



January 8, 2025

5E33088 BG# 4

EMNRD – Oil Conservation Division  
506 W. Texas Ave  
Artesia, NM 88210

**SUBJECT:** Closure Request Report for the Shepherd 3 2 23 27 Fee #401H, Incident ID # nAPP2429624454, Eddy County, New Mexico.

**1.0 Introduction**

On behalf of Devon Energy Production Company, LP (Devon), Souder, Miller & Associates (SMA) has prepared this Closure Request Report. This report describes the corrective actions for a produced water incident related to oil and gas production activities at the Shepherd Fee 3 2 23 27 Fee #401H (Shepherd), Incident ID nAPP2429624454, that occurred on October 21, 2024. The spill area is located at latitude N 32.333108 and longitude W -104.184162.

Devon completed a release notification to the New Mexico Energy, Minerals, and Natural Resources Department – Oil Conservation Division (OCD) via Operators Electronic Permitting and Payment Portal on October 21, 2024, for the submission of Notice of Release (NOR), followed by the submission of the Form C-141, Release Notification on October 22, 2024. This letter provides a description of the spill assessment and includes a request for spill closure.

Table 1: Release Information and Closure Criteria			
Name	Shepherd 3 2 23 27 Fee #401H	Company	Devon Energy Production Company, LP
API Number	30-015-45744	Location	L-03-23S-27E N 32.333108, W -104.184162
Incident Number	nAPP2429624454	Land Status	Private
Date of Release	October 21, 2024	Lease Number	
Source of Release	Pinhole on 1" line leading to site glass on 2 phase separator		
Released Volume	86 bbls	Recovered Volume	86 bbls
NMOCD Closure Criteria	Depth to groundwater 51-100 feet below ground surface (bgs)		

**2.0 Background**

On October 23, 2024, a pinhole leak was discovered on the one-inch dump flowline leading to the site glass located on the 2-phase separator. The total volume of released fluids was 86 barrels (bbls) of produced water. The release occurred within the secondary lined containment at Shepherd. Initial response activities were conducted by the operator, including source elimination, photographs of standing

fluids, recovery of approximately 86 bbls of produced water, and verification that the affected area was properly exposed and cleaned for visual observation. Documentation of the liner inspection, including photographs, is provided in the Site Assessment Report in Attachment 1.

### **3.0 Site Geology and Vegetation**

The Geologic Map of New Mexico by New Mexico Bureau of Geology and Mineral Resources indicates the surface geology at the incident location area is comprised of primarily Qa–Alluvium (Holocene to upper Pleistocene), deposits of upland plains and piedmont areas, and calcic soils and eolian cover sediments of High Plains region.

The surrounding geography and terrain are associated with fan remnants, alluvial fans, at elevations between 1,100 and 5,300 feet above mean sea level (amsl). This soil type is classified as prime farmland. The annual average rainfall and precipitation ranges between 7 to 15 inches. The soils in the release location area consists of loam, silt loam, very fine sandy loam, or clay loam with substratum textures of loam, silty clay loam, or silt loams.

The primary surficial soil type on the location is Reagan loam. Upton gravelly loam is the secondary soil type. The Reagan loam soils are classified as farmland of statewide importance, tend to be well drained, with low runoff, and a moderate available water supply. The Upton gravelly loam is classified as not prime farmland, is well drained, with high runoff, and a very low available water supply.

The ecological setting is vegetation of a grassland aspect. The location area is covered by grasses with shrubs and half-shrubs sparsely and evenly distributed. Tobosa, black grama, and blue grama are dominant, while subdominant shrubs are yucca, tarbush, cholla, mixed with forbs such as desert holly, scorpionweed, bladderpod, flax, nama, fleabane, Indianwheat, groundcherry, deerstongue, and rayless goldenrod.

### **4.0 Site Information and Closure Criteria**

The Shepherd is located approximately 2.40 miles south of Carlsbad, New Mexico, on private land at an elevation of approximately 3,112 feet amsl. SMA completed site assessment/characterization pursuant to 19.5.29.11-12 NMAC to determine potential environmental impacts and closure criteria. Site assessment and characterization results are included in Attachments 1 and 2.

There is no surface water located on site or within closure criteria parameters of the site. The nearest significant watercourse, as defined in 19.15.17.7.P NMAC, is the Pecos River located approximately 20.2 miles west of the site (U.S. Fish and Wildlife Service, National Wetlands Inventory, 2024). There are no continuous flowing watercourses or significant watercourses, lakebeds, sinkholes, playa lakes, or other critical water or community features as outlined in Paragraph (4) of Subsection C of 19.15.29.11 NMAC.

Depth to ground water was determined using New Mexico Office of the State Engineer (NMOSE) Water Rights Pod Location: ArcGIS Interactive Online Map. The nearest active pod is C-00071, an irrigation well located 0.05 miles from Shepherd. This well was reported via monthly meter reading, for a depth of 205 feet bgs.. Pod C-00071 is also described as the nearest freshwater well within 1,000 feet of Shepherd. Documentation of site characterization and depth to groundwater is included in Attachment 2.

Based on data included in the closure criteria determination worksheet, the incident at Shepherd is not subject to the requirements of 19.15.29.11.A.4 NMAC. Karst potential for the area that Shepherd is

medium, based on the New Mexico State Land Office Land Status Interactive Map (NMSLO). The closure criteria for the site are the constituent concentration limits associated with less than 50 feet depth to groundwater (DTGW) as stated in Table 1 of 19.15.29.12 NMAC.

**5.0 Remediation Activities**

Notification of the liner inspection, scheduled for December 5, 2024, was provided to Devon through email by SMA personnel on November 27, 2024. Devon provided notification to NMOCD through the ENMRD Electronic Permitting and Payment Portal for Operators on December 3, 2024. Notification documentation is included in Attachment 3.

On December 5, 2024, SMA personnel performed an on-site visual inspection of the secondary containment to verify liner integrity as outlined in Paragraph (5)(a) of Subsection A of 19.15.29.11 NMAC.

Visual observation of the liner included a complete inspection of all sidewalls and the base of the containment, around equipment, and all seams of the liner. The inspection included looking for any potential perforations in the liner that could lead to a breach of the secondary containment. Observations concluded no signs of any cuts, rips, tears, or weathering of the liner condition which need repairs or replacement. Liner integrity was confirmed. Photo documentation of the liner inspection is in the Site Assessment Photolog (Attachment 1).

**6.0 Conclusions and Recommendations**

Based on the liner inspection and assessment, SMA concludes the liner integrity is adequate to contain the release related to incident nAPP2429624454. There is no evidence of release to the environment. Based on the professional activities and site assessment, Devon Energy Production Company respectfully requests closure of the incident that occurred at Shepherd 3 2 23 27 Fee #401H.

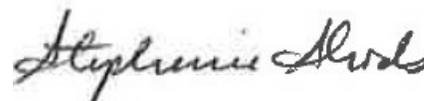
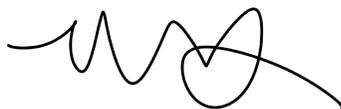
**7.0 Scope and Limitations**

The scope of our services included: visual inspection for liner integrity; regulatory liaison; and preparing this report. All work has been performed in accordance with accepted professional environmental consulting practices for oil and gas incidents in the Permian Basin in New Mexico.

If there are any questions regarding this report, please contact Stephanie Hinds at (505) 302-1127 or Monica Peppin at (575) 909-3418.

Submitted by:  
SOUDER, MILLER & ASSOCIATES

Reviewed by:



Monica Peppin, A.S.  
Project Manager

Stephanie Hinds, P.E.  
Senior Engineer

**REFERENCES:**

New Mexico Office of the State Engineer (NMOSE) online water well database

[Http://gis.ose.state.nm.us/gisapps/ose\\_pod\\_locations/](http://gis.ose.state.nm.us/gisapps/ose_pod_locations/)

USGS National Water Information System: Web interface online water well database

[https://nwis.waterdata.usgs.gov/nwis/gwlevels?site\\_no=321205103544701&agency\\_cd=USGS&format=html](https://nwis.waterdata.usgs.gov/nwis/gwlevels?site_no=321205103544701&agency_cd=USGS&format=html)

U.S. Fish and Wildlife Service: National Wetlands Inventory

[Wetlands Mapper | U.S. Fish & Wildlife Service](#)

New Mexico State Land Office: Land Status

[NMSLO Land Status](#)

United States Department of Agriculture: Natural Resources Conservation Service: Web Soil Survey

<https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>

USDA, USGS The National Map: Orthoimagry: FEMA's National Flood Hazard Layer (NFHL) Viewer

<https://hazards-fema.maps.arcgis.com/apps/webappviewer/index.html?id=8b0adb51996444d4879338b5529aa9cd>

**ATTACHMENTS:**

Attachment 1: Site Assessment Photolog

Attachment 2: Closure Criteria Determination Research

Attachment 3: Correspondence

# ATTACHMENT 1: SITE ASSESSMENT REPORT

# Site Inspection Report



Stronger Communities by Design

Client: Devon Energy Corporation

Incident ID: nAPP2429624454

Site Name: Shepherd Fee #401H

Project Manager: Monica Peppin

API: 30-015-45744

Project Owner: Jim Raley

## Field Notes

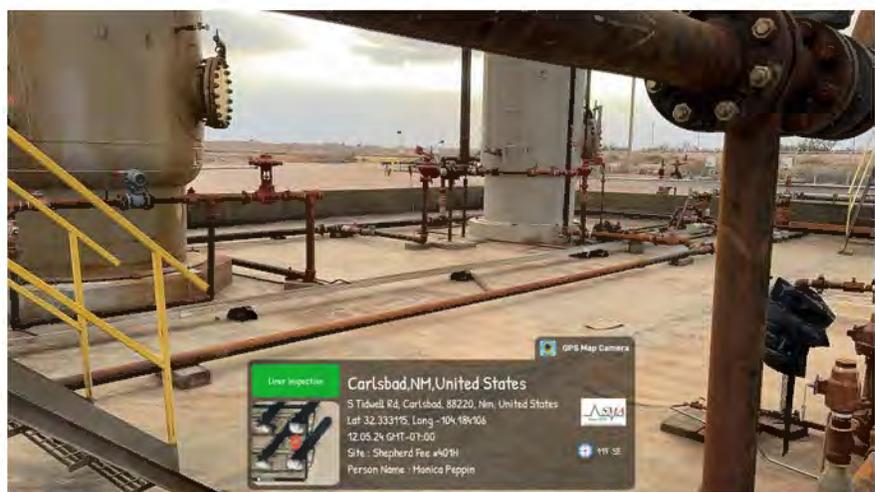
Dec 05, 2024, at 9:01 AM

- Arrive on site, complete safety paperwork. Begin visual inspection of secondary containment and collect photos of liner in a 360-degree view for proof of liner integrity. Inspected for any visible perforations, cuts, rips, tears, or substantial weathering that could lead to the potential breach through the liner.
- Inspection completed and the secondary containment liner shows that there are no signs of permeation through the liner and the barrier between the secondary containment and ground surface is isolated to withhold fluids.
- The secondary containment does not have any signs of potential breach and was from the pressure washing event to clean the lined containment to conduct the inspection.

## Visual documentation



Photograph #1: Site Details and Geographic Coordinates

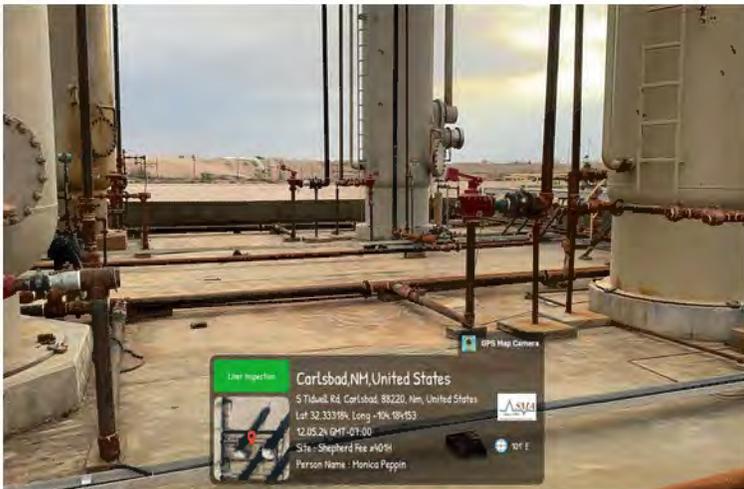
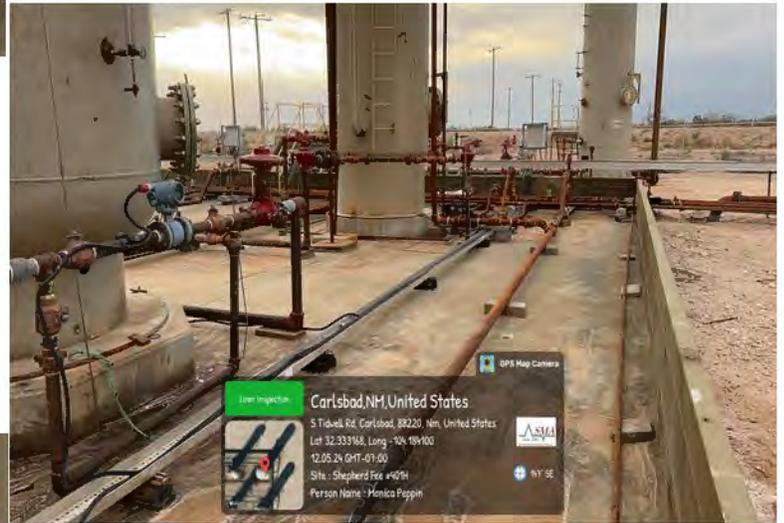


Photograph #2: Containment area from middle facing southwest



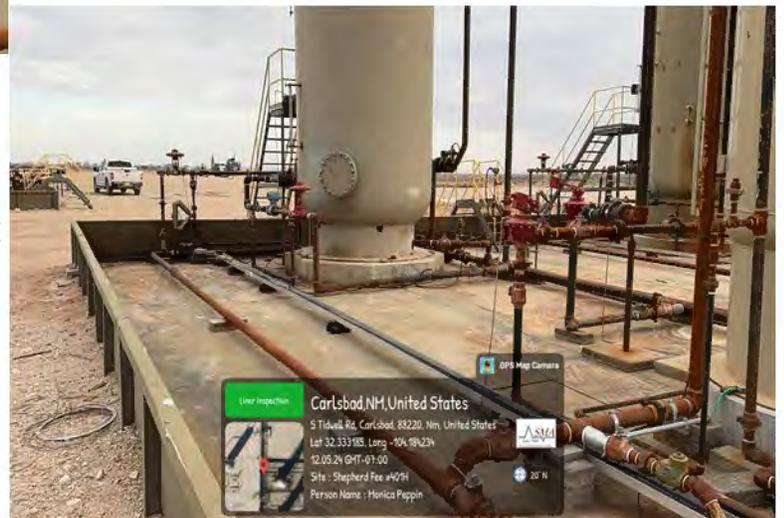
Photograph #3: Containment area from middle facing west

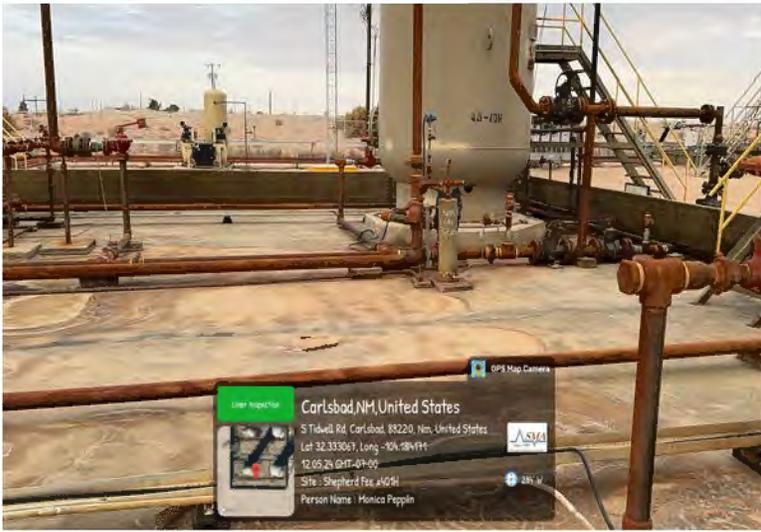
Photograph #4: Facing west from northeast corner



Photograph #5: Facing east showing north side of containment

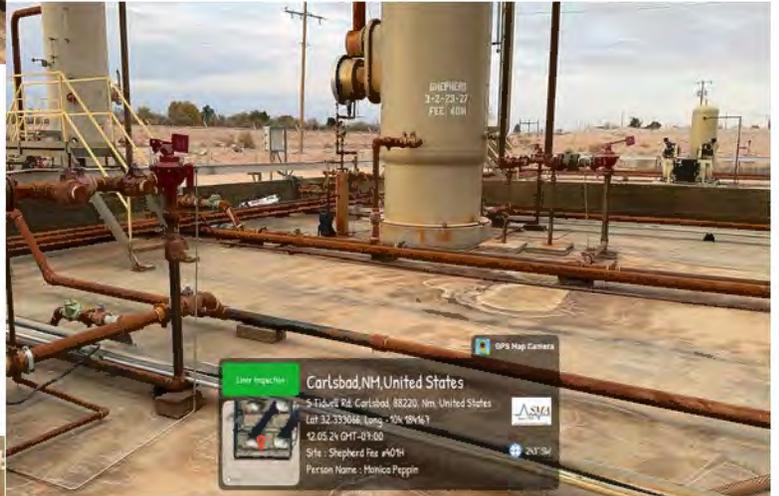
Photograph #6: Facing southeast showing east side of liner





Photograph #7: Facing north from south side of containment

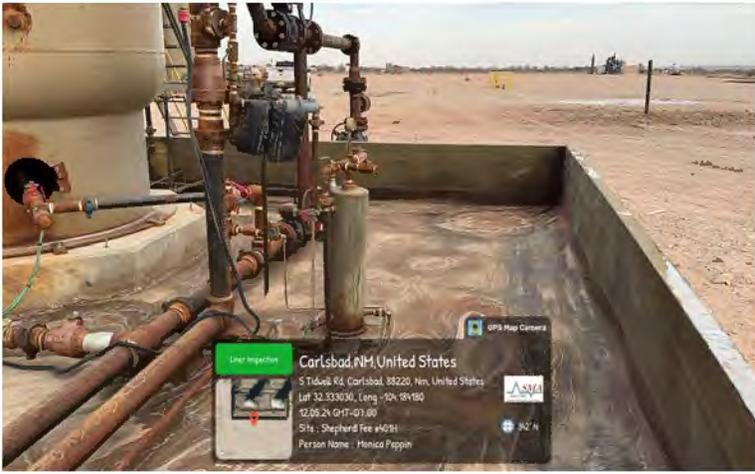
Photograph #8: Facing northwest from southeast middle area



Photograph #9: Facing west showing south area of containment

Photograph #10: Facing northeast from middle south side area





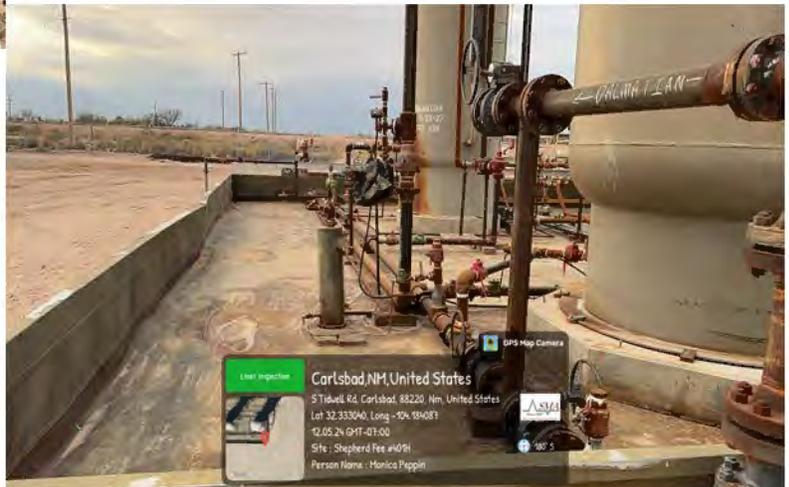
Photograph #11: Facing east from middle area of south side

Photograph #12: Facing north showing liner between tanks



Photograph #13: Facing north from southeast corner

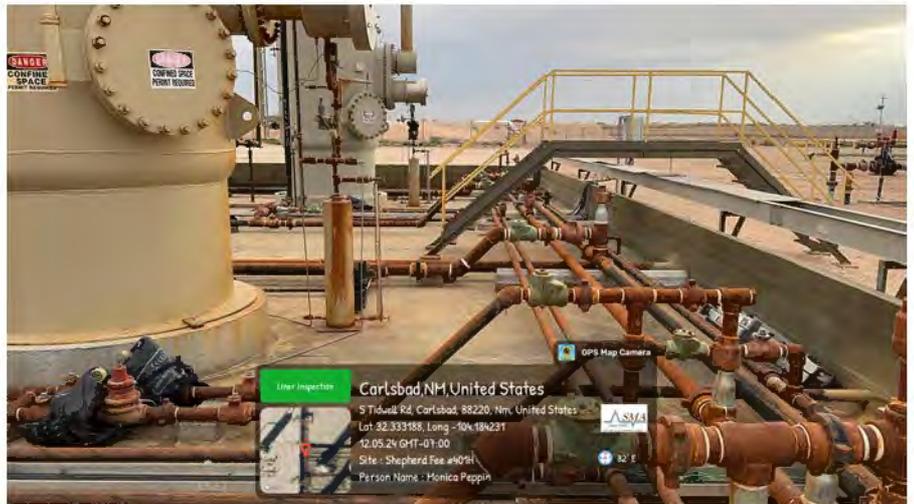
Photograph #14: Facing west from southeast corner





Photograph #15: Facing west on steps located on east middle area

Photograph #16: Facing north from southeast corner



Date: 12/5/2024

Technician: Monica Peppin

Signature: \_\_\_\_\_

# ATTACHMENT 2: CLOSURE CRITERIA DETERMINATION RESEARCH

# Shepherd Fee #401H

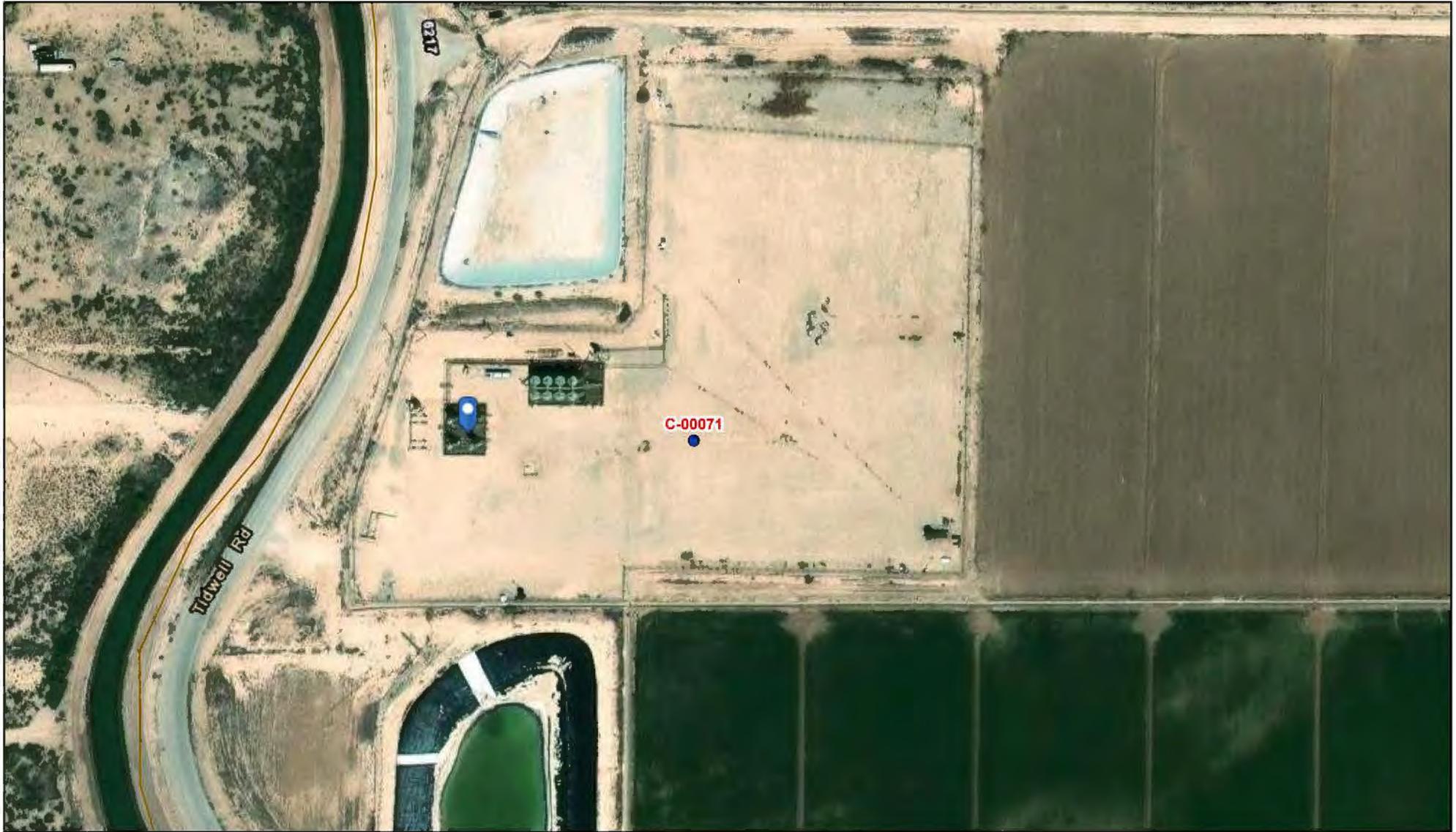
Approx Square Footage of Containment: 2,782 sq ft  
POR Coordinates: 32.333108, -104.184162

## Legend

-  Containment Area
-  Shepherd Fee #401H



### Shepherd Fee #401H

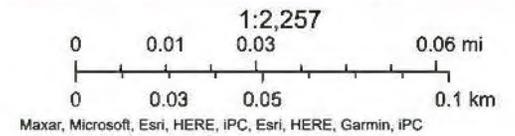


12/17/2024, 6:24:07 AM

GIS WATERS PODs NHD Flowlines

- Active
- Canal Ditch

**Nearest Fresh Water Well OSE Pod C-00071**  
**DTGW - 205 feet**  
**Distance to site: 0.05 miles/264 feet**



# Point of Diversion Summary

quarters are 1=NW 2=NE 3=SW 4=SE  
quarters are smallest to largest

NAD83 UTM in meters

Well Tag	POD Nbr	Q64	Q16	Q4	Sec	Tws	Rng	X	Y	Map
C 00071		NE	NW	SW	03	23S	27E	576865.0	3577649.0 *	

\* UTM location was derived from PLSS - see Help

<b>Driller License:</b>	<b>Driller Company:</b>			
<b>Driller Name:</b>	J.F. KIMWELL			
<b>Drill Start Date:</b>	1948-10-01	<b>Drill Finish Date:</b>	1948-10-31	<b>Plug Date:</b>
<b>Log File Date:</b>		<b>PCW Rcv Date:</b>	1952-12-17	<b>Source:</b> Shallow
<b>Pump Type:</b>	TURBIN	<b>Pipe Discharge Size:</b>		<b>Estimated Yield:</b> 2000
<b>Casing Size:</b>	16.00	<b>Depth Well:</b>	205	<b>Depth Water:</b>

## Meter Information

<b>Meter Number:</b>	608	<b>Meter Make:</b>	MCCROMETER
<b>Meter Serial Number:</b>	03-07165-10	<b>Meter Multiplier:</b>	1.0000
<b>Number of Dials:</b>	3	<b>Meter Type:</b>	Diversion
<b>Unit of Measure:</b>	Acre-Feet	<b>Reading Frequency:</b>	Monthly (No Reading Expected)

## Meter Readings (in Acre-Feet)

Read Date	Year	Mtr Reading	Flag	Rdr	Comment	Mtr Amount	Online
1998-12-29	1999	434.580	A	ms		0.000	
2000-01-06	1999	648.710	A	ms		214.130	
2000-10-20	2000	914.320	A	ms		265.610	
2001-01-11	2000	914.320	A	ms		0.000	
2001-05-09	2001	996.440	A	ms		82.120	
2001-07-25	2001	1109.770	A	ms		113.330	
2001-11-07	2001	1110.320	A	ms		0.550	
2002-06-12	2002	1110.320	A	ms		0.000	
2002-06-12	2002	1138.960	A	ms		28.640	

Read Date	Year	Mtr Reading	Flag	Rdr	Comment	Mtr Amount	Online
2002-06-12	2002	0.000	A	ms		0.000	
2002-09-04	2002	67.463	A	ms		67.463	
2002-10-23	2002	181.410	A	ms		113.947	
2003-01-16	2002	181.410	A	ms		0.000	
2003-04-03	2003	260.553	A	ms		79.143	
2003-06-05	2003	439.603	A	ms		179.050	
2003-08-20	2003	809.532	A	ab		369.929	
2003-10-28	2003	888.567	A	TW		79.035	
2004-01-07	2003	888.567	A	ab		0.000	
2004-04-27	2004	961.633	A	TW		73.065	
2004-07-15	2004	69.357	R	TW	Meter Rollover	107.724	
2004-10-20	2004	142.503	A	TW		73.146	
2005-01-03	2004	142.503	A	TW		0.000	
2005-03-30	2005	142.503	A	JW		0.000	
2005-07-06	2005	220.348	A	JW		77.845	
2005-10-19	2005	263.736	A	TW		43.388	
2006-01-09	2005	263.736	A	TW		0.000	
2006-04-12	2006	263.736	A	tw		0.000	
2006-07-12	2006	343.259	A	tw		79.523	
2007-01-09	2006	343.261	A	tw		0.002	
2007-07-10	2007	343.261	A	tw		0.000	
2007-10-11	2007	343.261	A	tw		0.000	
2008-01-03	2007	343.261	A	tw		0.000	
2008-04-24	2008	343.261	A	tw		0.000	
2008-07-17	2008	473.148	A	tw	rated	129.887	
2009-01-20	2008	0.000	A	tw		0.000	
2009-04-23	2009	24.011	A	tw		24.011	
2009-08-11	2009	192.145	A	tw		168.134	
2010-01-06	2009	206.041	A	tw		13.896	

Read Date	Year	Mtr Reading	Flag	Rdr	Comment	Mtr Amount	Online
2010-06-02	2010	259.451	A	tw		53.410	
2010-10-13	2010	286.681	A	tw		27.230	
2011-01-19	2010	299.199	A	tw		12.518	
2011-01-20	2011	0.000	A	tw		0.000	
2012-01-11	2011	187.018	A	tw		187.018	
2012-03-15	2012	255.501	A	tw		68.483	
2012-07-24	2012	604.564	A	tw		349.063	
2013-02-13	2012	717.807	A	tw		113.243	
2013-11-05	2013	953.744	A	tw		235.937	
2014-07-22	2014	11.457	R	tw	Meter Rollover	57.713	
2014-12-10	2014	25.462	A	tw		14.005	
2014-12-31	2014	0.000	A	tw		0.000	
2016-08-10	2016	14.971	A	tw		14.971	
2016-12-27	2016	58.999	A	tw		44.028	
2017-05-25	2017	58.999	A	tw		0.000	
2017-12-29	2017	58.999	A	tw		0.000	

**YTD Meter Amounts:**

Year	Amount
1999	214.130
2000	265.610
2001	196.000
2002	210.050
2003	707.157
2004	253.936
2005	121.233
2006	79.525
2007	0.000

Year	Amount
2008	129.887
2009	206.041
2010	93.158
2011	187.018
2012	530.789
2013	235.937
2014	71.718
2016	58.999
2017	0.000

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The data is furnished by the NMOSE/ISC and is accepted by the recipient with the expressed understanding that the OSE/ISC make no warranties, expressed or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the data.

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11/26/24 11:08 PM MST

Point of Diversion Summary

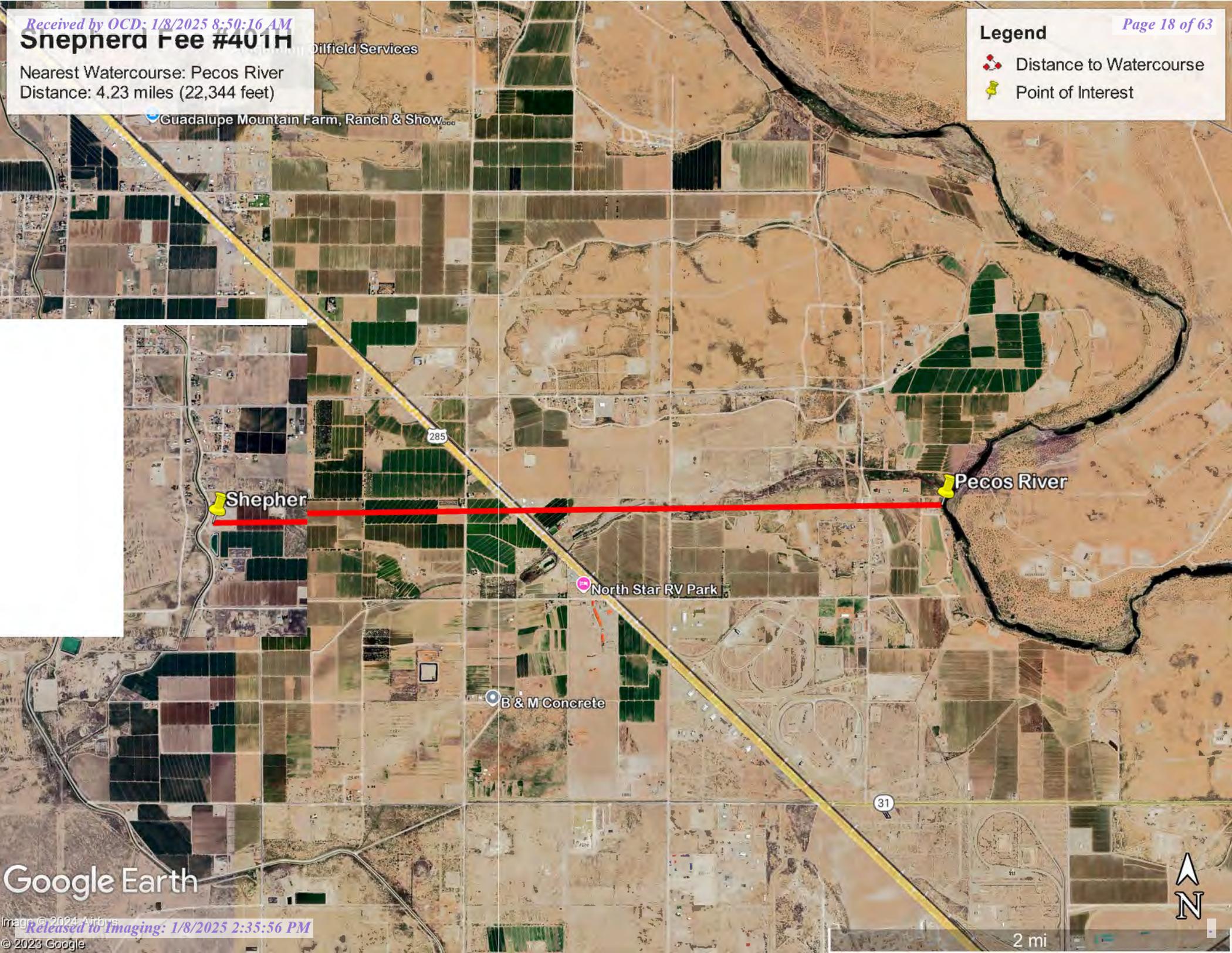
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# Shepherd Fee #401H

Nearest Watercourse: Pecos River  
Distance: 4.23 miles (22,344 feet)

**Legend**

-  Distance to Watercourse
-  Point of Interest





U.S. Fish and Wildlife Service  
National Wetlands Inventory

Shepherd Fee #401H  
Lakebed Distance: 9.02 miles/47,606 feet



December 17, 2024

**Wetlands**

-  Estuarine and Marine Deepwater
-  Estuarine and Marine Wetland

-  Freshwater Emergent Wetland
-  Freshwater Forested/Shrub Wetland
-  Freshwater Pond

-  Lake
-  Other
-  Riverine

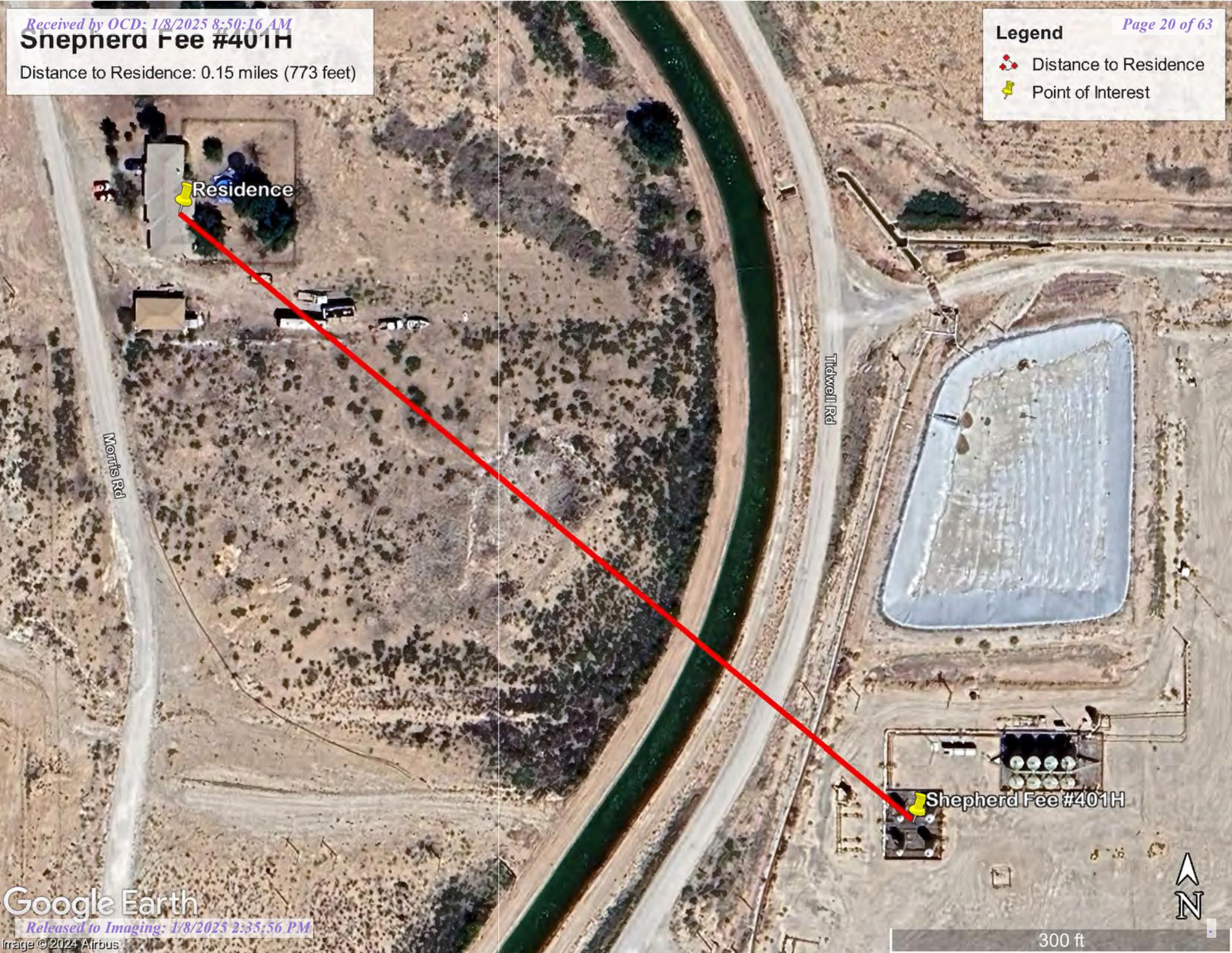
This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

# Shepherd Fee #401H

Distance to Residence: 0.15 miles (773 feet)

## Legend

-  Distance to Residence
-  Point of Interest



Residence

Shepherd Fee #401H

Morris Rd

Tidwell Rd

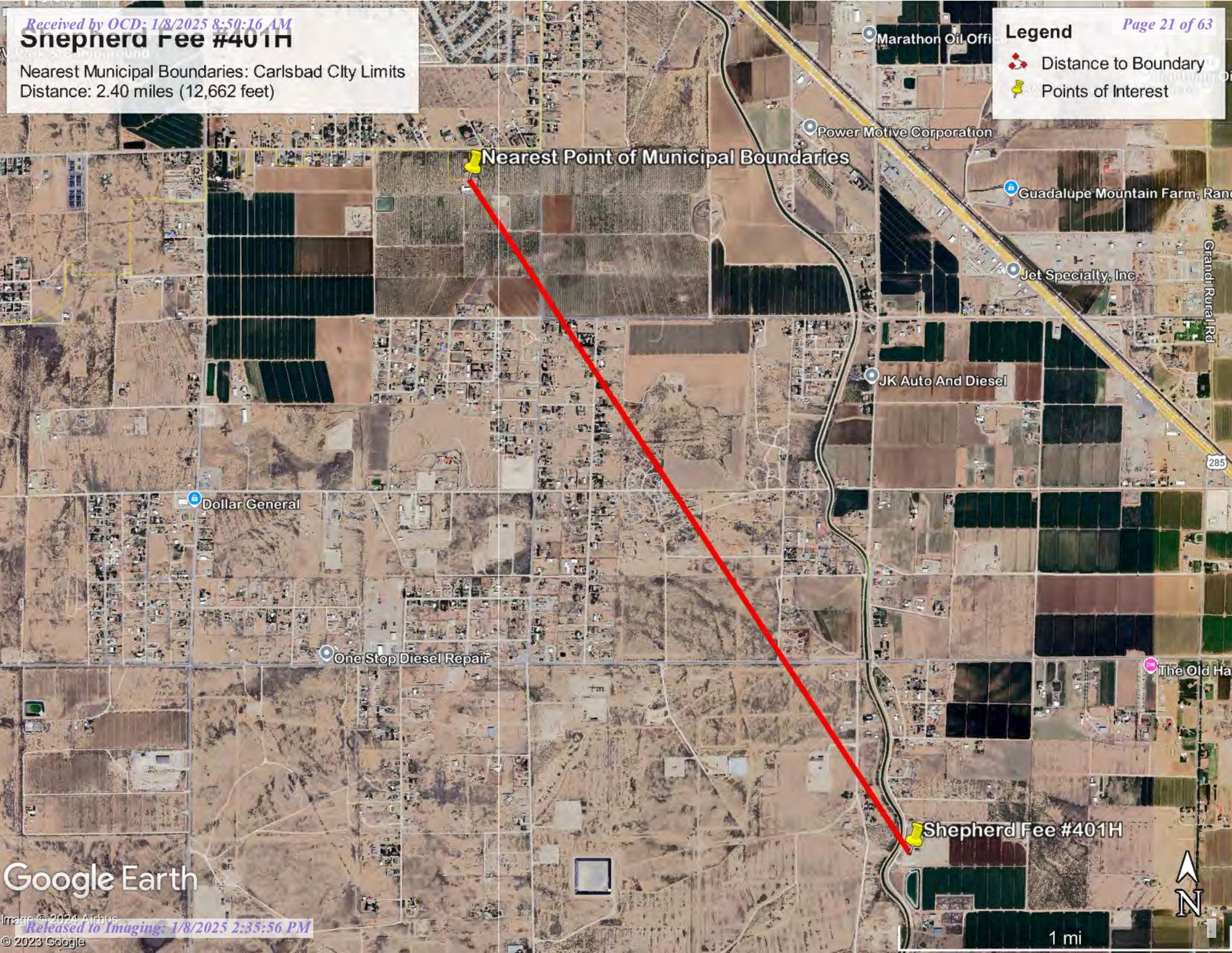


# Shepherd Fee #401H

Nearest Municipal Boundaries: Carlsbad City Limits  
Distance: 2.40 miles (12,662 feet)

## Legend

-  Distance to Boundary
-  Points of Interest



Nearest Point of Municipal Boundaries

Marathon Oil Offi

Power Motive Corporation

Guadalupe Mountain Farm, Ran

Jet Specialty, Inc.

JK Auto And Diesel

Dollar General

One Stop Diesel Repair

Shepherd Fee #401H

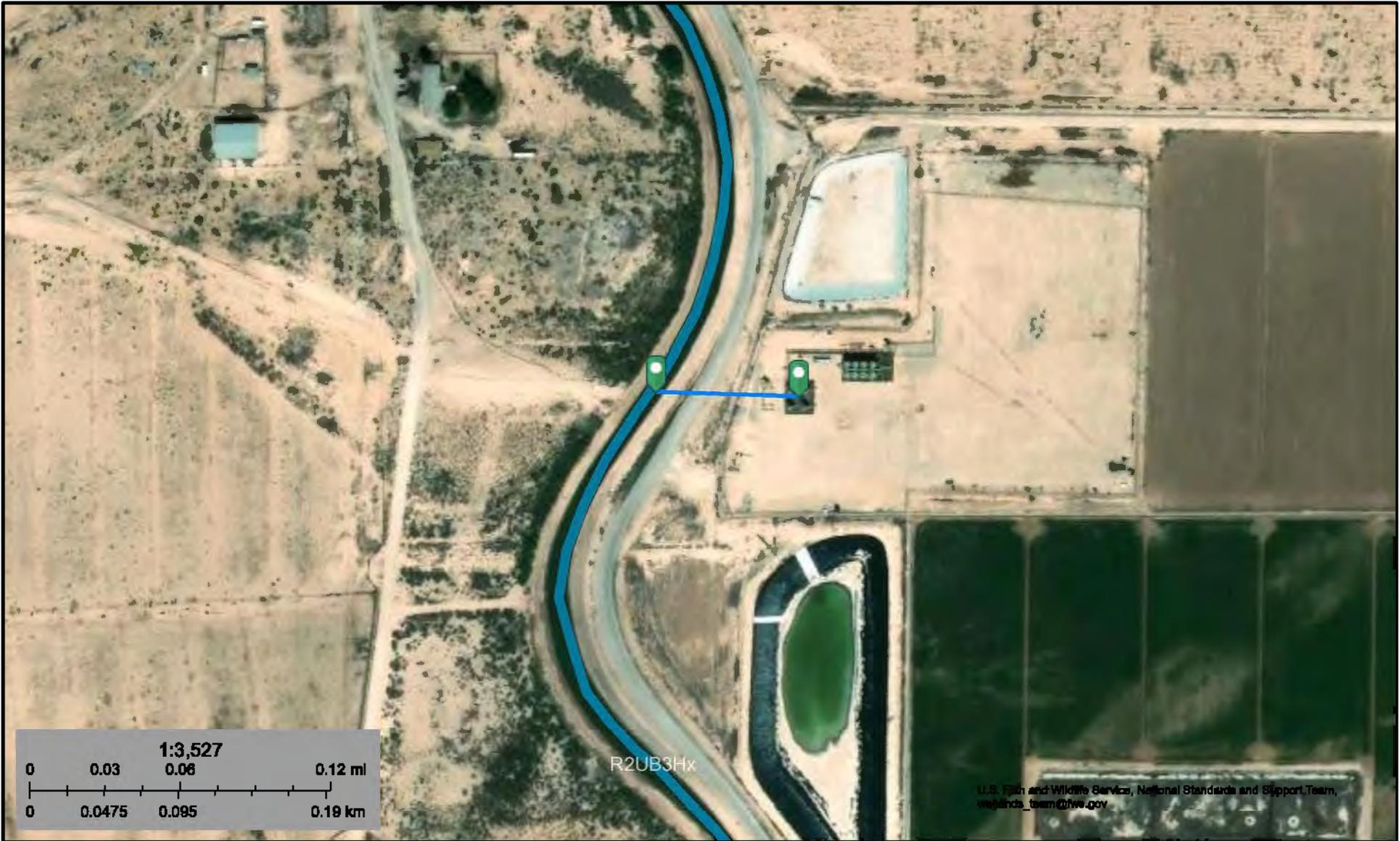
The Old Ha





U.S. Fish and Wildlife Service  
National Wetlands Inventory

Shepherd Fee #401H  
Nearest Wetlands: Riverine Distance: 0.05 miles/254 feet



November 27, 2024

**Wetlands**

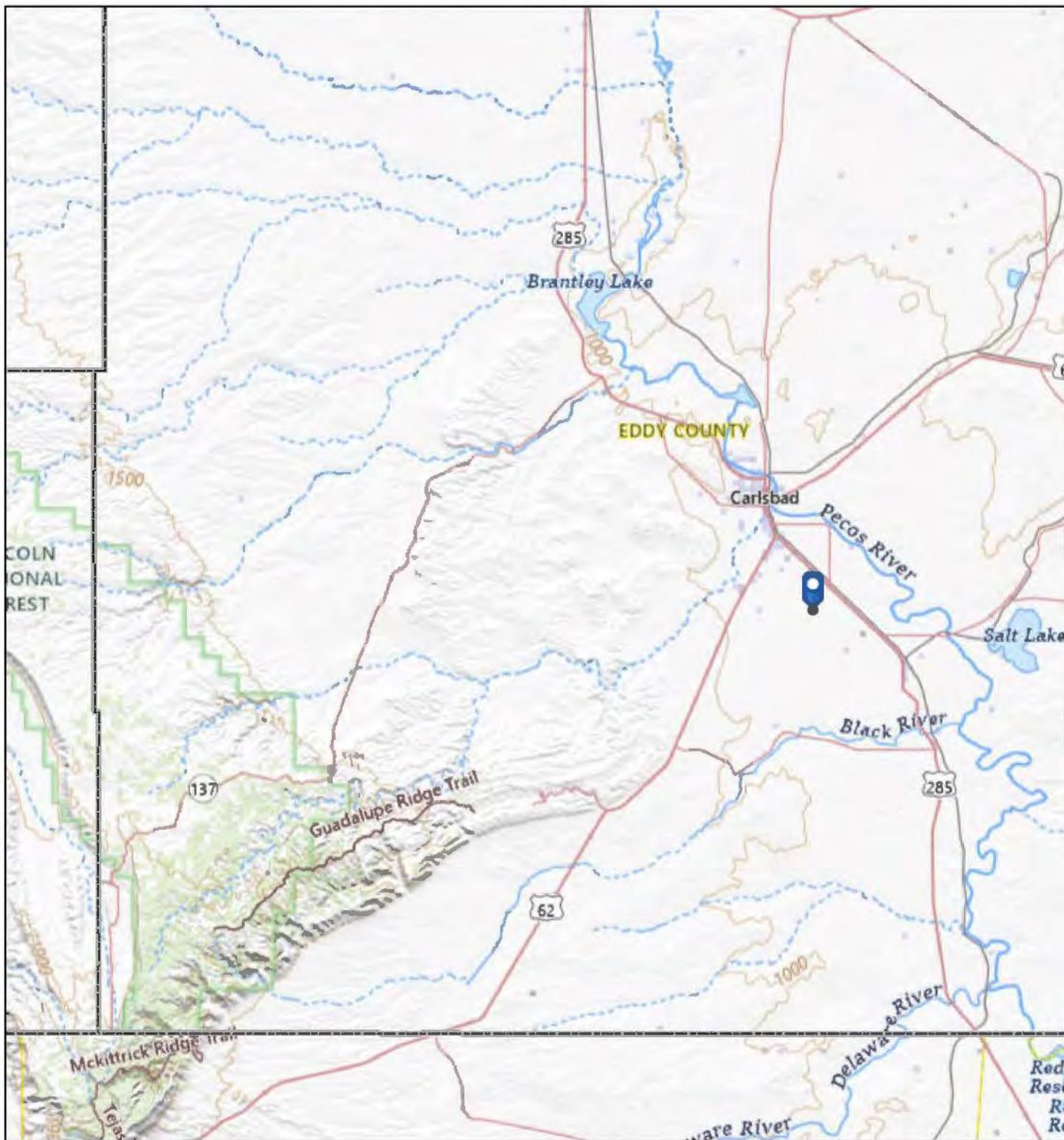
-  Estuarine and Marine Deepwater
-  Estuarine and Marine Wetland

-  Freshwater Emergent Wetland
-  Freshwater Forested/Shrub Wetland
-  Freshwater Pond

-  Lake
-  Other
-  Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

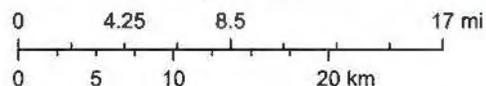
# Shepherd Fee #401H - Subsurface Mine Map



12/17/2024, 11:14:58 AM

1:577,791

- Mining\_Ghost\_Towns
- Counties
- REE\_Districts
- Fe skarn, carbonate-hosted Pb-Zn
- REE-Th-U veins, fluorite veins



New Mexico Bureau of Geology and Mineral Resources, New Mexico Bureau of Geology & Mineral Resources, Esri, CGIAR, USGS, NMBGMR, USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National

ArcGIS Web AppBuilder



### Shepherd Fee #401H - Karst Potential

0 0.03 0.05 0.1 mi

**New Mexico State Land Office**

Disclaimer:  
The New Mexico State Land Office assumes no responsibility or liability for, or in connection with the accuracy, reliability or use of the information provided herein with respect to State Land Office data or data from other sources.

Data pertaining to New Mexico State Trust Lands are provisional and subject to revision, and do not constitute an official record of title. Official records may be reviewed at the New Mexico State Land Office in Santa Fe, New Mexico.

Released to Imaging: 1/8/2025 2:35:56 PM  
Map Created: 12/17/2024

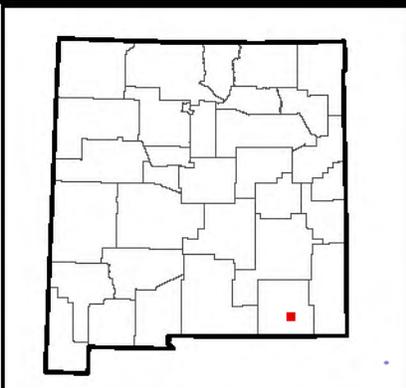
drawGraphics\_poly

- User drawn polygons
- Subdivisions
- Sections
- Townships
- Larger Towns
- Smaller Towns
- Villages

Karst\_Potential\_NM

Potential

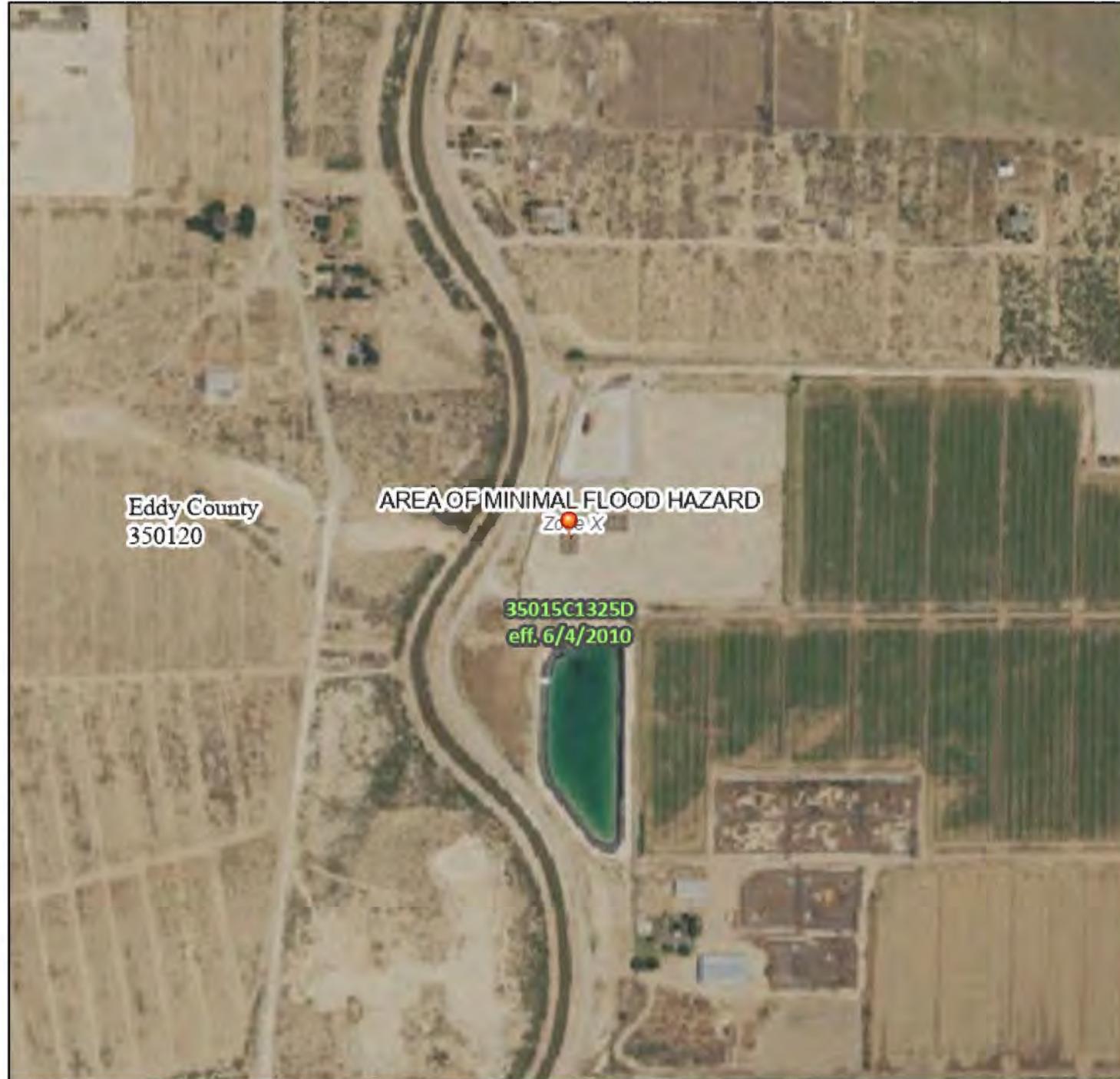
- High
- Medium
- Low
- Critical\_Karst\_Zone\_NM



# National Flood Hazard Layer FIRMette



104°11'22"W 32°20'14"N



## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
		Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
		Profile Baseline
	Hydrographic Feature	
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

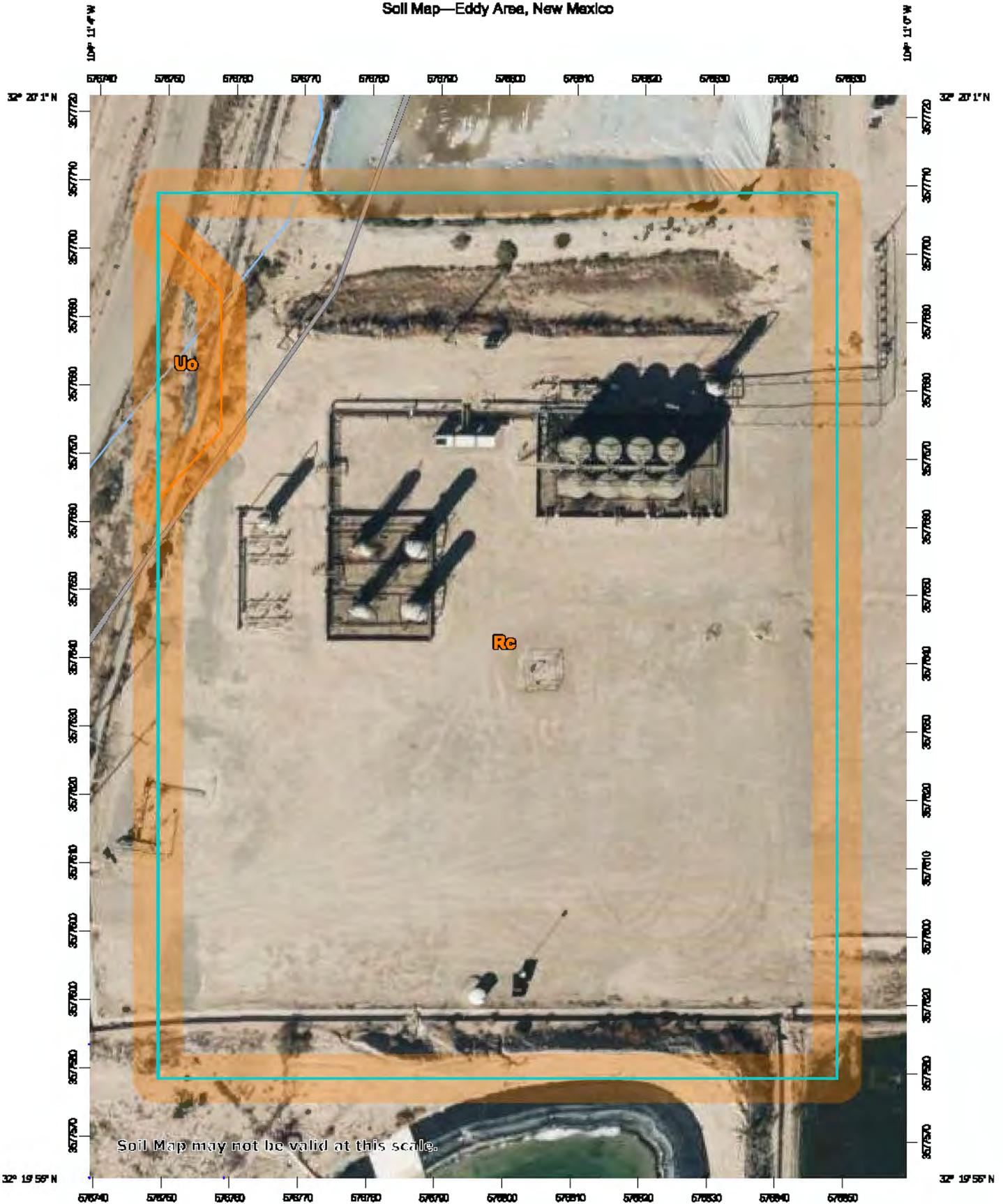
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/27/2024 at 7:32 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

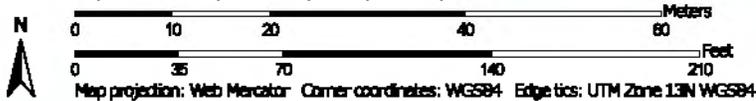
This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

# Soil Report/Map Shepherd Fee #401H

Soil Map—Eddy Area, New Mexico



Map Scale: 1:773 if printed on A portrait (8.5" x 11") sheet.



Natural Resources

Conservation Service

Web Soil Survey  
National Cooperative Soil Survey

11/27/2024  
Page 1 of 3

### MAP LEGEND

- Area of Interest (AOI)**
  -  Area of Interest (AOI)
- Soils**
  -  Soil Map Unit Polygons
  -  Soil Map Unit Lines
  -  Soil Map Unit Points
- Special Point Features**
  -  Blowout
  -  Borrow Pit
  -  Clay Spot
  -  Closed Depression
  -  Gravel Pit
  -  Gravelly Spot
  -  Landfill
  -  Lava Flow
  -  Marsh or swamp
  -  Mine or Quarry
  -  Miscellaneous Water
  -  Perennial Water
  -  Rock Outcrop
  -  Saline Spot
  -  Sandy Spot
  -  Severely Eroded Spot
  -  Sinkhole
  -  Slide or Slip
  -  Sodic Spot
- Water Features**
  -  Streams and Canals
- Transportation**
  -  Ralls
  -  Interstate Highways
  -  US Routes
  -  Major Roads
  -  Local Roads
- Background**
  -  Aerial Photography
- Other Features**
  -  Spoil Area
  -  Stony Spot
  -  Very Stony Spot
  -  Wet Spot
  -  Other
  -  Special Line Features

### MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

**Warning: Soil Map may not be valid at this scale.**  
 Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL:  
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Eddy Area, New Mexico  
 Survey Area Data: Version 20, Sep 3, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Nov 12, 2022—Dec 2, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Rc	Reagan loam, 0 to 1 percent slopes	3.1	97.8%
Uo	Upton gravelly loam, 0 to 9 percent slopes	0.1	2.2%
<b>Totals for Area of Interest</b>		<b>3.2</b>	<b>100.0%</b>

Map Unit Description: Reagan loam, 0 to 1 percent slopes—Eddy Area, New Mexico

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## Eddy Area, New Mexico

### Rc—Reagan loam, 0 to 1 percent slopes

#### Map Unit Setting

*National map unit symbol:* 1w5l

*Elevation:* 1,100 to 5,300 feet

*Mean annual precipitation:* 7 to 15 inches

*Mean annual air temperature:* 57 to 70 degrees F

*Frost-free period:* 200 to 240 days

*Farmland classification:* Farmland of statewide importance

#### Map Unit Composition

*Reagan and similar soils:* 97 percent

*Minor components:* 3 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Reagan

##### Setting

*Landform:* Fan remnants, alluvial fans

*Landform position (three-dimensional):* Rise

*Down-slope shape:* Convex, linear

*Across-slope shape:* Linear

*Parent material:* Alluvium and/or eolian deposits

##### Typical profile

*H1 - 0 to 8 inches:* loam

*H2 - 8 to 82 inches:* loam

##### Properties and qualities

*Slope:* 0 to 1 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained

*Runoff class:* Low

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high to high (0.60 to 2.00 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Calcium carbonate, maximum content:* 40 percent

*Maximum salinity:* Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)

*Sodium adsorption ratio, maximum:* 1.0

*Available water supply, 0 to 60 inches:* Moderate (about 8.2 inches)

##### Interpretive groups

*Land capability classification (irrigated):* 2e

*Land capability classification (nonirrigated):* 6c

*Hydrologic Soil Group:* B

Map Unit Description: Reagan loam, 0 to 1 percent slopes—Eddy Area, New Mexico

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*Ecological site:* R070BC007NM - Loamy  
*Hydric soil rating:* No

#### **Minor Components**

##### **Reeves**

*Percent of map unit:* 1 percent  
*Ecological site:* R070BC007NM - Loamy  
*Hydric soil rating:* No

##### **Upton**

*Percent of map unit:* 1 percent  
*Ecological site:* R070BC025NM - Shallow  
*Hydric soil rating:* No

##### **Reagan**

*Percent of map unit:* 1 percent  
*Ecological site:* R070BC007NM - Loamy  
*Hydric soil rating:* No

## **Data Source Information**

Soil Survey Area: Eddy Area, New Mexico  
Survey Area Data: Version 20, Sep 3, 2024

Map Unit Description: Upton gravelly loam, 0 to 9 percent slopes—Eddy Area, New Mexico

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## Eddy Area, New Mexico

### Uo—Upton gravelly loam, 0 to 9 percent slopes

#### Map Unit Setting

*National map unit symbol:* 1w67  
*Elevation:* 1,100 to 4,400 feet  
*Mean annual precipitation:* 7 to 15 inches  
*Mean annual air temperature:* 60 to 70 degrees F  
*Frost-free period:* 200 to 240 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Upton and similar soils:* 96 percent  
*Minor components:* 4 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Upton

##### Setting

*Landform:* Ridges, fans  
*Landform position (three-dimensional):* Side slope, rise  
*Down-slope shape:* Convex  
*Across-slope shape:* Convex  
*Parent material:* Residuum weathered from limestone

##### Typical profile

*H1 - 0 to 9 inches:* gravelly loam  
*H2 - 9 to 13 inches:* gravelly loam  
*H3 - 13 to 21 inches:* cemented  
*H4 - 21 to 60 inches:* very gravelly loam

##### Properties and qualities

*Slope:* 0 to 9 percent  
*Depth to restrictive feature:* 7 to 20 inches to petrocalcic  
*Drainage class:* Well drained  
*Runoff class:* High  
*Capacity of the most limiting layer to transmit water (Ksat):* Low to moderately high (0.01 to 0.60 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Calcium carbonate, maximum content:* 75 percent  
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)  
*Sodium adsorption ratio, maximum:* 1.0  
*Available water supply, 0 to 60 inches:* Very low (about 1.4 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 7s

Map Unit Description: Upton gravelly loam, 0 to 9 percent slopes—Eddy Area, New Mexico

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*Hydrologic Soil Group: D*  
*Ecological site: R070BC025NM - Shallow*  
*Hydric soil rating: No*

**Minor Components**

**Reagan**

*Percent of map unit: 1 percent*  
*Ecological site: R070BC007NM - Loamy*  
*Hydric soil rating: No*

**Atoka**

*Percent of map unit: 1 percent*  
*Ecological site: R070BC007NM - Loamy*  
*Hydric soil rating: No*

**Atoka**

*Percent of map unit: 1 percent*  
*Ecological site: R070BC007NM - Loamy*  
*Hydric soil rating: No*

**Upton**

*Percent of map unit: 1 percent*  
*Ecological site: R070BC025NM - Shallow*  
*Hydric soil rating: No*

**Data Source Information**

Soil Survey Area: Eddy Area, New Mexico  
Survey Area Data: Version 20, Sep 3, 2024

## Ecological site R070BC007NM Loamy

Accessed: 11/27/2024

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### General information

**Provisional.** A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

#### Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

**Table 1. Dominant plant species**

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

### Physiographic features

This site occurs on uplands landforms, mainly on hill slopes, ridges, plains, terraces and some fan remnants. Slopes range from 1 to 5 percent and average about 3 percent. Average annual precipitation is about 8 to 14 inches. Elevations range from 2,842 to 5,000 feet.

**Table 2. Representative physiographic features**

Landforms	(1) Plain (2) Terrace (3) Fan piedmont
Flooding frequency	None
Ponding frequency	None
Elevation	2,842–5,000 ft
Slope	0–5%
Aspect	E, S, W

### Climatic features

The average annual precipitation ranges from 8 to 13 inches. Variations of 5 inches, more or less, are common. Over 80 percent of the precipitation falls from April through October. Most of the summer precipitation comes in the form of high intensity short duration thunderstorms.

Temperatures are characterized by distinct seasonal changes and large annual and diurnal temperature changes. The average annual temperature is 61 degrees with extremes of 25 degrees below zero in the winter to 112 degrees in the summer.

The average frost-free season is 207 to 220 days. The last killing frost is in late March or early April, and the first killing frost is in late October or early November.

Temperature and rainfall both favor warm season perennial plant growth. In years of abundant spring moisture, annual forbs and cool season grasses can make up an important component of this site. Strong winds blow from the southwest in January through June rapidly drying out the soil during a critical time for cool season plant growth.

Climate data was obtained from <http://www.wrcc.sage.dri.edu/summary/climsmnm.html> web site using 50% probability for freeze-free and frost-free seasons using 28.5 degrees F and 32.5 degrees F respectively.

**Table 3. Representative climatic features**

Frost-free period (average)	221 days
Freeze-free period (average)	240 days
Precipitation total (average)	13 in

### Influencing water features

This site is not influenced by wetland or streams.

### Soil features

The soils of this site are deep to moderately deep. The moderately deep soils have either a petrocalcic, petrogypsic or gypsum horizon between 30 and 40 inches.

Surface textures are loam, silt loam, very fine sandy loam, or clay loam. Substratum textures are loam, silty clay loam, clay loam, or silt loams. Subsoil textures are silt loam, clay loam, silty clay loam, gravelly loam, gravelly clay loam or very gravelly loam. Permeability is moderate to slow and the available water holding capacity is high to moderate. The Atoka, Reeves, Russler, Milner soils may have high amounts of CaCO<sub>3</sub>, ranging as high as 40 percent in the subsoil. Rock fragments range from 5 to 50 percent in the subsoil. Reeves, Russler, Milner, Holloman soils will have 40 to 80 percent gypsum in the underlying material.

Maximum and minimum values listed below represent the characteristic soils for this site.

Characteristic Soils:

Atoka (petrocalcic)  
 Bigetty  
 Reagan  
 Reakor  
 Reeves (gypsum)  
 Russler (gypsum)  
 Largo  
 Russler (gypsum)  
 Largo  
 Berino  
 Tinney  
 Midessa  
 Ratliff  
 Holloman (gypsum)  
 Milner (gypsum)

**Table 4. Representative soil features**

Surface texture	(1) Loam (2) Very fine sandy loam (3) Silt loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderate to slow
Soil depth	30–72 in

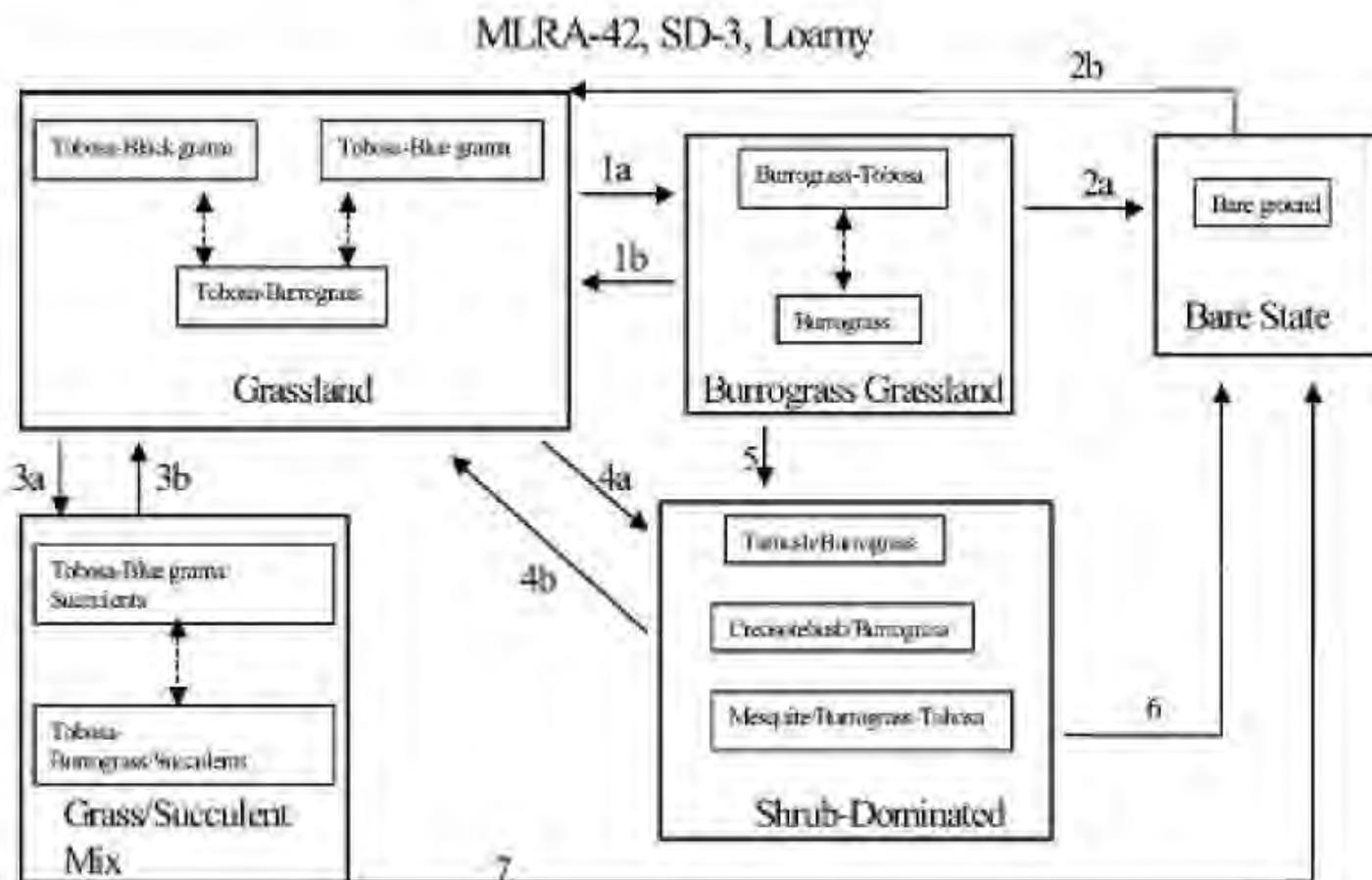
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	5–12 in
Calcium carbonate equivalent (0-40in)	0–10%
Electrical conductivity (0-40in)	0–8 mmhos/cm
Sodium adsorption ratio (0-40in)	0–6
Soil reaction (1:1 water) (0-40in)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

## Ecological dynamics

Overview: The Loamy site is associated with the Gyp Upland ecological site with which it intergrades. There is a pronounced increase in alkali sacaton along this interface. The loamy site is also associated with the Gravelly and Shallow ecological sites from which it receives run-on water. The Draw site often dissects Loamy sites and is distinguished from the Loamy site by increased production or greater densities of woody species. The historic plant community has a grassland aspect, dominated by grasses with shrubs and half-shrubs sparse and evenly distributed. Tobosa, black grama and blue grama are the dominant species. Retrogression within this state is characterized by a decrease in black and blue grama and an increase in burrograss. Continuous overgrazing and drought can initiate a transition to a Burrograss- Grassland state. Continued reduction in grass cover and resulting infiltration problems may eventually effect a change to a Bare State, with very little or no remaining grass cover. Alternatively, creosotebush, tarbush or mesquite may expand or invade. Transitions back to a Grassland State from a Bare or Shrub-Dominated state are costly and may not be economically feasible. Decreased fire frequency may play a part in the transition to the Grass/Succulent Mix state with increased amounts of cholla and prickly pear.

## State and transition model

Plant Communities and Transitional Pathways (diagram)



- 1a. Soil drying, overgrazing, drought, soil surface sealing; 1b. Restore natural overland flow, increase infiltration, prescribed grazing.
- 2a. Severe reduction in cover, soil surface sealing, decreased infiltration, erosion; 2b. Restore hydrology, break up physical crust, range seeding, prescribed grazing.
- 3a. Lack of fire, overgrazing, hail storms or other physical disturbance, drought; 3b. Prescribed fire, brush control, prescribed grazing.
- 4a. Seed dispersal of shrubs, persistent loss of grass cover, competition by shrubs, lack of fire; 4b. Brush control, range seeding -dependent on amount of grass (seed bank) remaining.
- 5. Loss of grass cover, seed dispersal of shrubs, competition by shrubs.
- 6 & 7. Brush control with continued loss of grass cover, soil sealing, erosion.

**State 1  
Historic Climax Plant Community**

**Community 1.1  
Historic Climax Plant Community**

State Containing Historic Climax Plant Community Grassland: The historic plant community has a grassland aspect, dominated by grasses with shrubs and half-shrubs sparse and evenly distributed. Black grama, blue grama, and tobosa are the dominant grass species. There are a variety of perennial forbs and their production varies widely by season and year. Globemallow, verbena, groundsels, croton and filaree are forbs commonly found on this site. Fourwing saltbush and winterfat are two of the more palatable shrubs. The Loamy ecological site encompasses a

wide variety of soils, with surface textures ranging from sandy loams to clay loams. Soil depths range from shallow to very deep and can include sub surface features such as calcic, petrocalcic, and gypsic horizons. These variations cause differences in plant community composition and dynamics. Black grama is found at highest densities on coarser textured sandy loams, with blue grama preferring finer textured loam and silt loam, and tobosa favoring lower landscape positions and loam to clay loam surface textures. Burrograss may often be the dominant grass species on silty soils, perhaps in part due to the seedlings ability to auger into and establish on physically crusted soils. Gypsum influenced soils typically have greater amounts of tobosa, burrograss, and ephedra. There is greater representation of sideoats and vine mesquite within the tobosa-blue grama community. Retrogression under continuous heavy grazing results in a decrease of black grama, blue grama, sideoats grama, plains bristlegrass, bush muhly, cane bluestem, vine mesquite, winterfat, and fourwing saltbush. Species such as burrograss, threeawns, sand dropseed, sand muhly, and broom snakeweed increase under continuous heavy grazing or prolonged periods of drought. Under continued retrogression burrograss can completely dominate the site. Creosotebush, tarbush, and mesquite, can also dominate. Cholla and prickly pear can increase on areas that are disturbed or overgrazed. Diagnosis: Tobosa, black grama, and blue grama are the dominant species. Grass cover is uniformly distributed with few large bare areas. Shrubs are sparse and evenly distributed. Slopes range from level to gently sloping and usually display limited evidence of active rills and gully formation if plant cover remains intact. Litter movement associated with overland flow is limited to smaller size class litter and short distances. Other shrubs include: yucca, mesquite, tarbush, cholla and creosote bush. Other forbs include: desert holly, scorpionweed, bladderpod, flax, nama, fleabane, Indianwheat, Indian blanket flower, groundcherry, deerstongue, and rayless goldenrod.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	585	833	1080
Forb	39	55	72
Shrub/Vine	26	37	48
<b>Total</b>	<b>650</b>	<b>925</b>	<b>1200</b>

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0%
Grass/grasslike foliar cover	15-30%
Forb foliar cover	0%
Non-vascular plants	0%
Biological crusts	0%
Litter	25-30%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	40-50%

Figure 5. Plant community growth curve (percent production by month). NM2807, R042XC007NM Loamy HCPC. R042XC007NM Loamy HCPC Warm Season Plant Community..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	10	10	25	30	15	5	0	0

State 2

## **Burrograss-Grassland**

### **Community 2.1**

#### **Burrograss-Grassland**

Burrograss-Grassland: Changes in hydrology resulting in decreased available soil moisture, reduces grass cover and increases bare ground. Burrograss is the dominant grass. Tobosa cover is variable and can range from sizeable areas to small patches occupying only depressions or the lowest and wettest positions within the site. Threeawns, ear muhly, sand muhly, and fluffgrass occur at increased densities compared to the grassland state. Shrub densities may increase especially mesquite, creosotebush or tarbush. Retrogression within this state is characterized by a further decrease in grass cover and increased bare ground. Further deterioration of this site can result in the transition to a bare state or becoming shrub dominated. Diagnosis: Burrograss is the dominant species. Grass cover is no longer uniformly distributed, instead tending to be patchy with large areas of bare ground present. Physical crusts are present in bare areas reducing infiltration and suppressing seedling establishment by any grass species other than burrograss. Transition to Burrograss-Grassland (1a): Transitions from grassland to a burrograss-grassland state may occur due to changes in hydrology. Gullies, roads or obstructions that alter natural water flow patterns may cause this transition. Changes in surface hydrology may also occur due to overgrazing or drought. The reduction in grass cover promotes increased soil physical crusts and reduces infiltration. 5 Key indicators of approach to transition: ? Diversion of overland flow resulting in decreased soil moisture. ? Increase in amount of burrograss cover ? Reduction in grass cover and increase in size and frequency of bare patches. ? Formation of physical crusts—indicating reduced infiltration. ? Evidence of litter movement—indicating loss or redistribution of organic matter. Transition back to Grassland (1b) The natural hydrology of the site must be returned. Culverts, turnouts, or rerouting roads may help re-establish natural overland flow, if roads or trails have altered the hydrology. Erosion control structures or shaping and filling gullies may help regain natural flow patterns and establish vegetation if the flow has been channeled. Breaking up physical crusts by soil disturbance may promote infiltration and seedling emergence. Allow natural revegetation to take place. Prescribed grazing will help ensure proper forage utilization and reduce grass loss due to grazing.

## **State 3**

### **Bare State**

#### **Community 3.1**

##### **Bare State**

Bare State: Extremely low ground cover, soil degradation and erosion characterize this state. Very little vegetation remains. Burrograss is the dominant grass and cover is extremely patchy. Physical soil crusts are extensive. Erosion and resource depletion increase as site degrades. Diagnosis: Very little cover remains. Erosion is evident by soil sealing, water flow patterns, pedestals or terracettes. Rills and gullies may be present and active. Transition to Bare State (2a): Extended drought, continuous heavy grazing, or other disturbance that severely depletes grass cover can effect this transition. As grass cover decreases, sheet flow and erosion increase, and physical soil crusts form, thereby further reducing infiltration. Key indicators of approach to transition: ? Continued reduction in grass cover. ? Increased soil surface sealing. ? Increased erosion. ? Reduced aggregate stability in bare areas. Transition back to Grassland (2b) Restore the hydrology, see (1a). With the extent of grass loss range seeding may be necessary. Utilizing livestock or mechanical means to break up the physical crusts may increase infiltration and aid seedling establishment. Prescribed grazing will help ensure adequate deferment period following seeding, and proper forage utilization once the grass stand is well established. The degree to which this site is capable of recovery depends on the restoration of hydrology, extent of degradation to soil resources, and adequate rainfall necessary to establish grasses.

## **State 4**

### **Grass/Succulent Mix**

#### **Community 4.1**

##### **Grass/Succulent Mix**

Grass / Succulent Mix: Increased representations of succulents characterize this site. Increased densities of cholla or pricklypear is recognized as a management concern, but their impact on grass production is unclear. Light to

medium cholla or prickly pear infestation doesn't seem to greatly reduce grass production, however it limits access to palatable grasses and interferes with livestock movement and handling. Tobosa and blue grama are the dominant species on this site. Retrogression within this site is characterized by a decrease in blue grama and an increase in succulents, tobosa and burrograss. Diagnosis: Cholla or prickly pear is found at increased densities. Grass cover is variable ranging from uniformly distributed to patchy with frequent areas of bare ground present. Tobosa or blue grama is the dominant grass species. Transition to Grass/Succulent Mix (3a): If fire was historically a part of desert grassland ecosystem and played a role in suppressing seedlings of shrubs and succulents, then fire suppression may favor the increase of succulents.1 Heavy grazing by livestock or other physical disturbances may help disseminate seed and increase the establishment of succulents. Areas historically overgrazed by sheep are sometimes associated with higher densities of Succulents. Intense hailstorms can spread pricklypear by breaking off joints causing new plants to take root.3 During severe drought perennial grass cover can decline significantly, leaving resources available for use by more drought tolerant succulents. Cholla and pricklypear are both adapted to and favored by drought due to the ability of their shallow, wide spreading root systems to absorb and store water.4 Key indicators of approach to transition: ? Decrease or change in distribution of grass cover. ? Increase in amount of succulent seedlings. ? Increased cover of succulents. Transition back to Grassland (3b) Fire is an effective means of controlling cholla and prickly pear if adequate grass cover remains to carry fire.2 Cholla greater than two feet tall or pricklypear with a large amount of pads (>15-20) are harder to kill. Chemical control is effective in controlling prickly pear and cholla; apply when growth starts in May. Hand grubbing is also effective if cholla or pricklypear is severed 2-4 inches below ground and care is taken not to let broken joints or pads take root. Stacking and burning piles and grubbing during winter or drought help keeps broken joints and pads from rooting. Prescribed grazing will help ensure proper forage utilization and sustain grass cover.

## **State 5 Shrub Dominated**

### **Community 5.1 Shrub Dominated**

Shrub Dominated: Increased shrub cover characterizes this state. Mesquite, creosotebush, and/or tarbush are the dominant shrub species. Burrograss or tobosa is the dominant grass species. Grass cover is decreased, typically patchy with large bare areas present; however, sometimes grass cover can remain relatively high for extended periods when associated with light to moderate infestations of mesquite. Variations in soil characteristics play a part in determining which shrub species increase. Mesquite is well adapted to a wide range of soil types, but increases more often on deep soils low in carbonates, that have a sandy surface overlying finer textured soils. Tarbush prefers finer textured, calcareous soils, usually in lower positions that receive some extra water. Creosotebush is less tolerant of fine textured soils, preferring sandy, calcareous soils that have some gravel. Creosotebush also does well on soils that are shallow over caliche. Retrogression within this state is characterized by a decrease in tobosa, and an increase in burrograss. As the site continues to degrade shrub cover continues to increase and grass cover is severely reduced. Diagnosis: Mesquite, Creosotebush, and/or tarbush are the dominant shrubs. Blue grama and black grama cover is low or absent. Burrograss or tobosa are the dominant grasses. Typically grass cover is patchy with large interconnected bare areas present. Physical soil crusts are present, especially on silt loam surface soils. Transition to Shrub Dominated (4a): Wildlife and livestock consume and disperse mesquite seeds. Flood events may wash creosote or tarbush seeds off adjacent gravelly sites onto the loamy site and supply adequate moisture for germination. Persistent loss of grass cover due to overgrazing or drought can cause large bare patches, providing competition free areas for shrub seedling establishment. As shrub cover increases, competition for soil resources, especially water, becomes a major factor in further reducing grass cover. Reduction of fire, due to either fire suppression policy or loss of adequate fine fuels may increase the probability of shrub encroachment. Increased soil surface physical crusts and associated decreased infiltration, may prevent the establishment of grass seedlings. Transition to Shrub Dominated (5): The dispersal of creosotebush, tarbush or mesquite seed, combined with loss of grass cover and resource competition by shrubs may cause this transition. Key indicators of approach to transition: ? Decreased grass and litter cover. ? Increased bare patch size. ? Increased physical soil crusts. ? Increased amount of mesquite, creosotebush, or tarbush seedlings. ? Increased shrub cover. Transition back to Grassland (4b) Brush control will be necessary to remove shrubs and eliminate competition for resources necessary for grass establishment or reproduction. Seeding may be necessary on those sites where desired grass species are absent or very limited. Pitting and seeding may increase the chances of successful grass establishment. Prescribed grazing will help ensure adequate time is elapsed before grazing seeded area is allowed and proper forage utilization following seeding establishment. Transition to Bare State (6): If grass cover on the shrub-dominated state is

severely limited and shrubs are removed a bare state may result. This transition will depend on amount of grasses or seed remaining, whether site is seeded, or if seeding is successful. Transition to Bare State (7): Removal of succulents and continued overgrazing or drought may cause loss of remaining grasses and erosion. Soil surface physical crusting may also be an important factor in inhibiting grass seedling establishment

## Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Warm Season</b>			278–324	
	tobosagrass	PLMU3	<i>Pleuraphis mutica</i>	278–324	–
2	<b>Warm Season</b>			9–46	
	burrograss	SCBR2	<i>Scleropogon brevifolius</i>	9–46	–
3	<b>Warm Season</b>			231–278	
	black grama	BOER4	<i>Bouteloua eriopoda</i>	231–278	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	231–278	–
4	<b>Warm Season</b>			28–46	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	28–46	–
5	<b>Warm Season</b>			46–93	
	bush muhly	MUPO2	<i>Muhlenbergia porteri</i>	46–93	–
	plains bristlegrass	SEVU2	<i>Setaria vulpiseta</i>	46–93	–
6	<b>Warm Season</b>			9–28	
	Arizona cottontop	DICA8	<i>Digitaria californica</i>	9–28	–
7	<b>Warm Season</b>			46–93	
	threeawn	ARIST	<i>Aristida</i>	46–93	–
	muhly	MUHLE	<i>Muhlenbergia</i>	46–93	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	46–93	–
8	<b>Warm Season</b>			28–46	
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	28–46	–
<b>Shrub/Vine</b>					
9	<b>Shrub</b>			9–28	
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	9–28	–
	jointfir	EPHED	<i>Ephedra</i>	9–28	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	9–28	–
	cane bluestem	BOBA3	<i>Bothriochloa barbinodis</i>	5–24	–
	Arizona cottontop	DICA8	<i>Digitaria californica</i>	5–24	–
	plains bristlegrass	SEVU2	<i>Setaria vulpiseta</i>	5–24	–
10	<b>Shrub</b>			9–28	
	javelina bush	COER5	<i>Condalia ericoides</i>	9–28	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	9–28	–
	Grass, annual	2GA	<i>Grass, annual</i>	5–15	–
11	<b>Shrubs</b>			9–28	
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	9–28	–
<b>Forb</b>					

12	<b>Forb</b>			9-46	
	threadleaf ragwort	SEFLF	<i>Senecio flaccidus var. flaccidus</i>	9-46	-
	globemallow	SPHAE	<i>Sphaeralcea</i>	9-46	-
	verbena	VEPO4	<i>Verbena polystachya</i>	9-46	-
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	5-15	-
	pricklypear	OPUNT	<i>Opuntia</i>	5-15	-
13	<b>Forb</b>			9-28	
	croton	CROTO	<i>Croton</i>	9-28	-
	woolly groundsel	PACA15	<i>Packera cana</i>	9-28	-
14	<b>Forb</b>			9-28	
	Goodding's tansyaster	MAPIG2	<i>Machaeranthera pinnatifida ssp. gooddingii var. gooddingii</i>	9-28	-
	woolly paperflower	PSTA	<i>Psilostrophe tagetina</i>	9-28	-
15	<b>Forb</b>			9-28	
	redstem stork's bill	ERCI6	<i>Erodium cicutarium</i>	9-28	-
	Texas stork's bill	ERTE13	<i>Erodium texanum</i>	9-28	-
16	<b>Forb</b>			9-28	
	Forb (herbaceous, not grass nor grass-like)	2FORB	<i>Forb (herbaceous, not grass nor grass-like)</i>	9-28	-

## Animal community

This site provides habitats which support a resident animal community that is characterized by pronghorn antelope, black-tailed jackrabbit, black tailed prairie dog, yellow-faced pocket gopher, banner-tailed kangaroo rat, hispid cotton rat, swift fox, burrowing owl, horned lark, mockingbird, meadowlark, mourning dove, scaled quail, Great Plains toad, plains spadefoot toad, prairie rattlesnake and western coachwhip snake.

## Hydrological functions

The runoff curve numbers are determined by field investigations using hydraulic cover conditions and hydrologic soil groups.

Hydrologic Interpretations  
 Soil Series Hydrologic Group  
 Atoka C  
 Bigetty B  
 Ratliff B  
 Reyab B  
 Holloman B  
 Largo B  
 Holloman B  
 Bigetty B  
 Berino B  
 Reagan B  
 Reakor B  
 Reeves B  
 Russler C

## Recreational uses

This site offers limited potential for hiking, horseback riding, nature observation and photography. Game bird, antelope and predator hunting are also limited.

## Wood products

This site has no potential for wood products

## Other products

This site is suitable for grazing by all kinds and classes of livestock, during all seasons of the year. Under retrogression, such plants as black grama, blue grama, sideoats grama, bush muhly, plains bristlegrass, Arizona cottontop, fourwing saltbush and winterfat decrease and there is an increase in burrograss, threeawns, sand dropseed, muhlys, broom snakeweed and javilinabush. Under continued retrogression, burrograss can completely dominate the site. Creosotebush, mesquite, and tarbush can also dominate. Grazing management alone will not improve the site in the above situation. This site is well suited to a system of management that rotates the season of use.

## Other information

Guide to Suggested Initial Stocking Rate Acres per Animal Unit Month

Similarity Index Ac/AUM

100 - 76 3.0 – 4.2

75 – 51 4.1 – 5.5

50 – 26 5.3 – 7.0

25 – 0 7.1 +

## Inventory data references

Other References:

Data collection for this site was done in conjunction with the progressive soil surveys within the Southern Desertic Basins, Plains and Mountains, Major Land Resource Areas of New Mexico. This site has been mapped and correlated with soils in the following soil surveys. Eddy County Lea County and Chavez County.

## Other references

Literature References:

1. Brooks, M.L., AND D.A. Pyke. 2001. Invasive plants and fire in the deserts of North America. Pages 1–14 in K.E.M. Galley and T.P. Wilson (eds.). Proceedings of the Invasive Species Workshop: the Role of Fire in the Control and Spread of Invasive Species.
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## Contributors

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Don Sylvester

## Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

1. **Number and extent of rills:**

---

2. **Presence of water flow patterns:**

---

3. **Number and height of erosional pedestals or terracettes:**

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

---

5. **Number of gullies and erosion associated with gullies:**

---

6. **Extent of wind scoured, blowouts and/or depositional areas:**

---

7. **Amount of litter movement (describe size and distance expected to travel):**

---

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial**

distribution on infiltration and runoff:

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

---

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

Dominant:

Sub-dominant:

Other:

Additional:

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

---

14. **Average percent litter cover (%) and depth ( in):**

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

---

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**

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## Shepherd Fee #401H - Ecological Data

### Ecological site R070BC025NM

### Shallow

Accessed: 11/27/2024

#### General information

**Provisional.** A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

##### Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

**Table 1. Dominant plant species**

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

#### Physiographic features

This site occurs on knolls, ridges, hillslopes alluvial fans and escarpments. Slopes range from 0 to 25 percent and average about 7 percent. Direction of slope varies and is usually not significant. Elevations range from 2,842 to 4,500 feet.

**Table 2. Representative physiographic features**

Landforms	(1) Hill (2) Ridge (3) Fan piedmont
Flooding frequency	None
Ponding frequency	None
Elevation	2,842–4,500 ft
Slope	0–25%
Aspect	Aspect is not a significant factor

#### Climatic features

The average annual precipitation ranges from 8 to 13 inches. Variations of 5 inches, more or less, are common. Over 80 percent of the precipitation falls from April through October. Most of the summer precipitation comes in the form of high intensity – short duration thunderstorms.

Temperatures are characterized by distinct seasonal changes and large annual and diurnal temperature changes. The average annual temperature is 61 degrees with extremes of 25 degrees below zero in the winter to 112 degrees in the summer.

The average frost-free season is 180 to 220 days. The last killing frost is late March or early April, and the first killing frost is in late October or early November.

Temperature and rainfall both favor warm season perennial plant growth. In years of abundant spring moisture, annual forbs and cool season grasses can make up an important component of this site. Because of the shallow soil depth, the vegetation on this site can take advantage of moisture almost anytime it falls. Strong winds that blow from the west and southwest blow from January through June, which accelerates soil drying at a critical time for cool season plant growth.

Climate data was obtained from <http://www.wrcc.sage.dri.edu/summary/climsmnm.html> web site using 50% probability for freeze-free and frost-free seasons using 28.5 degrees F and 32.5 degrees F respectively.

**Table 3. Representative climatic features**

Frost-free period (average)	220 days
Freeze-free period (average)	240 days
Precipitation total (average)	13 in

### Influencing water features

This site is not influenced from water from wetlands or streams.

### Soil features

The soils of this site are shallow to very shallow. Soils are derived from mixed calcareous eolian deposits derived from sedimentary rock. Surface layers are very cobbly loam, very gravelly loam, gravelly loam, cobbly loam, gravelly fine sandy loam or gravelly sandy loam.

There is an indurated caliche layer or limestone bedrock that occurs within 20 inches and averages less than 10 inches. Limestone or caliche layer may be the restrictive layer.

Minimum and maximum values listed below represent the characteristic soils for this site.

Characteristic soils:

Lozier  
Potter  
Tencee  
Upton  
Ector  
Kimbrough

**Table 4. Representative soil features**

Surface texture	(1) Gravelly loam (2) Extremely gravelly loam (3) Extremely cobbly loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Very slow to moderately slow
Soil depth	4–20 in
Surface fragment cover <=3"	15–40%
Available water capacity (0-40in)	1 in
Calcium carbonate equivalent (0-40in)	15–60%

Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–1
Soil reaction (1:1 water) (0-40in)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	13–42%
Subsurface fragment volume >3" (Depth not specified)	0–1%

## Ecological dynamics

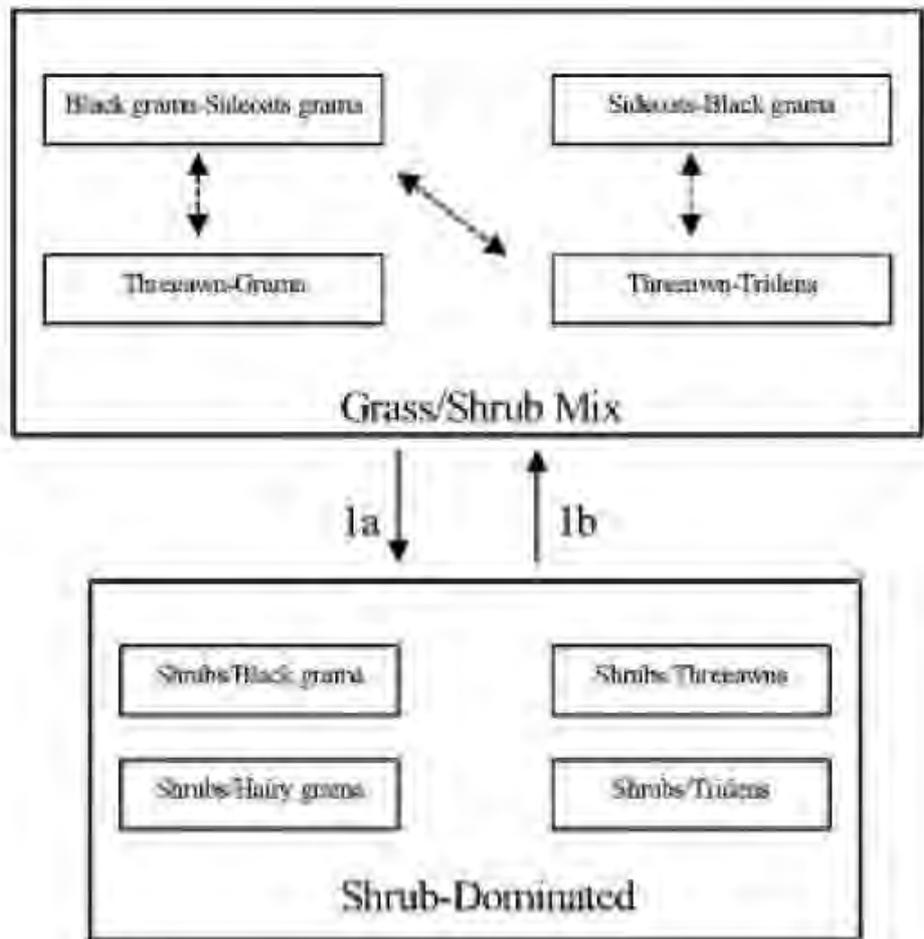
### Overview:

The Shallow site is associated with and Limestone Hills, Loamy, and Shallow Sandy sites. When associated with Limestone Hills, the Shallow site occurs on the summits, foot slopes and toeslopes of hills. Loamy sites often occur as areas between low elongated hills with rounded crests (Shallow site). When the Shallow Sandy site and Shallow site occur in association, the Shallow Sandy soils occupy the tops of low ridges and the Shallow site soils occur on the steeper sideslopes of the ridge. The historic plant community of the Shallow site has the aspect of a grassland/shrub mix, dominated by grasses, but with shrubs common throughout the site. Black grama is the dominant grass species; creosotebush, mesquite, and catclaw mimosa are common shrubs. Overgrazing and or extended drought can reduce grass cover, effect a change in grass species dominance, and may result in a shrub-dominated state. 1

## State and transition model

**Plant Communities and Transitional Pathways (diagram)**

**MLRA-42, SD-3, Shallow**



1a. Extended drought, overgrazing, no fire

1b. Brush control, Prescribed grazing

**State 1  
Grass/Shrub Mix**

**Community 1.1  
Grass/Shrub Mix**

Grassland/Shrub Mix: The historic plant community is dominated by black grama with sideoats grama as the sub-dominant. Blue grama, hairy grama, bush muhly, and sand dropseed also occur in significant amounts. Sideoats grama can occur as the dominant grass with black grama as sub-dominant on the western side of the Land Resource Unit SD-3. This may be due to higher average elevation on the west side. Retrogression within this state due to extended drought or overgrazing will cause a decrease in species such as black grama, sideoats grama, blue grama, and bush muhly. Threeawns may become the dominant grass species due to a decline in more palatable grasses or because of its ability to quickly recover following drought. Continued loss of grass cover and associated increase in amount of bare ground may result in a shrub-dominated state. Decreased fire frequencies may also be

an important component in the cause of this transition. Diagnosis: Grass cover is fairly uniform, however, surface gravel, cobble, and bare ground make up a large percent of total ground cover, and grass production during unfavorable years may only average 150-175 pounds per acre. Shrubs are common with canopy cover averaging five to ten percent. Evidence of erosion such as rills and gullies are rare, but may occur on slopes greater than eight percent.

**Table 5. Annual production by plant type**

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	168	352	536
Shrub/Vine	63	131	200
Forb	20	42	64
<b>Total</b>	<b>251</b>	<b>525</b>	<b>800</b>

**Table 6. Ground cover**

Tree foliar cover	0%
Shrub/vine/liana foliar cover	5-10%
Grass/grasslike foliar cover	10-15%
Forb foliar cover	0%
Non-vascular plants	0%
Biological crusts	0%
Litter	5-8%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	40-60%

**Figure 5. Plant community growth curve (percent production by month). NM2825, R042XC025NM Shallow HCPC. R042XC025NM Shallow HCPC Warm Season Plant Community.**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	5	10	10	25	30	12	5	0	0

**State 2  
Shrub-Dominated**

**Community 2.1  
Shrub-Dominated**

Shrub-Dominated: This state is characterized by an increase in shrubs and a decrease in grass cover relative to grassland/shrub mix. As grass cover decreases shrubs increase, especially creosotebush, catclaw mimosa, whitethorn acacia, and mesquite. Each of these shrub species may become dominant in localized areas or across the site, depending on the spatial variability in soil characteristics and landscape position. Black grama, threeawns, hairy grama, or hairy tridens may be the dominant grass species. Fluffgrass, burrograss and broom snakeweed increase in representation. The Shallow site is resistant to state change, due to the natural rock armor of the soil and a shallow impermeable layer. The amount of rock fragments on the soil surface assist in retarding erosion. On Shallow sites with low slope, the shallow depth to either a petrocalcic layer or limestone bedrock helps to keep water perched and available to shallow rooted grasses for extended periods. 2 Diagnosis: Shrubs are the dominant species, especially creosotebush, catclaw mimosa, whitethorn acacia, or mesquite. Grass cover is variable ranging

from patchy with large connected bare areas present to sparse with only a limited amount in shrub inter-spaces. Transition to Shrub-Dominated (1a) Overgrazing and or extended periods of drought, and suppression of natural fire regimes are thought to cause this transition. As grass cover is lost, soil fertility and available soil moisture decline, due to the reduction of organic matter and decreased infiltration.<sup>3</sup> Shrubs have the ability to extract nutrients and water from a greater area of soil than grasses and are better able to utilize limited water. Competition by shrubs for water and nutrients limits grass recruitment and establishment. Fire historically may have played a part in suppressing shrub expansion; fire suppression may therefore facilitate shrub expansion. Key indicators of approach to transition: \*Decrease or change in composition or distribution of grass cover. \*Increase in size and frequency of bare patches. \*Increase in amount of shrub seedlings. Transition back to Grassland/Shrub Mix (1b) Brush control is necessary to re-establish grasses. Prescribed grazing will help to ensure proper forage utilization and sustain grass cover. Once the transition is reversed and grass cover is re-established, periodic use of prescribed fire may assist in maintaining the Grassland/Shrub state.

### Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1				105–158	
	black grama	BOER4	<i>Bouteloua eriopoda</i>	105–158	–
2				79–105	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	79–105	–
3				79–105	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	79–105	–
	hairy grama	BOHI2	<i>Bouteloua hirsuta</i>	79–105	–
4				26–53	
	bush muhly	MUPO2	<i>Muhlenbergia porteri</i>	26–53	–
5				16–26	
	cane bluestem	BOBA3	<i>Bothriochloa barbinodis</i>	16–26	–
6				26–53	
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	26–53	–
7				16–26	
	hairy woollygrass	ERPI5	<i>Erioneuron pilosum</i>	16–26	–
8				5–16	
	ear muhly	MUAR	<i>Muhlenbergia arenacea</i>	5–16	–
9				5–16	
	New Mexico feathergrass	HENE5	<i>Hesperostipa neomexicana</i>	5–16	–
10				5–16	
	low woollygrass	DAPU7	<i>Dasyochloa pulchella</i>	5–16	–
11				16–26	
	Grass, perennial	2GP	<i>Grass, perennial</i>	16–26	–
<b>Forb</b>					
12				11–26	
	stemless four-nerve daisy	TEACE	<i>Tetraneuris acaulis var. epunctata</i>	11–26	–
13				5–16	
	woolly groundsel	PACA15	<i>Packera cana</i>	5–16	–

14				5-16	
	globemallow	SPHAE	<i>Sphaeralcea</i>	5-16	-
15				5-16	
	bladderpod	LESQU	<i>Lesquerella</i>	5-16	-
16				5-16	
	cassia	CASSI	<i>Cassia</i>	5-16	-
17				11-26	
	Forb (herbaceous, not grass nor grass-like)	2FORB	<i>Forb (herbaceous, not grass nor grass-like)</i>	11-26	-
<b>Shrub/Vine</b>					
18				5-16	
	littleleaf sumac	RHMI3	<i>Rhus microphylla</i>	5-16	-
19				5-16	
	creosote bush	LATR2	<i>Larrea tridentata</i>	5-16	-
20				5-16	
	littleleaf ratany	KRER	<i>Krameria erecta</i>	5-16	-
21				5-16	
	javelina bush	COER5	<i>Condalia ericoides</i>	5-16	-
22				5-16	
	American tarwort	FLCE	<i>Flourensia cernua</i>	5-16	-
23				5-16	
	crown of thorns	KOSP	<i>Koeberlinia spinosa</i>	5-16	-
24				11-26	
	honey mesquite	PRGL2	<i>Prosopis glandulosa</i>	11-26	-
	honey mesquite	PRGL2	<i>Prosopis glandulosa</i>	11-26	-
25				5-16	
	catclaw mimosa	MIACB	<i>Mimosa aculeaticarpa var. biuncifera</i>	5-16	-
26				5-16	
	pricklypear	OPUNT	<i>Opuntia</i>	5-16	-
27				11-26	
	mariola	PAIN2	<i>Parthenium incanum</i>	11-26	-
	mariola	PAIN2	<i>Parthenium incanum</i>	11-26	-
28				5-16	
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	5-16	-
29				16-26	
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	16-26	-

## Animal community

This site provides habitats which support a resident animal community that is characterized by desert cottontail, spotted ground squirrel, Merriam's kangaroo rat, cactus mouse, white-throated woodrat, gray fox, spotted skunk, roadrunner, Swainson's hawk, white-necked raven, cactus wren, pyrrhuloxia, lark sparrow, mourning dove, scaled quail, leopard lizard, round-tailed horned lizard, prairie rattlesnake, marbled whiptail, and greater earless lizard. Where associated with limestone hills, mule deer utilize this site.

Where large woody shrubs occur, most resident birds and scissor-tailed flycatcher, morning dove, lark sparrow and

Swainson's hawk nest.

## Hydrological functions

The runoff curve numbers are determined by field investigations using hydraulic cover conditions and hydrologic soil groups.

### Hydrologic Interpretations

Soil Series----- Hydrologic Group

Lozier----- D

Potter----- C

Tencee----- D

Upton----- C

Kimbrough----- D

Upton----- D

Ector----- D

## Recreational uses

This site offers recreation potential for hiking, horseback riding, rock hunting, nature photography and bird hunting and birding. During years of abundant spring moisture, a colorful array of wild flowers is displayed during May and June. A few summer and fall flowers also occur.

## Wood products

This site has no potential for wood production.

## Other products

This site is suited for grazing by all kinds and classes of livestock during all seasons of the year. Missmanagement will cause a decrease in black grama, sideoats grama, and blue grama, bush muhly and New Mexico feathergrass. A corresponding increase in bare ground will occur. There will also be an increase in muhlys, fluffgrass, creosotebush, javalinabush, catclaw, and mesquite. This site will respond best to a system of management that rotates the season of use.

## Other information

Guide to Suggested Initial Stocking Rate Acres per Animal Unit Month

Similarity Index----- Ac/AUM

100 - 76----- 3.7 – 4.5

75 – 51----- 4.3 – 5.5

50 – 26----- 5.3 – 10.0

25 – 0----- 10.1 +

## Inventory data references

Data collection for this site was done in conjunction with the progressive soil surveys within the Southern Deseretic Basins, Plains and Mountains, Major Land Resource Areas of New Mexico (SD-3). This site has been mapped and correlated with soils in the following soil surveys. Eddy County, Lea County, and Chaves County.

## Other references

Literature Cited:

1. Humphrey, R.R. 1974. Fire in the deserts and desert grassland of North America. In: Kozlowski, T. T.; Ahlgren, C. E., eds. Fire and ecosystems. New York: Academic Press: 365-400.

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David Trujillo  
Don Sylvester

**Rangeland health reference sheet**

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

**Indicators**

1. **Number and extent of rills:**

---

2. **Presence of water flow patterns:**

---

3. **Number and height of erosional pedestals or terracettes:**

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

---

5. **Number of gullies and erosion associated with gullies:**

---

6. **Extent of wind scoured, blowouts and/or depositional areas:**

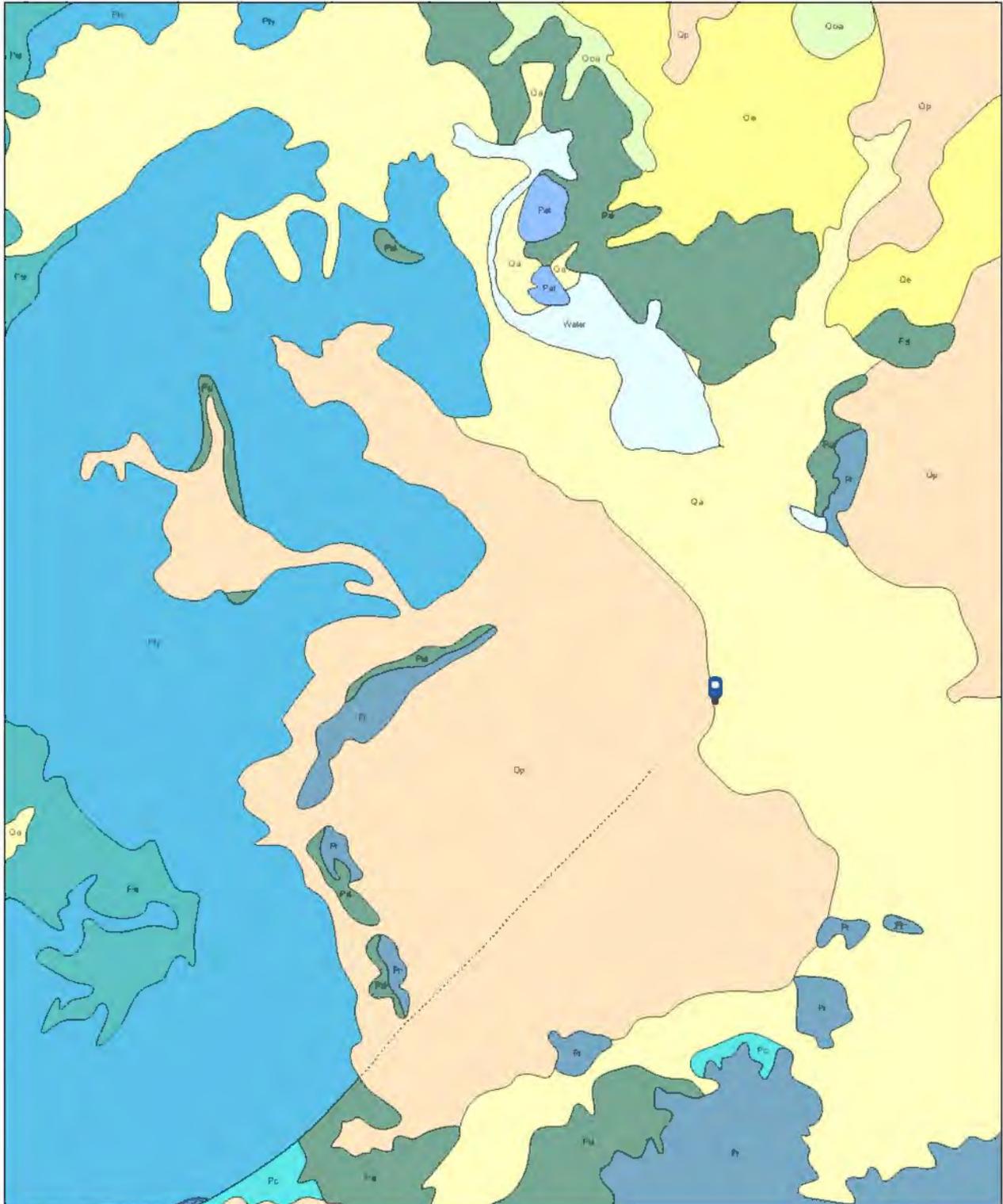
---

7. **Amount of litter movement (describe size and distance expected to travel):**

- 
8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**
- 
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**
- 
10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**
- 
11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**
- 
12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**
- Dominant:
- Sub-dominant:
- Other:
- Additional:
- 
13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**
- 
14. **Average percent litter cover (%) and depth ( in):**
- 
15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**
- 
16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**
- 
17. **Perennial plant reproductive capability:**

# Geological Lithological Unit Map - Qa

## Shepherd Fee #401H

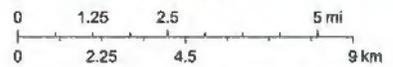


11/27/2024, 12:04:30 AM

**Lithologic Units**

- Playas—Alluvium and evaporite deposits (Holocene)
- Water—Perennial standing water
- Qa—Alluvium (Holocene to upper Pleistocene)

1:144,448



Eri, NASA, NGA, USGS, NMBGMR, USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census

ArcGIS Web AppBuilder

USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset,

# ATTACHMENT 3: CORRESPONDENCE



RE: [EXTERNAL] nAPP2430926272 Shepherd Fee #401H Liner Inspection Notification

From: Raley, Jim <Jim.Raley@dvn.com>  
 Date: Tue 12/3/2024 5:39 AM  
 To: Monica Peppin <Monica.Peppin@soudermiller.com>  
 Cc: Stephanie Hinds <stephanie.hinds@soudermiller.com>

Submitted on 12/3/2024  
 Note: for date of 12/5/2024 not requested 12/4/2024.

Jim Raley | Environmental Professional - Permian Basin  
 5315 Buena Vista Dr., Carlsbad, NM 88220  
 C: (575)689-7597 | [jim.ralej@dvn.com](mailto:jim.ralej@dvn.com)



From: Monica Peppin <Monica.Peppin@soudermiller.com>  
 Sent: Wednesday, November 27, 2024 3:49 PM  
 To: Raley, Jim <Jim.Raley@dvn.com>  
 Cc: Stephanie Hinds <stephanie.hinds@soudermiller.com>; ocd.enviro@emnrd.nm.gov  
 Subject: [EXTERNAL] nAPP2430926272 Shepherd Fee #401H Liner Inspection Notification

All:

SMA anticipates conducting soil sampling activities at the following site on Wednesday, December 4, 2024:  
 Proposed Date: 12.4.24  
 Proposed Time Frame: 9:30 AM  
 Site Name: Shepherd Fee #401H  
 Incident Number: nAPP2428624454  
 API: 30-015-45744

Liner Inspection Notification	
Incident ID and Site Name:	nAPP2428624454 Shepherd Fee #401H
API # and Corresponding Agency:	30-015-45744/EMNRD - OCD
Question	Answer (Fill In)
What is the liner inspection surface area in square feet (secondary containment):	2,782 sq ft
Have all the impacted materials been removed from the liner and cleaned?	Yes
Liner inspection date pursuant to Subparagraph (a) of Paragraph (5) of Subsection A of 19.15.29.11 NMAC: 48 HOURS PRIOR TO INSPECTION	Wednesday, December 4, 2024
Time liner inspection will commence:	9:30 AM
Please provide any information necessary for observers to contact inspector: (Name and Number)	Monica Peppin 575.909.3418
Please provide any information necessary for navigation to liner inspection site and coordinates (Lat/Long)	Intersection of Grandl Rd/Brantley Rd travel west for 0.90 miles, turn right on Tidwell Rural Road, travel north for 0.44 miles, turn right facing east drive 0.04 miles and location on left 32.3S3108, -104.164162 GPS location of Containment



Monica Peppin, A.S.

Project Manager

Stronger Communities by Design

Direct/Mobile: 575.909.3418

Office: 575.689.7040

Sante Fe Main Office  
Phone: (505) 476-3441

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Online Phone Directory  
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**State of New Mexico**  
**Energy, Minerals and Natural Resources**  
**Oil Conservation Division**  
**1220 S. St Francis Dr.**  
**Santa Fe, NM 87505**

QUESTIONS

Action 418292

**QUESTIONS**

Operator: DEVON ENERGY PRODUCTION COMPANY, LP 333 West Sheridan Ave. Oklahoma City, OK 73102	OGRID: 6137
	Action Number: 418292
	Action Type: [C-141] Remediation Closure Request C-141 (C-141-v-Closure)

**QUESTIONS**

<b>Prerequisites</b>	
Incident ID (n#)	nAPP2429624454
Incident Name	NAPP2429624454 SHEPHERD 3 2 23 27 FEE #401H @ 30-015-45744
Incident Type	Produced Water Release
Incident Status	Remediation Closure Report Received
Incident Well	[30-015-45744] SHEPHERD 3 2 23 27 FEE #401H

<b>Location of Release Source</b>	
<i>Please answer all the questions in this group.</i>	
Site Name	SHEPHERD 3 2 23 27 FEE #401H
Date Release Discovered	10/21/2024
Surface Owner	Private

<b>Incident Details</b>	
<i>Please answer all the questions in this group.</i>	
Incident Type	Produced Water Release
Did this release result in a fire or is the result of a fire	No
Did this release result in any injuries	No
Has this release reached or does it have a reasonable probability of reaching a watercourse	No
Has this release endangered or does it have a reasonable probability of endangering public health	No
Has this release substantially damaged or will it substantially damage property or the environment	No
Is this release of a volume that is or may with reasonable probability be detrimental to fresh water	No

<b>Nature and Volume of Release</b>	
<i>Material(s) released, please answer all that apply below. Any calculations or specific justifications for the volumes provided should be attached to the follow-up C-141 submission.</i>	
Crude Oil Released (bbls) Details	Not answered.
Produced Water Released (bbls) Details	Cause: Corrosion   Dump Line   Produced Water   Released: 86 BBL   Recovered: 86 BBL   Lost: 0 BBL.
Is the concentration of chloride in the produced water >10,000 mg/l	Yes
Condensate Released (bbls) Details	Not answered.
Natural Gas Vented (Mcf) Details	Not answered.
Natural Gas Flared (Mcf) Details	Not answered.
Other Released Details	Not answered.
Are there additional details for the questions above (i.e. any answer containing Other, Specify, Unknown, and/or Fire, or any negative lost amounts)	Not answered.

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QUESTIONS, Page 2

Action 418292

**QUESTIONS (continued)**

Operator: DEVON ENERGY PRODUCTION COMPANY, LP 333 West Sheridan Ave. Oklahoma City, OK 73102	OGRID: 6137
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**QUESTIONS**

<b>Nature and Volume of Release (continued)</b>	
Is this a gas only submission (i.e. only significant Mcf values reported)	<b>No, according to supplied volumes this does not appear to be a "gas only" report.</b>
Was this a major release as defined by Subsection A of 19.15.29.7 NMAC	<b>Yes</b>
Reasons why this would be considered a submission for a notification of a major release	<b>From paragraph A. "Major release" determine using: (1) an unauthorized release of a volume, excluding gases, of 25 barrels or more.</b>
<i>With the implementation of the 19.15.27 NMAC (05/25/2021), venting and/or flaring of natural gas (i.e. gas only) are to be submitted on the C-129 form.</i>	

**Initial Response**

*The responsible party must undertake the following actions immediately unless they could create a safety hazard that would result in injury.*

The source of the release has been stopped	True
The impacted area has been secured to protect human health and the environment	True
Released materials have been contained via the use of berms or dikes, absorbent pads, or other containment devices	True
All free liquids and recoverable materials have been removed and managed appropriately	True
If all the actions described above have not been undertaken, explain why	Not answered.

*Per Paragraph (4) of Subsection B of 19.15.29.8 NMAC the responsible party may commence remediation immediately after discovery of a release. If remediation has begun, please prepare and attach a narrative of actions to date in the follow-up C-141 submission. If remedial efforts have been successfully completed or if the release occurred within a lined containment area (see Subparagraph (a) of Paragraph (5) of Subsection A of 19.15.29.11 NMAC), please prepare and attach all information needed for closure evaluation in the follow-up C-141 submission.*

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to OCD 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 OCD does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to groundwater, surface water, human health or the environment. In addition, OCD 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.

I hereby agree and sign off to the above statement	Name: James Raley Title: EHS Professional Email: jim.raley@dvn.com Date: 10/22/2024
--	--

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QUESTIONS, Page 3

Action 418292

**QUESTIONS (continued)**

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	Action Number: 418292
	Action Type: [C-141] Remediation Closure Request C-141 (C-141-v-Closure)

**QUESTIONS**

**Site Characterization**

Please answer all the questions in this group (only required when seeking remediation plan approval and beyond). This information must be provided to the appropriate district office no later than 90 days after the release discovery date.

What is the shallowest depth to groundwater beneath the area affected by the release in feet below ground surface (ft bgs)	Between 100 and 500 (ft.)
What method was used to determine the depth to ground water	NM OSE iWaters Database Search
Did this release impact groundwater or surface water	No
<b>What is the minimum distance, between the closest lateral extents of the release and the following surface areas:</b>	
A continuously flowing watercourse or any other significant watercourse	Between 1 and 5 (mi.)
Any lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark)	Greater than 5 (mi.)
An occupied permanent residence, school, hospital, institution, or church	Between 500 and 1000 (ft.)
A spring or a private domestic fresh water well used by less than five households for domestic or stock watering purposes	Between 200 and 300 (ft.)
Any other fresh water well or spring	Between 200 and 300 (ft.)
Incorporated municipal boundaries or a defined municipal fresh water well field	Greater than 5 (mi.)
A wetland	Between 200 and 300 (ft.)
A subsurface mine	Greater than 5 (mi.)
An (non-karst) unstable area	Greater than 5 (mi.)
Categorize the risk of this well / site being in a karst geology	Medium
A 100-year floodplain	Between 1 and 5 (mi.)
Did the release impact areas not on an exploration, development, production, or storage site	No

**Remediation Plan**

Please answer all the questions that apply or are indicated. This information must be provided to the appropriate district office no later than 90 days after the release discovery date.

Requesting a remediation plan approval with this submission	Yes
<i>Attach a comprehensive report demonstrating the lateral and vertical extents of soil contamination associated with the release have been determined, pursuant to 19.15.29.11 NMAC and 19.15.29.13 NMAC.</i>	
Have the lateral and vertical extents of contamination been fully delineated	Yes
Was this release entirely contained within a lined containment area	Yes
<i>Per Subsection B of 19.15.29.11 NMAC unless the site characterization report includes completed efforts at remediation, the report must include a proposed remediation plan in accordance with 19.15.29.12 NMAC, which includes the anticipated timelines for beginning and completing the remediation.</i>	
On what estimated date will the remediation commence	10/26/2024
On what date will (or did) the final sampling or liner inspection occur	12/05/2024
On what date will (or was) the remediation complete(d)	12/05/2024
What is the estimated surface area (in square feet) that will be remediated	2782
What is the estimated volume (in cubic yards) that will be remediated	0

*These estimated dates and measurements are recognized to be the best guess or calculation at the time of submission and may (be) change(d) over time as more remediation efforts are completed. The OCD recognizes that proposed remediation measures may have to be minimally adjusted in accordance with the physical realities encountered during remediation. If the responsible party has any need to significantly deviate from the remediation plan proposed, then it should consult with the division to determine if another remediation plan submission is required.*

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QUESTIONS, Page 4

Action 418292

**QUESTIONS (continued)**

Operator: DEVON ENERGY PRODUCTION COMPANY, LP 333 West Sheridan Ave. Oklahoma City, OK 73102	OGRID: 6137
	Action Number: 418292
	Action Type: [C-141] Remediation Closure Request C-141 (C-141-v-Closure)

**QUESTIONS**

<b>Remediation Plan (continued)</b>	
<i>Please answer all the questions that apply or are indicated. This information must be provided to the appropriate district office no later than 90 days after the release discovery date.</i>	
<b>This remediation will (or is expected to) utilize the following processes to remediate / reduce contaminants:</b>	
<i>(Select all answers below that apply.)</i>	
Is (or was) there affected material present needing to be removed	Yes
Is (or was) there a power wash of the lined containment area (to be) performed	Yes
OTHER (Non-listed remedial process)	Not answered.
<i>Per Subsection B of 19.15.29.11 NMAC unless the site characterization report includes completed efforts at remediation, the report must include a proposed remediation plan in accordance with 19.15.29.12 NMAC, which includes the anticipated timelines for beginning and completing the remediation.</i>	
I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to OCD 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 OCD does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to groundwater, surface water, human health or the environment. In addition, OCD 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.	
I hereby agree and sign off to the above statement	Name: James Raley Title: EHS Professional Email: jim.raley@dvsn.com Date: 01/08/2025
<i>The OCD recognizes that proposed remediation measures may have to be minimally adjusted in accordance with the physical realities encountered during remediation. If the responsible party has any need to significantly deviate from the remediation plan proposed, then it should consult with the division to determine if another remediation plan submission is required.</i>	

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QUESTIONS, Page 6

Action 418292

**QUESTIONS (continued)**

Operator: DEVON ENERGY PRODUCTION COMPANY, LP 333 West Sheridan Ave. Oklahoma City, OK 73102	OGRID: 6137
	Action Number: 418292
	Action Type: [C-141] Remediation Closure Request C-141 (C-141-v-Closure)

**QUESTIONS**

<b>Liner Inspection Information</b>	
Last liner inspection notification (C-141L) recorded	<b>407774</b>
Liner inspection date pursuant to Subparagraph (a) of Paragraph (5) of Subsection A of 19.15.29.11 NMAC	<b>12/05/2024</b>
Was all the impacted materials removed from the liner	<b>Yes</b>
What was the liner inspection surface area in square feet	<b>2782</b>

<b>Remediation Closure Request</b>	
<i>Only answer the questions in this group if seeking remediation closure for this release because all remediation steps have been completed.</i>	
Requesting a remediation closure approval with this submission	<b>Yes</b>
Have the lateral and vertical extents of contamination been fully delineated	<b>Yes</b>
Was this release entirely contained within a lined containment area	<b>Yes</b>
What was the total surface area (in square feet) remediated	<b>2782</b>
What was the total volume (cubic yards) remediated	<b>0</b>
Summarize any additional remediation activities not included by answers (above)	<b>Secondary Containment inspection completed. No breach through liner</b>

*The responsible party must attach information demonstrating they have complied with all applicable closure requirements and any conditions or directives of the OCD. This demonstration should be in the form of a comprehensive report (in .pdf format) including a scaled site map, sampling diagrams, relevant field notes, photographs of any excavation prior to backfilling, laboratory data including chain of custody documents of final sampling, and a narrative of the remedial activities. Refer to 19.15.29.12 NMAC.*

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to OCD 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 OCD does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to groundwater, surface water, human health or the environment. In addition, OCD 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. The responsible party acknowledges they must substantially restore, reclaim, and re-vegetate the impacted surface area to the conditions that existed prior to the release or their final land use in accordance with 19.15.29.13 NMAC including notification to the OCD when reclamation and re-vegetation are complete.

I hereby agree and sign off to the above statement	Name: James Raley Title: EHS Professional Email: jim.raley@dvn.com Date: 01/08/2025
--	--

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CONDITIONS

Action 418292

**CONDITIONS**

Operator: DEVON ENERGY PRODUCTION COMPANY, LP 333 West Sheridan Ave. Oklahoma City, OK 73102	OGRID: 6137
	Action Number: 418292
	Action Type: [C-141] Remediation Closure Request C-141 (C-141-v-Closure)

**CONDITIONS**

Created By	Condition	Condition Date
scwells	Liner report approved. For future releases at this site, the minimum distance to to a continuously flowing watercourse should be updated to between 200-300 feet.	1/8/2025