMAC) state the following,

> *The responsible person shall complete division-approved corrective action for releases that endanger public health or the environment. The responsible person shall address releases in accordance with a remediation plan submitted to and approved by the division or with an abatement plan submitted in accordance with 19.15.30 NMAC.* [emphasis added]

Release characterization is the first phase of corrective action unless the release is ongoing or is of limited volume and all impacts can be immediately addressed. Proper and cost-effective remediation typically cannot occur without adequate characterization of the impacts of any release. Furthermore, the Division has the ability to impose reasonable conditions upon the efforts it oversees. **As such, the Division is requiring a workplan for the characterization of impacts associated with this release be submitted to the OCD District _1_ office in __Hobbs____ on or before _9/11/2017_. If and when the release characterization workplan is approved, there will be an associated deadline for submittal of the resultant investigation report. Modest extensions of time to these deadlines may be granted, but only with acceptable justification.**

The goals of a characterization effort are: 1) determination of the lateral and vertical extents along with the magnitude of soil contamination. 2) determine if groundwater or surface waters have been impacted. 3) If groundwater or surface waters have been impacted, what are the extents and magnitude of that impact. 4) The characterization of any other adverse impacts that may have occurred (examples: impacts on vegetation, impacts on wildlife, air quality, loss of use of property, etc.). To meet these goals as quickly as possible, the following items must, at a minimum, be addressed in the release characterization workplan and subsequent reporting:

- Horizontal delineation of soil impacts in each of the four cardinal compass directions. Adsorbed soil contamination must be characterized for the following constituents using the associated laboratory methods: benzene, toluene, ethylbenzene, and total xylenes by either Method 8260 or 8021, total petroleum hydrocarbons by Method 8015 extended range (GRO+DRO+MRO; C_6 thru C_{36}), and for chloride by Method 300. This is not an exclusive list of potential contaminants. Analyzed parameters should be modified based on the nature of the released substance(s). Soil sampling must be both within the impacted area and beyond.

- Vertical delineation of soil impacts. Adsorbed soil contamination must be characterized for the following constituents using the associated laboratory methods: benzene, toluene, ethylbenzene, and total xylenes by either Method 8260 or 8021, total petroleum hydrocarbons by Method 8015 extended range (GRO+DRO+MRO; C_6 thru C_{36}), and for chloride by Method 300. As above, this is not an exclusive list of potential contaminants and can be modified. Vertical characterization samples should be taken at depth intervals no greater than five feet apart. Lithologic description of encountered soils must also be provided. At least ten vertical feet of soils with contaminant concentrations at or below these values must be demonstrated as existing above the water table.

- Nominal detection limits for field and laboratory analyses must be provided.

- Composite sampling is not generally allowed.

- Field screening and assessment techniques are acceptable (headspace, titration, EC [include algorithm for validation purposes], EM, etc.), but the sampling and assay procedures must be clearly defined. Copies of field notes are highly desirable. A statistically significant set of split samples must be submitted for confirmatory laboratory analysis, including the laterally farthest and vertically deepest sets of soil samples. Make sure there are at least two soil samples submitted

for laboratory analysis from each borehole or test pit (highest observed contamination and deepest depth investigated). Copies of the actual laboratory results must be provided including chain of custody documentation.

•Probable depth to shallowest protectable groundwater and lateral distance to nearest surface water. If there is an estimate of groundwater depth, the information used to arrive at that estimate must be provided. If there is a reasonable assumption that the depth to protectable water is 50 feet or less, the responsible party should anticipate the need for at least one groundwater monitoring well to be installed in the area of likely maximum contamination.

• If groundwater contamination is encountered, an additional investigation workplan may be required to determine the extents of that contamination. Groundwater and/or surface water samples, if any, must be analyzed by a competent laboratory for volatile organic hydrocarbons (typically Method 8260 full list), total dissolved solids, pH, major anions and cations including chloride and sulfate, dissolved iron, and dissolved manganese. The investigation workplan must provide the groundwater sampling method(s) and sample handling protocols. To the fullest extent possible, aqueous analyses must be undertaken using nominal method detection limits. As with the soil analyses, copies of the actual laboratory results must be provided including chain of custody documentation.

• Accurately scaled and well-drafted site maps must be provided providing the location of borings, test pits, monitoring wells, potentially impacted areas, and significant surface features including roads and site infrastructure that might limit either the release characterization or remedial efforts. Field sketches may be included in subsequent reporting, but should not be considered stand-alone documentation of the site's layout. Digital photographic documentation of the location and fieldwork is recommended, especially if unusual circumstances are encountered.

Nothing herein should be interpreted to preclude emergency response actions or to imply immediate remediation by removal cannot proceed as warranted. Nonetheless, characterization of impacts and confirmation of the effectiveness of remedial efforts must still be provided to the OCD before any release incident will be closed.

Jim Griswold
OCD Environmental Bureau Chief
1220 South St. Francis Drive
Santa Fe, New Mexico 87505
505-476-3465
jim.griswold@state.nm.us

APPENDIX B

Photographs

Site Viewing South

Site Viewing Southeast

Site Viewing Northeast

Site Viewing North