

# Location Checklist



<b>Operator / #</b>	BONANZA CREEK ENERGY OPERATING COMPANY LLC / 8960		
<b>Location ID &amp; Name</b>	<a href="#">323120</a> ROTHE/5-6 Pad		
<b>County</b>	Weld, CO		
<b>Well Information</b>	Well Name:	ROTHE #5-6	
	Well API #:	<a href="#">05-123-12586</a>	
	Lat/Long as Drilled:	40.343190 / -104.487170	
	Plug Date & Form 6s Doc #:	03/12/2019 & <a href="#">401979639</a>	
<b>Facility Entities</b>	X	Tank Battery (Off-Site)	Pits
	X	Wells	X On-Location Flowlines (Form 42) Doc #: <a href="#">401956569</a>
		Domestic Taps	X Off-Location Flowlines (Form 44) Doc #: <a href="#">402074479</a>
<b>Equipment On-Site</b>	X	None	Debris
		Pit mouse/rat holes, cellars backfilled	
<b>Access Road</b>	X	Regraded	X Contoured
		Culverts removed	X Gravel removed
		Pre-Existing (Must provide supporting documentation)	
<b>Reclamation Status</b>	X	Location and associated disturbances reclaimed	
		Subsidence	
<b>Spills or Releases (Form 19)</b>	X	No	Yes
<b>Remediation (Form 27/27A)</b>		No	X Yes – Resolved 2022
<b>On-Location Flowlines</b>		No	X Yes
<b>Off-Location Flowlines</b>		No	X Yes
<b>Inspection Corrective Actions</b>	X	No	Yes
<b>Sundry Notice</b>	Form 4 Doc # & Date:	<a href="#">401209720</a> & 03/31/2017	
	Purpose:	CHANGE OF WELL, FACILITY OR OIL & GAS LOCATION NAME OR NUMBER. <ul style="list-style-type: none"> <li>○ From: Name: ROTHE-64N63W Number: 6SWNW</li> <li>○ To: Name: Rothe Number: 5-6 Pad</li> <li>○ Effective Date: 02/14/2017</li> </ul>	
	Comments:	None	
	Attachments:	None	
<b>Drone Information</b>	Make & Model	DJI M300/DJI Mavic 3 Multispectral	
	Image Processing Software	Pix4dfields – RGB/Multispectral Imagery & Pix4dmatic – RGB Imagery	
	Pilot Name & FAA Certificate #	Sam Streeter, #4100157	
	Date of FAA Certificate Issuance	23 Dec 2023	

# SITE-SPECIFIC QUALITY ASSURANCE & QUALITY CONTROL AUDIT



## Final Reclamation Complete Notice – Cropland Drone Imagery

### PERMIT CLOSURE REPORT – CROPLAND

**Location ID** 323120

**Location Name** ROTHE/5-6 Pad

#### Report Date

27 Sep 2024

Soil Sage has conducted a thorough data audit as part of our Quality Assurance and Quality Control (QA/QC) protocols. This report was developed in accordance with the ECMC Operator Guidance – Operator supplied cropland drone imagery and information for submitting a final reclamation complete notice.

#### Crop Year and Type

Crop 2024 – Alfalfa

#### Quality Assurance & Quality Control Audit

<b>Auditor</b>	Soil Sage
<b>Audit Date</b>	19 Mar 2024

#### Audit Methodology

The following source materials were consulted during the QA and QC audit process:

- ✓ Site Permit Closures provided by CIVITAS Resources
- ✓ Colorado Oil & Gas Information System – COGIS Database
- ✓ On-site Evaluation and Proprietary Soil Sage Drone Imagery data collection
- ✓ Review of legacy imagery for site location and facility parameters

All pertinent data, imagery, and materials are included at the end of this report.

## Site Description

<b>Name</b>	ROTHE/5-6 Pad		
<b>Location ID</b>	<a href="#">323120</a>		
<b>Operator / #</b>	BONANZA CREEK ENERGY OPERATING COMPANY LLC / 8960		
<b>Field</b>	WATTENBERG / 90750		
<b>County, State</b>	Weld, CO		
<b>Lat/Long</b>	40.343190 / -104.487170		
	Planned Location	<input checked="" type="checkbox"/>	As Drilled
<b>Facility Status</b>	CL	<b>Location</b>	SWNW 6 4N63W
<b>Facility Status Date</b>	03/12/2019		
<b>Facility Entities</b>	<input checked="" type="checkbox"/> Tank Battery (Off-Site)		Pits
	<input checked="" type="checkbox"/> Wells	<input checked="" type="checkbox"/>	Off-Location Flowlines ( <b>Form 44</b> )
	Domestic Taps	<input checked="" type="checkbox"/>	On-Location Flowlines ( <b>Form 42</b> )
	Electric Utilities		
<b>Equipment on Site</b>	<input checked="" type="checkbox"/> No		Yes
	If yes, list:		
	Pit mouse/rat holes, cellars backfilled		
<b>Access Road</b>	<input checked="" type="checkbox"/> Regraded	<input checked="" type="checkbox"/>	Contoured
	Culverts Removed	<input checked="" type="checkbox"/>	Gravel Removed
	Pre-Existing: must provide supporting documentation		
<b>Environment Incidents &amp; Remediation</b>	None		Spill or Release ( <b>Form 19</b> )
	<input checked="" type="checkbox"/> Remediation ( <b>Form 27/27A</b> )		
<b>Variance Requests</b>	No Variance Requests were detected during this QA & QC Audit.		
<b>Inspection Corrective Actions (CA)s</b>	No Corrective Actions (CA)s were detected during the QA & QC Audit.		
	Complete ECMC Inspection Search Results: <a href="#">Link</a>		
<b>Sundry Notice (Form 4)</b>	<p><b>Form 4 Doc # &amp; Date:</b> <a href="#">401209720</a> &amp; 03/31/2017</p> <ul style="list-style-type: none"> <li><b>Purpose:</b> CHANGE OF WELL, FACILITY OR OIL &amp; GAS LOCATION NAME OR NUMBER</li> <li><b>From:</b> Name: ROTHE-64N63W    Number: 6SWNW</li> <li><b>To:</b>    Name: Rothe    Number: 5-6 Pad</li> <li><b>Effective Date:</b> 02/14/2017</li> </ul>		

	<p><b>Form 4s were detected during the QA &amp; QC Audit.</b> See individual scout card data for details.</p>
<p><b>On Location Flowlines (Form 42)</b></p>	<p><b>Form 42s were detected during the QA &amp; QC Audit.</b> See individual scout card data for details.</p>
<p><b>Off-Location Flowlines (Form 44)</b></p>	<p><b>Form 44 Doc # &amp; Date:</b> <a href="#">402074479</a> &amp; 06/14/2019</p> <ul style="list-style-type: none"> <li>○ <b>Purpose:</b> Abandonment</li> <li>○ <b>Abandonment Date:</b> 04/23/2019</li> <li>○ <b>ECMC Approval Date &amp; Signee:</b> 06/14/2019 by Jeff Robbins</li> <li>○ <b>Operator Comments:</b> None Stated</li> <li>○ <b>Note:</b> This Form 44 includes data for two Off-Location Flowlines: <a href="#">465332</a> and <a href="#">465333</a>. This Location is connected to <a href="#">465332</a> below.</li> </ul> <p><b>Flowline Facility Information</b></p> <ul style="list-style-type: none"> <li>○ <b>ECMC Flowline ID:</b> <a href="#">465332</a></li> <li>○ <b>Operator Flowline ID:</b> Rothe 5-6 Flowline</li> <li>○ <b>Status &amp; Date:</b> AC &amp; 06/14/2019</li> <li>○ <b>Flowline Type:</b> Wellhead Line</li> <li>○ <b>Type of Fluids Transported:</b> Multiphase</li> <li>○ <b>Start Point Location ID:</b> <a href="#">323120</a></li> <li>○ <b>Start Point Riser Lat/Long:</b> 40.343191 / -104.487185 (ROTHER #5-6 Well)</li> <li>○ <b>Equipment at Start Point:</b> Well</li> <li>○ <b>End Point Location ID:</b> <a href="#">464906</a></li> <li>○ <b>End Point Riser Lat/Long:</b> 40.343638 / -104.486070 (Rothe/Tank Battery Production Facilities)</li> <li>○ <b>Equipment at End Point Riser:</b> Separator</li> </ul>
<p><b>Site Investigation and Remediation Workplan (Form 27/27A)</b></p>	<p><b>Remediation Project #:</b> <a href="#">13510</a></p> <p><b>Form 27A Supplemental Doc # &amp; Date:</b> <a href="#">403058307</a> &amp; 05/26/2022</p> <ul style="list-style-type: none"> <li>○ <b>Purpose:</b> Rule 913.c.(2): Buried or partially buried vessel closure, which will be by removal.</li> <li>○ <b>Lat/Long of Remediation:</b> 40.343301/-104.486017</li> <li>○ <b>Facility Type &amp; Facility ID:</b> Location &amp; <a href="#">323120</a></li> <li>○ <b>Operator Comments:</b> While conducting an internal audit of remediation projects, I discovered this project was still open. Upon further review, it appears that appropriate closure data was provided on the supplemental report submitted on 5/6/2019, but the Final Closure Request was mistakenly checked as "NO". Bonanza Creek</li> </ul>



	<p>respectfully requests closure of this release based on sample data collected on 4/19/2019.</p> <ul style="list-style-type: none"> <li>○ <b>ECMC Comments:</b> Data collected for closure in 2019 and not submitted and no NFA requested. This submittal requested NFA determination.</li> <li>○ <b>Closure Request Approved:</b> 05/26/2022 by Bob Chesson</li> <li>○ <b>Final Resolution:</b> <b>Case Resolved on 05/26/2022</b></li> </ul> <p><b>Form 27 Initial Doc # &amp; Date:</b> <a href="#">402029606</a> &amp; 05/04/2019</p> <ul style="list-style-type: none"> <li>○ <b>Purpose:</b> 909.c.(1), Rule 905: Pit or PW vessel closure.</li> <li>○ <b>Operator Comments:</b> None Stated</li> </ul>
<b>Field Inspection Form (Form INSP)</b>	<p><b>Form INSP Doc # &amp; Date:</b> <a href="#">675000393</a> &amp; 04/20/2018</p> <ul style="list-style-type: none"> <li>○ <b>Status Summary:</b> NO FOLLOW UP INSPECTION REQUIRED</li> <li>○ <b>Inspected Facilities:</b> ROTHE 5-6 Well</li> <li>○ <b>Inspection Status:</b> SI</li> <li>○ <b>Inspection Date &amp; Inspector:</b> 04/20/2018 by Alicia Duran</li> <li>○ <b>Comments:</b> Automation array. Shared berm with crude oil tanks. Plumbed to surface.</li> <li>○ <b>Attachments:</b> Inspection Photos Doc # <a href="#">675000398</a></li> </ul> <p><b>Form INSP Doc # &amp; Date:</b> <a href="#">674101725</a> &amp; 11/18/2014</p> <ul style="list-style-type: none"> <li>○ <b>Status Summary:</b> THIS IS A FOLLOW UP INSPECTION. NO FOLLOW UP INSPECTION REQUIRED.</li> <li>○ <b>Inspected Facilities:</b> ROTHE 5-6 Well</li> <li>○ <b>Inspection Status:</b> SI</li> <li>○ <b>Inspection Date &amp; Inspector:</b> 11/18/2014 by Jeffrey Rickard</li> <li>○ <b>Comments:</b> Bradenhead is exposed at surface. Corrective actions from last inspection have been performed.</li> </ul>
<b>COGIS Tank Facilities Information (Scout Card)</b>	<p><b>No Tank Battery documents were detected during this QA/QC Audit.</b> However, the Tank Battery is referenced in Form 44 Doc #<a href="#">402074479</a> as the End Point Production Facilities and is at Location ID <a href="#">464906</a>.</p>

<b>COGIS Well Information (Scout Card)</b>	<p><b>Well Name:</b> ROTHE #5-6</p> <p><b>API#:</b> <a href="#">05-123-12586</a></p> <p><b>FACILITY ID:</b> 244791</p> <ul style="list-style-type: none"> <li>○ <b>Status &amp; Date:</b> PA &amp; 03/12/2019</li> <li>○ <b>Lat/Long as Drilled:</b> 40.343190 / -104.487170</li> <li>○ <b>Form 6 Doc # &amp; Date:</b> <a href="#">401979639</a> &amp; 06/13/2019</li> <li>○ <b>Form 4 Doc # &amp; Date:</b> <a href="#">401965885</a> &amp; 03/14/2019</li> </ul> <p><b>Purpose:</b> DIGITAL WELL LOG UPLOAD</p> <ul style="list-style-type: none"> <li>○ <b>Form 42 Doc # &amp; Date:</b> <a href="#">401956569</a> &amp; 03/04/2019</li> </ul> <p><b>Purpose:</b> START OF PLUGGING OPERATIONS - 48-hour notice required. Date: 03/08/2019.</p> <ul style="list-style-type: none"> <li>○ <b>Form 42:</b> There are 6 Form 42 OFFSET WELL MITIGATION Documents, refer to <a href="#">Well Docs</a>.</li> </ul>
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ECMC Abbreviations: [Location & Facility Status Codes](#), [Inspection Types & Statuses](#) and [ECMC Help](#).

## Audit Key Findings – Designation Land Use Observations

PREVIOUS LAND USE	CURRENT LAND USE
<p><b>Reference Imagery for Infrastructure:</b></p> <p>DRCOG 2004</p>	<p><b>Remotely Sensed Imagery:</b></p> <p>04 Apr 2024; 20 May 2024</p>
<p><b>Designation:</b></p> <p>Oil &amp; Gas Facility</p>	<p><b>Designation:</b></p> <p>Cropland</p>

### The following imagery sources were reviewed during this audit:

EarthExplorer, DRCOG 2002 - 2014, NAIP Imagery 2011, 2013, 2015, 2017, 2019, 2021, ESRI Maxar and Remotely Sensed Imagery Sep 2022

## Site Observation Notes

No additional information.

In accordance with ECMC guidance, this cropland evaluation has demonstrated that this location has been returned to its original condition and crops are reflective of the cropland reference areas.

## Closure Information

Location ID [323120](#) ROTHE/5-6 Pad is in Weld County, Colorado near the intersection of County Road 50 and County Road 61. There is one plugged and abandoned well (Rothe #5-6 API # [05-123-12586](#)). There is an Off-Location Flowline between this well and the production facility at Location ID [464906](#).

On May 4<sup>th</sup>, 2019, a Form 27 Initial was submitted for 909.c.(1), Rule 905: Pit or PW vessel closure, under Remediation Project # [13510](#). Remediation Project # [13510](#) was closed in a Form 27 Supplemental on May 26<sup>th</sup>, 2022.

Rothe #5-6 well (API # [05-123-12586](#)) was plugged and abandoned on March 12<sup>th</sup>, 2019. The access road was reclaimed at this time. The related production facility, Location ID [464906](#), was closed and reclaimed in 2019.

Soil Sage drone imagery confirms that no equipment was left on site at this location after reclamation activities occurred.

## Summary Acreage Table

Description	Acres
Historic Disturbance Extent	0.13
Access Road	0.09
Flowline	Not Included
Tank Battery	Off-Site (Loc ID <a href="#">464906</a> )
Well Pad	0.04

## Drone Information

Make	DJI
Model	M300/Mavic 3 Multispectral
Image Processing Software	Pix4dfields – RGB/Multispectral Imagery & Pix4dmatic – RGB Imagery
Pilot Name	Sam Streeter
Pilot FAA Certificate Number	4100157
Date of FAA Certificate Issuance	23 Dec 2023

### Infrastructure

Facility – CL – 03/12/2019

Well – PA – 03/12/2019

Tank Battery - Off-Site - CL - 06/14/2019

Pit – No Documentation

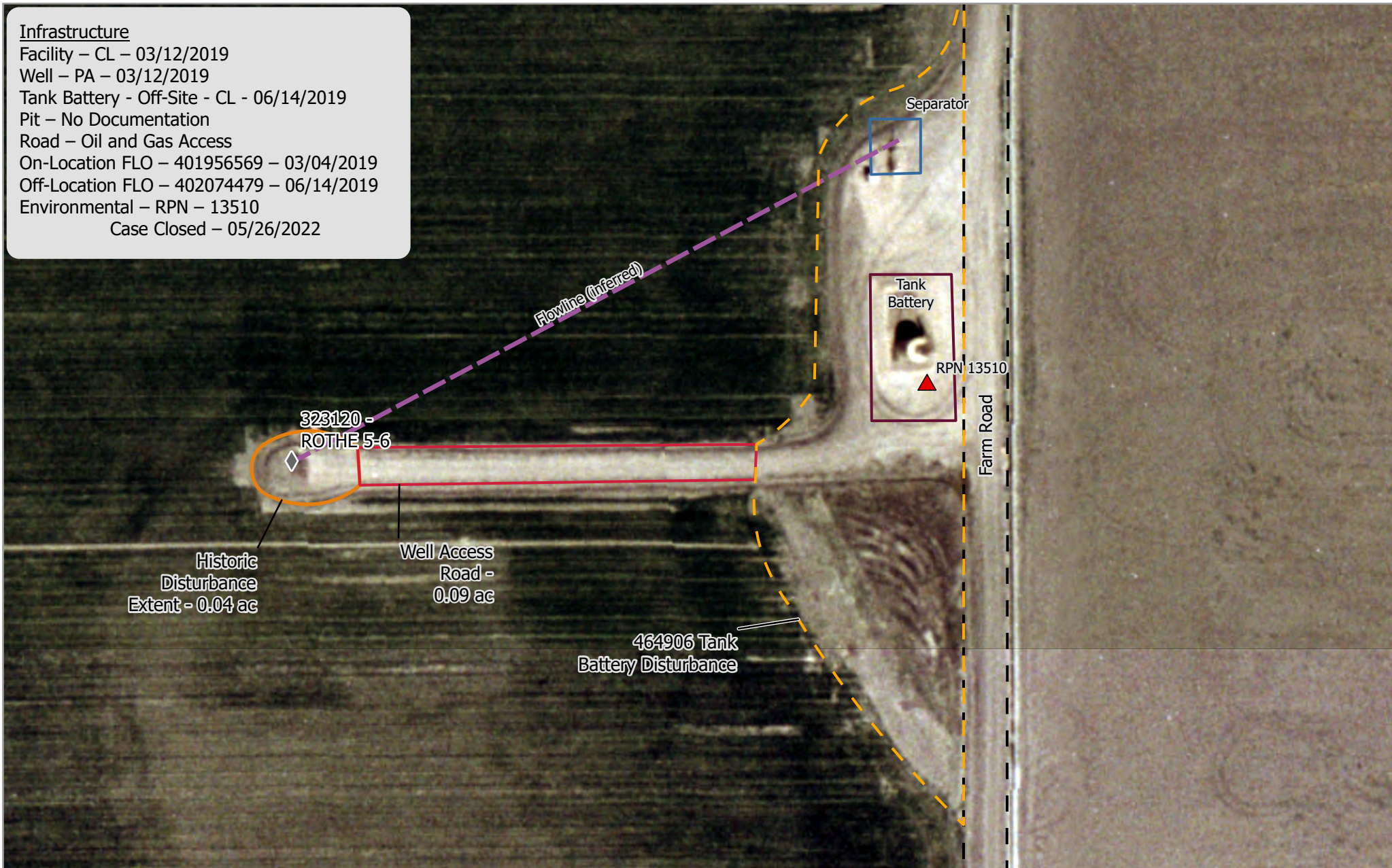
Road – Oil and Gas Access

On-Location FLO – 401956569 – 03/04/2019

Off-Location FLO – 402074479 – 06/14/2019

Environmental – RPN – 13510

Case Closed – 05/26/2022



### CIV - 323120- ROTHE 5-6 Map Extent - Pre-Plugging Overview

Imagery: DRCOG

Imagery Date: Apr 2004

Map Date: 16 Sep 2024

Datum: WGS 1984 UTM Zone 13N

POC: Soil Sage

- |                             |                  |
|-----------------------------|------------------|
| ◆ Wells                     | Well Access Road |
| ▲ Remediation               | Farm Road        |
| — Flowline                  | Tank Battery     |
| Historic Disturbance Extent | Separator        |

0 10 20 40 Meters

Total Disturbance:

0.13 Acres

Scale: 1:800

Pad Location:

40.343190

-104.487170



Service Credits - Esri Community Maps  
Contributors, © OpenStreetMap, Microsoft,  
Esri, TomTom, Garmin, Sphero,  
GeoTechnologies, Inc., MET/NASA, USGS,  
EPA, NPS, US Census Bureau, USDA,  
USFWS





### Infrastructure

Facility – CL – 03/12/2019

Well – PA – 03/12/2019

Tank Battery – Off-Site - CL - 06/14/2019

Pit – No Documentation

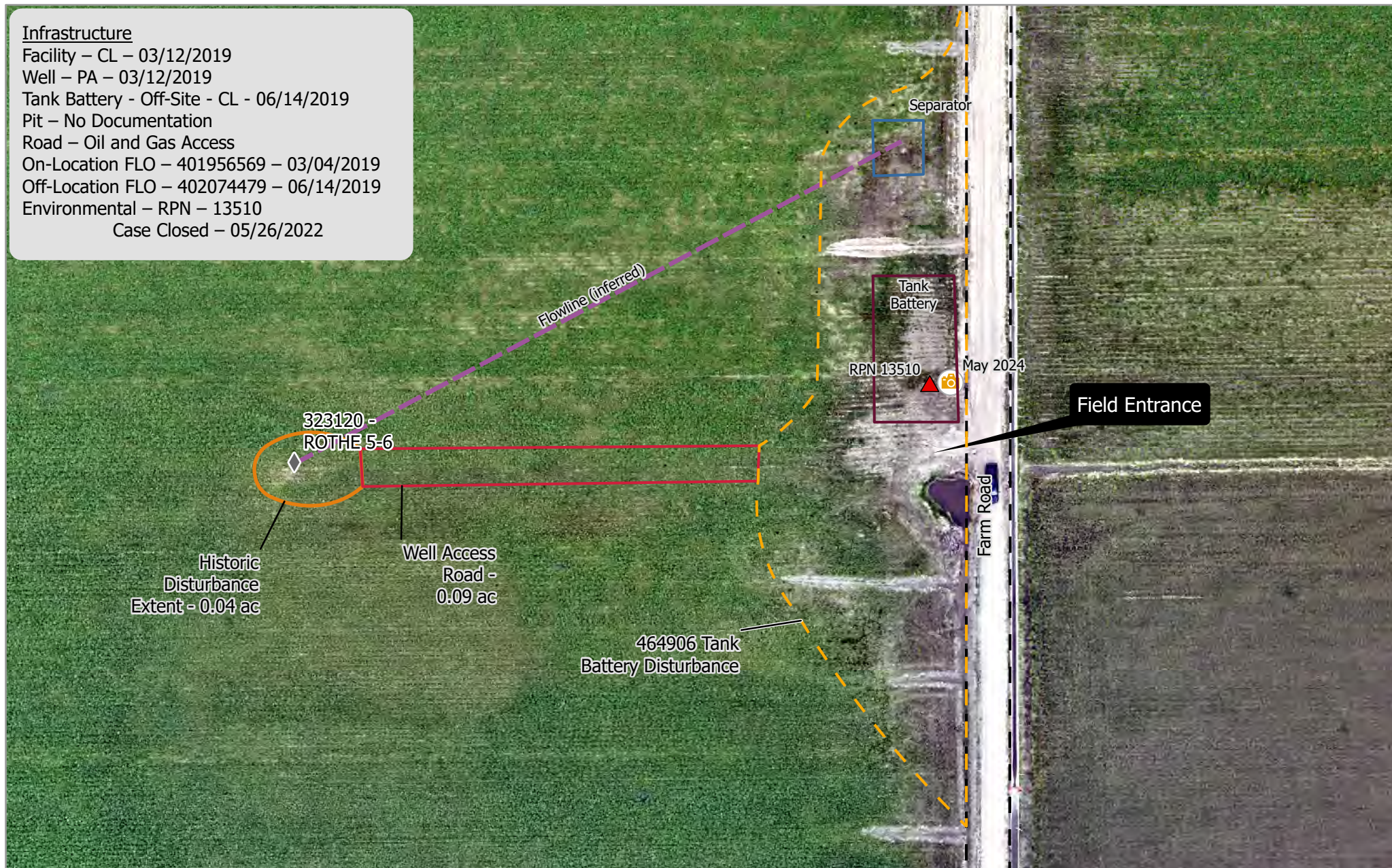
Road – Oil and Gas Access

On-Location FLO – 401956569 – 03/04/2019

Off-Location FLO – 402074479 – 06/14/2019

Environmental – RPN – 13510

Case Closed – 05/26/2022



### CIV - 323120- ROTHE 5-6 Map Extent - Post-Plugging Overview

Imagery: RS Orthomosaic  
Imagery Date: 20 May 2024  
Map Date: 16 Sep 2024  
Datum: WGS 1984 UTM Zone 13N  
POC: Soil Sage

- |  |   |
|--|---|
|  Wells              |  Historic Disturbance Extent |
|  Observation Points |  Well Access Road            |
|  Remediation        |  Farm Road                   |
|  Flowline           |  Tank Battery                |
|  |  Separator                   |

0 10 20 40 Meters

Total Disturbance:  
0.13 Acres  
Scale: 1:800

Pad Location:  
40.343190  
-104.487170



Service Credits - Esri Community Maps  
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Esri, TomTom, Garmin, SafeGraph,  
GeoTechnologies, Inc., MET/NASA, USGS,  
EPA, NPS, US Census Bureau, USDA,  
USFWS





## Cardinal Directional Drone Photos & Reference Area Photos

*Site Investigation and Photos Date*

20 May 2024

*Drone Photo Height*

120 feet

Cardinal directional photos of the site. Reference overview map.



**In View** – Well, Tank Battery (Loc ID [464906](#)), Access Road, Flowline

**NORTH** – 40.342631 / -104.487173





**In View** – Well, Tank Battery (Loc ID [464906](#)), Access Road, Flowline

**EAST** – 40.343174 / -104.487965



**In View** – Well, Access Road, Flowline

**SOUTH** – 40.343626 / -104.487143





**In View** – Well, Access Road, Flowline

**WEST** – 40.343134 / -104.486237





## Well – Handheld Photographic Evidence

### *Site Investigation and Photos Date*

20 May 2024

Handheld photos taken from the access road to the east of Location ID [323120](#), Rothe #5-6 wellhead.  
No handheld photos taken from Rothe #5-6 wellhead location due to crop height.

 <p>A handheld photograph showing a field of tall, green grass. The photo includes a compass overlay at the top with directions S, SW, and W, and a scale bar. The text overlay at the bottom reads: "228°SW (M) • 40.343301, -104.485979 ±19m ▲ 1385m". In the bottom right corner, it says "323120" and "20 May 2024, 6:39:57 PM". The label "Grass Hay" is in the bottom left corner.</p>	 <p>A handheld photograph showing a field of tall, green grass. The photo includes a compass overlay at the top with directions SW, W, and NW, and a scale bar. The text overlay at the bottom reads: "260°W (M) • 40.343299, -104.485974 ±12m ▲ 1385m". In the bottom right corner, it says "323120" and "20 May 2024, 6:40:06 PM". The label "Brome" is in the bottom left corner.</p>
Overhead – Grass Hay – 40.343301/-104.485979	Overhead - Brome ( <i>Bromus</i> spp.) – 40.343299/-104.485974







# Irrigation Water Ditch and Road – Handheld Photographic Evidence

*Site Investigation and Photos Date*

04 Apr 2024


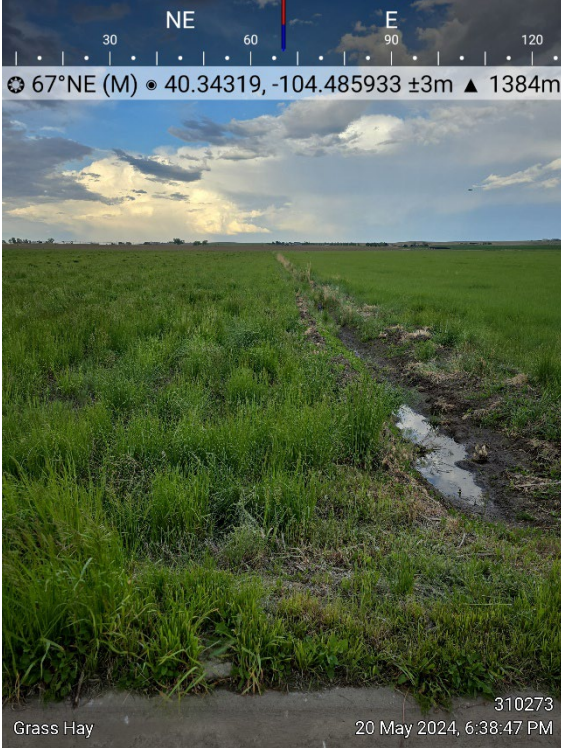
Handheld photos taken from the farm road to the east of Location ID [323120](#).

 <p>323120 Irrigation Water Ditch and Road 04 Apr 2024, 1:13:06 PM</p>	 <p>323120 Irrigation Water Ditch and Road 04 Apr 2024, 1:13:25 PM</p>
Looking Southwest - Irrigation Water Ditch/Road – 40.343244/-104.485889	Looking Southwest - Irrigation Water Ditch/Road – 40.343237/-104.485942

# Off-Location Tank Battery Within Cropland – Handheld Photographic Evidence

*Site Investigation and Photos Date*

20 May 2024

 <p>Looking North at Tank Battery Location – 40.343253 / -104.485984</p>	 <p>Looking East at Tank Battery Location – 40.343190 / -104.485933</p>
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<p>Looking West at Tank Battery Location – 40.343234 / -104.485930</p>	



*Cardinal Directional Drone Photos Showing No Equipment Remaining*

Site Investigation and Photos Date

04 Apr 2024

Drone Photo Height

100 feet

Cardinal directional photos of the site. Reference overview map.



**In View** – Well, Access Road, Flowline

**NORTH** – 40.342778 / -104.487243





**In View** – Tank Battery (Loc ID [464906](#)), Access Road, Flowline

**NORTH** – 40.342758 / -104.486196



**In View** – Well, Tank Battery (Loc ID [464906](#)), Access Road, Flowline

**EAST** – 40.343259 / -104.487664





**In View** – Tank Battery (Loc ID [464906](#)), Access Road, Flowline

**EAST** – 40.343391 / -104.486792



**In View** – Well, Access Road, Flowline

**SOUTH** – 40.343769 / -104.487150





**In View** – Tank Battery (Loc ID [464906](#)), Access Road, Flowline

**SOUTH** – 40.344098 / -104.486117



**In View** – Well, Access Road, Flowline

**WEST** – 40.343220 / -104.486499





**In View** – Well, Tank Battery (Loc ID [464906](#)), Access Road, Flowline

**WEST** – 40.343453 / -104.485349

# ATTACHMENTS

## Maps and Figures

### *Area Maps*

Elevation & Contours

Hydrology

## Background Information

### *Natural Resources Conservation Service (NRCS) Map Unit Description*

Reference Soil Document

### Infrastructure

Facility – CL – 03/12/2019

Well – PA – 03/12/2019

Tank Battery – Off-Site - CL - 06/14/2019

Pit – No Documentation

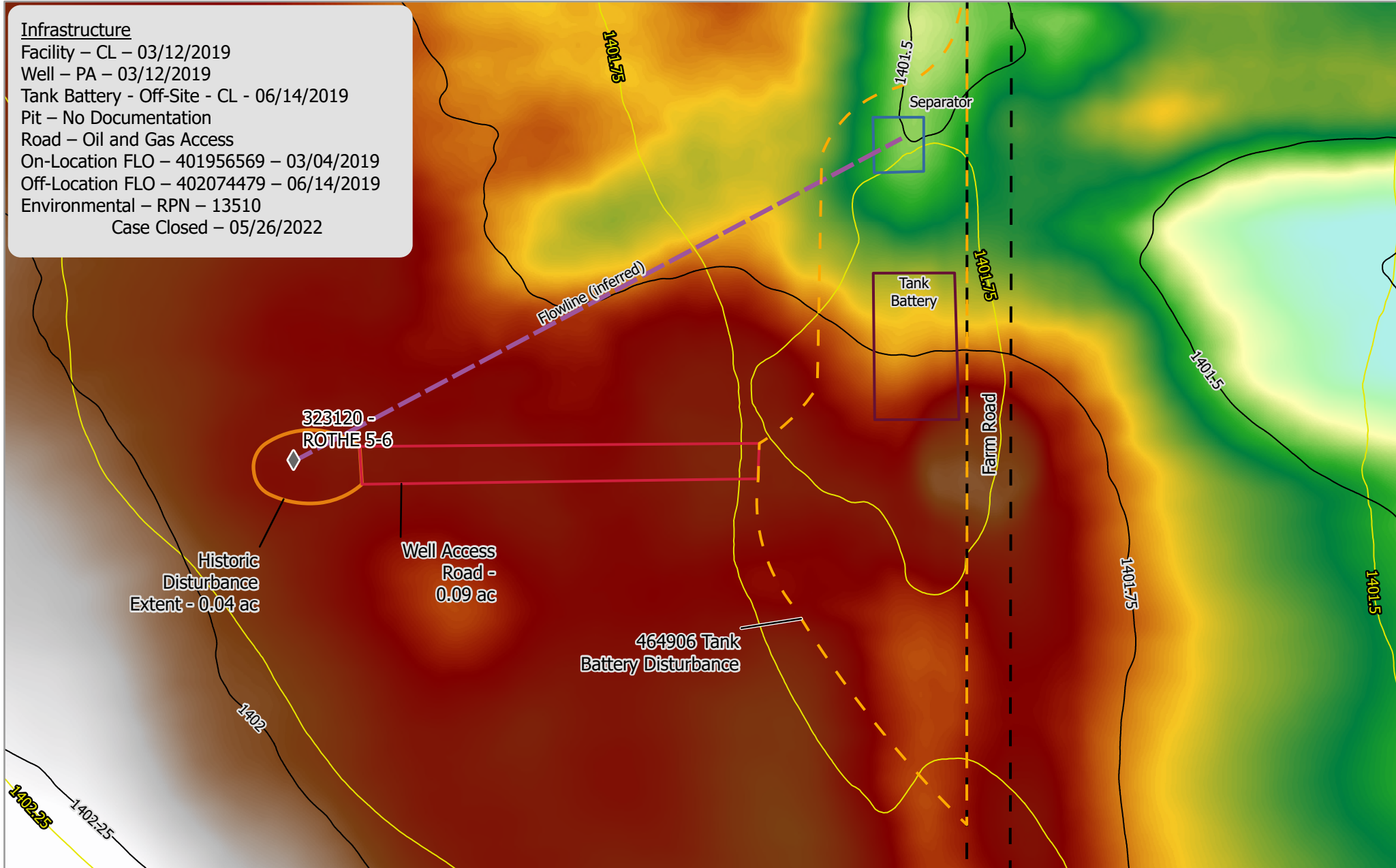
Road – Oil and Gas Access

On-Location FLO – 401956569 – 03/04/2019

Off-Location FLO – 402074479 – 06/14/2019

Environmental – RPN – 13510

Case Closed – 05/26/2022



### CIV - 323120- ROTHE 5-6 Map Extent - Elevation & Contours

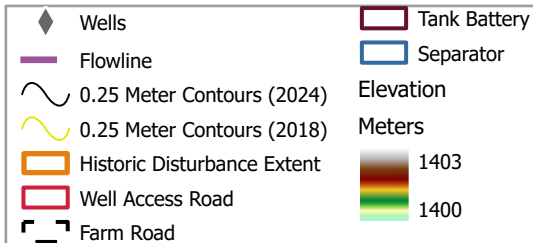
Imagery: RS DSM, CWCB

Imagery Date: 2024, 2018

Map Date: 16 Sep 2024

Datum: WGS 1984 UTM Zone 13N

POC: Soil Sage



0 10 20 40 Meters

Total Disturbance:

0.13 Acres

Scale: 1:800

Pad Location:

40.343190

-104.487170



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GeoTechnology, Inc, MET/NASA, USGS,  
EPA, NPS, US Census Bureau, USDA,  
USFWS





### Infrastructure

Facility – CL – 03/12/2019

Well – PA – 03/12/2019

Tank Battery – Off-Site – CL – 06/14/2019

Pit – No Documentation

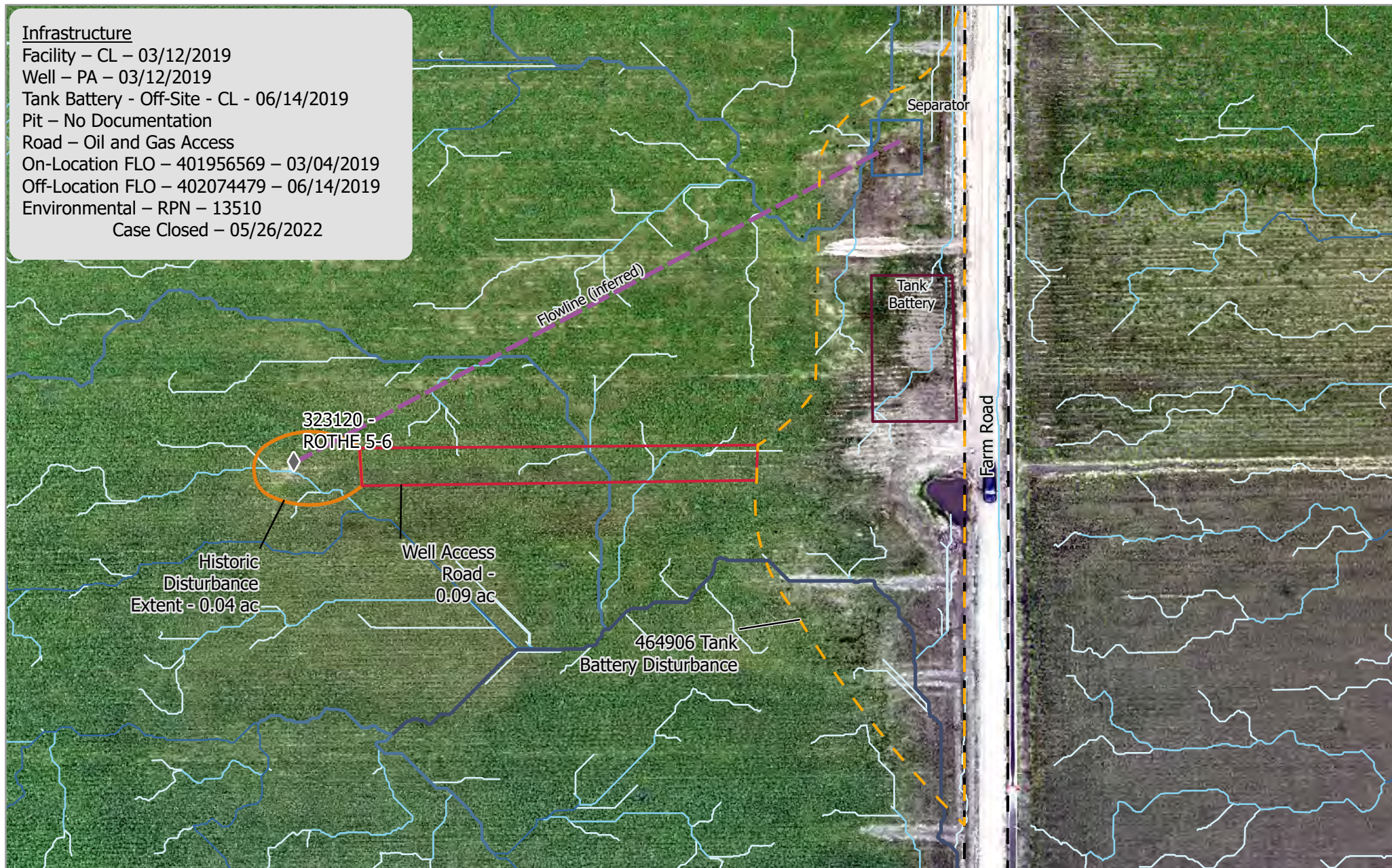
Road – Oil and Gas Access

On-Location FLO – 401956569 – 03/04/2019

Off-Location FLO – 402074479 – 06/14/2019

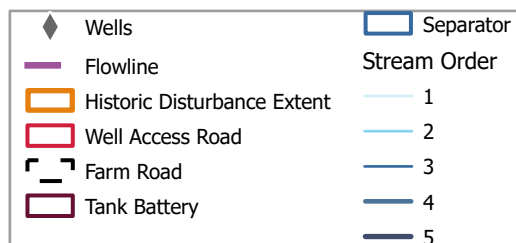
Environmental – RPN – 13510

Case Closed – 05/26/2022



### CIV - 323120- ROTHE 5-6 Map Extent - Hydrology

Imagery: RS DSM, Orthomosaic  
Imagery Date: 20 May 2024  
Map Date: 16 Sep 2024  
Datum: WGS 1984 UTM Zone 13N  
POC: Soil Sage



0 10 20 40 Meters

Total Disturbance:  
0.13 Acres  
Scale: 1:800

Pad Location:  
40.343190  
-104.487170



Service Credits - Esri Community Maps  
Contributors, © OpenStreetMap, Microsoft,  
Esri, TomTom, Garmin, Sphero,  
GeoTechnologies, Inc., MET/NASA, USGS,  
EPA, NPS, US Census Bureau, USDA,  
USFWS





# Soil Properties

## USDA Soil Description

### Reference Soil Information

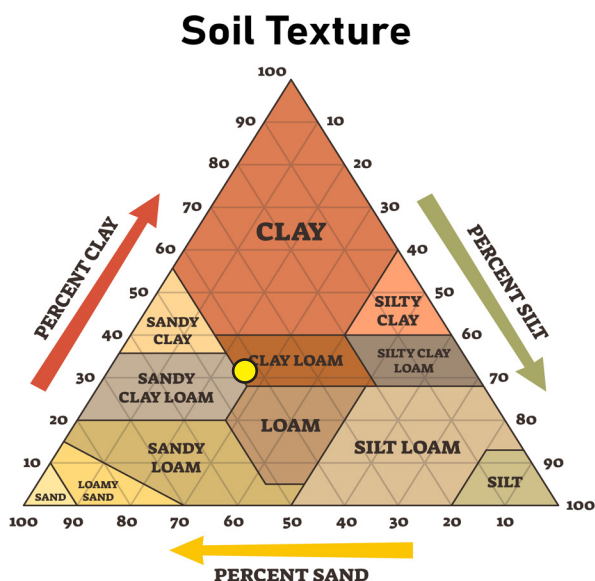
The location of the site is contained within two soil types, Nunn Clay Loam and Otero Sandy Loam.

### Map Unit 41 Reference Soil information - Nunn clay loam

This soil is formed from Pleistocene aged alluvium and/or eolian deposits. Landform is terraces. Ecological Site Description is Clayey Plains. Soils are well-drained with a high water holding capacity, and slope 0 to 1 percent.

Depth (in)	Physical			Chemical			
	Texture	Bulk Density	Particle Size Percent sand, silt, clay	pH	EC	SAR	OM%
0-6	Clay Loam	1.41	43-26-31	7.2	0.5	0.0	1.50
6-10	Clay Loam	1.37	32-30-38	7.6	0.5	0.0	1.50
10-26	Clay Loam	1.37	32-30-38	7.6	0.5	0.0	1.50
26-31	Clay Loam	1.46	42-26-32	8.0	0.5	0.0	0.75
31-47	Loam	1.52	47-32-21	8.4	0.5	0.1	0.25
47-80	Loam	1.54	48-28-24	8.5	0.5	0.1	0.25

### Soil Texture Triangle reflect the 0-10 in depth



### Erosion Potential (10 inches)

- K Factor, Whole soil - .32. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.
- Wind Erodibility Group – 6. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible.

# Soil Properties

## USDA Soil Description

### Reference Soil Information

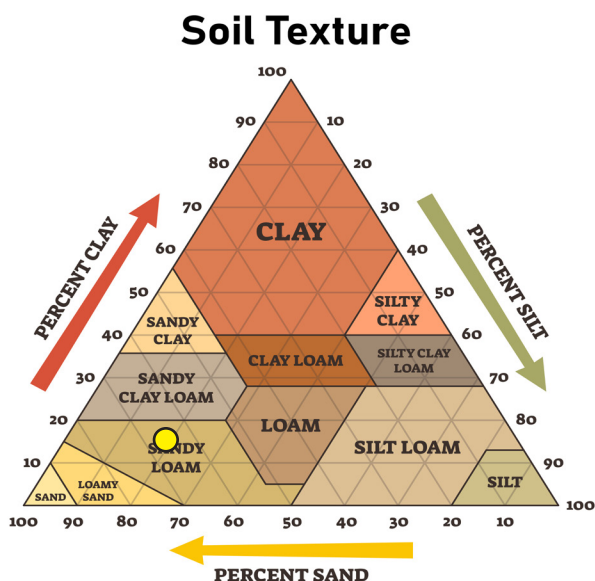
The location of the site is contained within two soil types, Nunn Clay Loam and Otero Sandy Loam.

### Map Unit 50 Reference Soil information - Otero sandy loam

This soil is formed from eolian deposits and/or mixed outwash. Landform is plains. Ecological Site Description is Sandy Plains. Soils are well-drained with a moderate water holding capacity, and slope 0 to 1 percent.

	Physical			Chemical			
Depth (in)	Texture	Bulk Density	Particle Size Percent sand, silt, clay	pH	EC	SAR	OM%
0-12	Sandy Loam	1.43	66-19-15	7.9	1.0	0.0	1.25
12-60	Fine Sandy Loam	1.43	65-20-15	7.9	2.0	0.0	0.25

### Soil Texture Triangle reflect the 0-10 in depth



### Erosion Potential (10 inches)

- K Factor, Whole soil - .15. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.
- Wind Erodibility Group – 3. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible.



## Soil Reference Information

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There is a general relationship of soil bulk density to root growth based on soil texture. Bulk densities ideal for root growth are less than 1.60 g/cc for sandy textures, less than 1.40 g/cc for loamy textures, and less than 1.10 g/cc for clayey textures. Bulk densities that restrict root growth are greater than 1.80 g/cc for sandy textures, 1.65 g/cc for loamy textures, and 1.47 g/cc for clayey textures.

# Vegetation

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## Reference vegetation – Clayey Plains Ecology

### Climate

Average Annual Precipitation 14 to 17 inches annually - average 15 inches

Average Annual Air Temperature ranges from 50 to 52 degrees F

Drought conditions in effect

Long-term effects of these latest drought events have yet to be determined. Growth of native cool-season plants begin about April 1 and continue to mid-June. Native warm-season plants begin growth about May 1 and continue to about August 15. Regrowth of cool-season plants occur in September in most years, depending on moisture.

The plant community consists of 70-90% grasses and grass-like, 5-15% forbs, and 5-15% shrubs. Dominant grasses include western wheatgrass, green needlegrass, and blue grama. Other grasses and grass-like plants that occur in minor amounts are buffalograss, sideoats grama, and sun sedge. Significant forbs are American vetch, purple prairie clover, and scarlet globemallow. Dominant shrubs that occupy this community are fourwing saltbush and winterfat.

Well suited to carbon sequestration.

### Ecological dynamics

The Warm-Season Shortgrass State is characterized by a warm-season shortgrass bunchgrass (blue grama) and stoloniferous grass (buffalograss). The Increased Bare Ground State is characterized by early successional warm-season and cool-season short bunchgrass (Fendler threeawn, squirreltail), annual grasses (sixweeks fescue), and forbs (curlycup gumweed). Common annual invasives (cheatgrass, Russian thistle), and/or perennial invasives (bindweed) may also occur. Drought has increased mortality of blue grama and green needlegrass in some locations.

## Reference Vegetation – Clayey Plains Ecology

### At Risk Plant Community

Key species from the Reference Plant Community, green needlegrass, western wheatgrass, American vetch, fourwing saltbush, and winterfat, have decreased in abundance. Blue grama and buffalograss have increased in abundance. Sand dropseed, red threeawn, sixweeks fescue, bottlebrush squirreltail, and hairy false goldenaster (aka hairy goldaster) have also increased.

The plant community is at risk of losing green needlegrass, western wheatgrass, American vetch, fourwing saltbush, and winterfat.

# Vegetation

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## Reference Vegetation – Clayey Plains Ecology

### Warm-Season Shortgrass Dominant Plant Community

Most of the key grass, forb, and shrub species are absent. Western wheatgrass may persist in trace amounts, greatly reduced in vigor and not readily seen. Blue grama and buffalograss dominate the community with a tight “sod-bound” appearance. Red threeawn, sand dropseed, sixweeks fescue, and hairy false goldenaster (aka hairy goldaster) have increased.

### Increased Bare Ground Plant Community

Red threeawn, curlycup gumweed and annual plants such as sixweeks fescue, cheatgrass and Russianthistle have increased and/or invaded. Blue grama may persist in localized areas. Introduced species such as field bindweed can also be present, especially on prairie dog towns. An ecological threshold has been crossed. Erosion and loss of organic matter/carbon reserves are concerns. Nutrient and water cycles and energy flow are impaired.

### Transition State

Long-term heavy continuous grazing with over stocking, or excessive defoliation, without adequate recovery periods following each grazing event will shift this plant community toward the Increased Bare Ground Plant Community. An ecological threshold has been crossed. Erosion and loss of organic matter/carbon reserves are concerns.

## Clayey Plains Ecosystem Vegetative Community Composition

Common Name	Scientific Name
Western Wheatgrass	<i>Pascopyrum smithii</i>
Blue Grama	<i>Bouteloua gracilis</i>
Green Needlegrass	<i>Nassella viridula</i>
Buffalograss	<i>Bouteloua dactyloides</i>
Sideoats Grama	<i>Bouteloua curtipendula</i>
Alkali Sacaton	<i>Sporobolus airoides</i>
Needleleaf Sedge	<i>Carex duriuscula</i>
Saltgrass	<i>Distichlis spicata</i>
Indian Ricegrass	<i>Achnatherum hymenoides</i>
Sand Dropseed	<i>Sporobolus cryptandrus</i>
American Vetch	<i>Vicia americana</i>
Purple Prairie Clover	<i>Dalea purpurea</i>
Scarlet Globemallow	<i>Sphaeralcea coccinea</i>
Dotted Blazing Star	<i>Liatris punctata</i>
Rush Skeletonplant	<i>Lygodesmia juncea</i>
Prairie Sunflower	<i>Helianthus petiolaris</i>

# Vegetation

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## Reference vegetation – Sandy Plains Ecology

### Climate

Average Annual Precipitation 14 to 17 inches annually - average 15 inches

Average Annual Air Temperature ranges from 50 to 52 degrees F

Drought conditions in effect

Long-term effects of these latest drought events have yet to be determined. Growth of native cool-season plants begin about April 1 and continue to mid-June. Native warm-season plants begin growth about May 1 and continue to about August 15. Regrowth of cool-season plants occur in September in most years, depending on moisture.

### Reference dynamics

The Reference State is characterized by 70-85% grasses and grass-like plants, 10-15% forbs, and 5-15% woody plants. The dominant tall warm season grasses are prairie sandreed, sand bluestem and switchgrass. Blue grama dominates the understory. Important cool season grasses and grass-likes are needle and thread and sun sedge. Key forbs and shrubs are American vetch, pacific peavine (manystem pea), purple prairie clover, and spreading buckwheat.

Drought has increased mortality of blue grama in some locations.

Well suited for carbon sequestration.

## Reference Vegetation – Sandy Plains Ecology

### At Risk Plant Community

Key species from the Reference Plant Community, sand bluestem, prairie sandreed, switchgrass, leadplant and western sandcherry have decreased in frequency and production. Blue grama has increased. Sand dropseed, Fendler threeawn, hairy goldaster, croton, slimflower scurfpea, western ragweed, stickleaf, heath aster, lupine, loco, milkvetch and plains pricklypear cactus have increased. Soils that have a sandy loam or coarser subsoil will show an increase in sand sagebrush.

The risk of losing key warm-season tallgrasses, important forbs and shrubs is a major concern. Blue grama is increasing at the expense of the tallgrasses and deep-rooted shrubs. Water cycle, nutrient cycle and energy flow may become impaired due to a shift in root structure and species composition. Less litter is being produced.

# Vegetation

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## Sandy Plains Ecosystem Vegetative Community Composition

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Common Name	Scientific Name
Blue Grama	<i>Bouteloua gracilis</i>
Prairie Sandreed	<i>Calamovilfa longifolia</i>
Sand Bluestem	<i>Andropogon hallii</i>
Switchgrass	<i>Panicum virgatum</i>
Needle and Thread	<i>Hesperostipa comata</i>
Western Wheatgrass	<i>Pascopyrum smithii</i>
Little Bluestem	<i>Schizachyrium scoparium</i>
Indiangrass	<i>Sorghastrum nutans</i>
Sideoats Grama	<i>Bouteloua curtipendula</i>
Sand Dropseed	<i>Sporobolus cryptandrus</i>
Indian Ricegrass	<i>Achnatherum hymenoides</i>
Buffalograss	<i>Bouteloua dactyloides</i>
Thin Paspalum	<i>Paspalum setaceum</i>
Purple Prairie Clover	<i>Dalea purpurea</i>
Upright Prairie Coneflower	<i>Ratibida columnifera</i>
Scarlet Globemallow	<i>Sphaeralcea coccinea</i>
American Vetch	<i>Vicia americana</i>
White Heath Aster	<i>Symphyotrichum ericoides</i>
Winged Buckwheat	<i>Eriogonum alatum</i>
White sagebrush	<i>Artemisia ludoviciana</i>