



Devon Energy Corporation
Walter Harvey.
6488 Seven Rivers Hwy
Artesia, New Mexico 88210

(575) 748-1807 Phone
www.devonenergy.com

June 15, 2015

Dr. Thomas Oberding
NMOCD District 1
1625 French Drive
Hobbs, New Mexico 88240

Re: Devon Energy, Terrapin Recycling Facility and Containment C-147 Registration Package

Dear Dr. Oberding

Please find enclosed the complete assembled C-147 registration for a recycling facility and containment located in the SE/4SW/4 of Section 2 of Township 26 South, Range 31 East. I believe the attached registration is complete and meets or exceeds all of the criteria for approval under NMOCD rules. Please let us know if you need any additional information or clarification regarding the application. Please note the surface owner is copied on this transmission. I will remain,

Sincerely yours,

A handwritten signature in blue ink that reads "Walter Harvey". The signature is written in a cursive style and is positioned above the typed name.

Walter Harvey
Field Landman
Devon Energy Corporation
Exploration and Strategic Services
6488 Seven Rivers Highway
Artesia, New Mexico 88210
(575) 703-3248 cell
(575) 748-1807 office
walter.harvey@dvn.com

Copy of the C-147 will be delivered to Mr. Ed Martin SLO, surface owner.



DEVON ENERGY
Oklahoma City, Oklahoma

C-147 Registration Package for
Terrapin Recycling Containment
and Recycling Facility
Section 2 T26S R31E

Submitted: June 16, 2015

C-147 and Site Specific Information

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

State of New Mexico
Energy Minerals and Natural Resources
Department
Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-147
Revised March 31, 2015

Recycling Facility and/or Recycling Containment

Type of Facility: Recycling Facility Recycling Containment*
Type of action: Permit Registration
 Modification Extension
 Closure Other (explain) _____

* At the time C-147 is submitted to the division for a Recycling Containment, a copy shall be provided to the surface owner.

Be advised that approval of this request does not relieve the operator of liability should operations result in pollution of surface water, ground water or the environment. Nor does approval relieve the operator of its responsibility to comply with any other applicable governmental authority's rules, regulations or ordinances.

1.
Operator: Devon Energy Corporation (For multiple operators attach page with information) OGRID #: 6137
Address: 333 West Sheridan, Oklahoma City, Oklahoma 73102-8260
Facility or well name (include API# if associated with a well): Terrapin Containment and Recycling Facility
OCD Permit Number: _____ (For new facilities the permit number will be assigned by the district office)
U/L or Qtr/Qtr _____ Section 2 Township 26S Range 31E County: Eddy
Surface Owner: Federal State Private Tribal Trust or Indian Allotment

2.
 Recycling Facility:
Location of recycling facility (if applicable): Latitude 32.0672011 Longitude -103.7538125 NAD: 1927 1983
Proposed Use: Drilling* Completion* Production* Plugging*
**The re-use of produced water may NOT be used until fresh water zones are cased and cemented*
 Other, *requires permit for other uses. Describe use, process, testing, volume of produced water and ensure there will be no adverse impact on groundwater or surface water.*
 Fluid Storage
 Above ground tanks Recycling containment Activity permitted under 19.15.17 NMAC explain type _____
 Activity permitted under 19.15.36 NMAC explain type: _____ Other explain _____
 For multiple or additional recycling containments, attach design and location information of each containment
 Closure Report (required within 60 days of closure completion): Recycling Facility Closure Completion Date: _____

3.
 Recycling Containment:
 Annual Extension after initial 5 years (attach summary of monthly leak detection inspections for previous year)
Center of Recycling Containment (if applicable): Latitude 32.0672011 Longitude -103.7538125 NAD: 1927 1983
 For multiple or additional recycling containments, attach design and location information of each containment
 Lined Liner type: Thickness 30-mil (Secondary), 60-mil (Primary) LLDPE HDPE PVC Other _____
 String-Reinforced
Liner Seams: Welded Factory Other Field Welds Volume: 300,000bbls (Usable) Dimensions: L 400' x W 400' x D 20'
 Recycling Containment Closure Completion Date: _____

4.

Bonding:

- Covered under bonding pursuant to 19.15.8 NMAC per 19.15.34.15(A)(2) NMAC (These containments are limited to only the wells owned or operated by the owners of the containment.)
- Bonding in accordance with 19.15.34.15(A)(1). Amount of bond \$ _____ (work on these facilities cannot commence until bonding amounts are approved)
- Attach closure cost estimate and documentation on how the closure cost was calculated.

5.

Fencing:

- Four foot height, four strands of barbed wire evenly spaced between one and four feet
- Alternate. Please specify Game Fence

6.

Signs:

- 12"x 24", 2" lettering, providing Operator's name, site location, and emergency telephone numbers
- Signed in compliance with 19.15.16.8 NMAC

7.

Variances:

Justifications and/or demonstrations that the proposed variance will afford reasonable protection against contamination of fresh water, human health, and the environment.

Check the below box only if a variance is requested:

- Variance(s): Requests must be submitted to the appropriate division district for consideration of approval. If a Variance is requested, include the variance information on a separate page and attach it to the C-147 as part of the application.
- If a Variance is requested, it must be approved prior to implementation.**

8.

Siting Criteria for Recycling Containment

Instructions: The applicant must provide attachments that demonstrate compliance for each siting criteria below as part of the application. Potential examples of the siting attachment source material are provided below under each criteria.

General siting

Ground water is less than 50 feet below the bottom of the Recycling Containment.

NM Office of the State Engineer - iWATERS database search; USGS; Data obtained from nearby wells

- Yes No
- NA

Within incorporated municipal boundaries or within a defined municipal fresh water well field covered under a municipal ordinance adopted pursuant to NMSA 1978, Section 3-27-3, as amended.

- Yes No
- NA

- Written confirmation or verification from the municipality; written approval obtained from the municipality

Within the area overlying a subsurface mine.

- Yes No

- Written confirmation or verification or map from the NM EMNRD-Mining and Minerals Division

Within an unstable area.

- Yes No

- Engineering measures incorporated into the design; NM Bureau of Geology & Mineral Resources; USGS; NM Geological Society; topographic map

Within a 100-year floodplain. FEMA map

- Yes No

Within 300 feet of a continuously flowing watercourse, or 200 feet of any other significant watercourse, or lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark).

- Yes No

- Topographic map; visual inspection (certification) of the proposed site

Within 1000 feet from a permanent residence, school, hospital, institution, or church in existence at the time of initial application.

- Yes No

- Visual inspection (certification) of the proposed site; aerial photo; satellite image

Within 500 horizontal feet of a spring or a fresh water well used for domestic or stock watering purposes, in existence at the time of initial application.

- Yes No

- NM Office of the State Engineer - iWATERS database search; visual inspection (certification) of the proposed site

Within 500 feet of a wetland.

- Yes No

- US Fish and Wildlife Wetland Identification map; topographic map; visual inspection (certification) of the proposed site

9.

Recycling Facility and/or Containment Checklist:

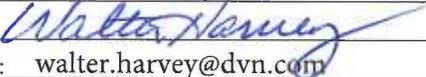
Instructions: Each of the following items must be attached to the application. Indicate, by a check mark in the box, that the documents are attached.

- Design Plan - based upon the appropriate requirements.
- Operating and Maintenance Plan - based upon the appropriate requirements.
- Closure Plan - based upon the appropriate requirements.
- Site Specific Groundwater Data -
- Siting Criteria Compliance Demonstrations -
- Certify that notice of the C-147 (only) has been sent to the surface owner(s)

10.

Operator Application Certification:

I hereby certify that the information and attachments submitted with this application are true, accurate and complete to the best of my knowledge and belief.

Name (Print): Walter Harvey Title: Field Landman
 Signature:  Date: 6/16/2016
 e-mail address: walter.harvey@dvn.com Telephone: (575) 748-2335

11.

OCD Representative Signature: _____ **Approval Date:** _____

Title: _____ **OCD Permit Number:** _____

- OCD Conditions _____
- Additional OCD Conditions on Attachment _____

DISTANCE TO GROUNDWATER

Figure 1, Figure 2, Figure 7, and the discussion below demonstrates that groundwater (fresh water as defined by NMOCD Rules) at the location is greater than 50 feet beneath the containment. Figure 1 is a geologic/ topographic map that shows:

1. The location of the proposed containment with the surface elevation.
2. Water wells from the OSE database are plotted as a green water droplet. OSE wells are often mis-located in the WATERS database as older wells are plotted in the center of the quarter, quarter, quarter, of the Section Township and Range.
3. The depth-to-water from the most recent available measurement for each well is provided adjacent to the well symbol.
4. Figure 7 is a boring to a depth of 52' from the surface (auger refusal) at the impoundment location. No moisture or groundwater was noted during the drilling.

GEOLOGY

Our examination of the geology of the area near the proposed containment causes us to conclude that, on a regional basis, the uppermost water-bearing zone lay in the Triassic Chinle Formation, the basal unit of which is the Santa Rosa Sandstone. Existing data do not allow us to determine if the water in the Chinle is unconfined or confined. For a confined aquifer, the depth to groundwater is the top of the permeable unit (e.g. 100 feet) but the depth to groundwater (the potentiometric surface) can be a few feet below the ground surface.

Saturated alluvium exists southwest of the location within the Bell Lake Sink. Two wells were developed within this depression, both of which are abandoned. Alluvium also exists northeast of the site, but this unit does not appear to hold groundwater. The hydrogeology of the area is described in the next section.

Figure 2 is the same scale as geologic and topographic map that shows:

1. The location of the proposed containment.
2. Water wells measured by the USGS or other professionals, the formation completion depth of the well (see Figure 1 Legend) and the calculated elevation of the groundwater surface and the date of the observation.
3. Isocontour lines displaying the elevation of the groundwater surface of the Rustler Formation.

HYDROGEOLOGY

To verify that depth to groundwater is greater than 50', USGS data and a deep boring were analyzed. The Misc data are measured water levels in wells or logged borings for hydrogeologic information. The available groundwater data and boring log are presented in Figures 1 and 7 respectively.

Water level data from the OSE database rely upon observed water levels by drillers during the completion of the water well. The OSE dataset provides some useful data in certain areas.

From the best available data, Devon has determined the depth to the groundwater surface beneath the proposed containment is greater than 50’.

DISTANCE TO SURFACE WATER

Figure 2 and the site visit demonstrates that the location is not within 300 feet of a continuously flowing watercourse or any other significant watercourse or 200 feet from lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark).

- No continuously flowing watercourses or other water bodies, as defined by NMOCD Rules, exist within the prescribed setback criteria for containment.
- The nearest surface water body is a lake/pond located about 1 mile west

DISTANCE TO PERMANENT RESIDENCE OR STRUCTURES

Figure 3 and the site visit demonstrates that the location is not within 1000 feet from an occupied permanent residence, school, hospital, institution, church, or other structure in existence at the time of initial application.

- The nearest structures are oil and gas wells and tank batteries.
- A cattle gathering area with corrals is located about 0.9 miles northwest of the proposed containment in the area of the Tip Top wells.

Distance to Non-Public Water Supply

Figures 1 and 3 demonstrate that the location is not within 500 horizontal feet of a private, domestic fresh water well or spring that less than five households use for domestic or stock watering purposes, or within 1,000 horizontal feet of any other fresh water well or spring, in existence at the time of initial application.

- Figure 1 shows the locations of all area water wells, active or plugged.
- There are no known domestic water wells located within 1,000 feet of the proposed containment.
- No springs were identified within the mapping area (see Figure 3).

Distance to Municipal Boundaries and Fresh Water Fields

Figure 4 demonstrates that the location is not within incorporated municipal boundaries or within defined municipal fresh water well fields covered under a municipal ordinance adopted pursuant to NMSA 1978, Section 3-27-3, as amended

- The closest municipality is Carlsbad, NM approximately 35 miles to the northwest.
- The closest public well field is located approximately 39 miles to the west.

DISTANCE TO WETLANDS

Figure 3 demonstrates the location is not within 300 feet of wetlands.

DISTANCE TO SUBSURFACE MINES

Figure 3 and our general reconnaissance of the area demonstrate that the nearest mines are caliche pits. This location is not within an area overlying a subsurface mine.

DISTANCE TO HIGH OR CRITICAL KARST AREAS

Figure 5 shows the location of the temporary containments with respect to BLM Karst areas.

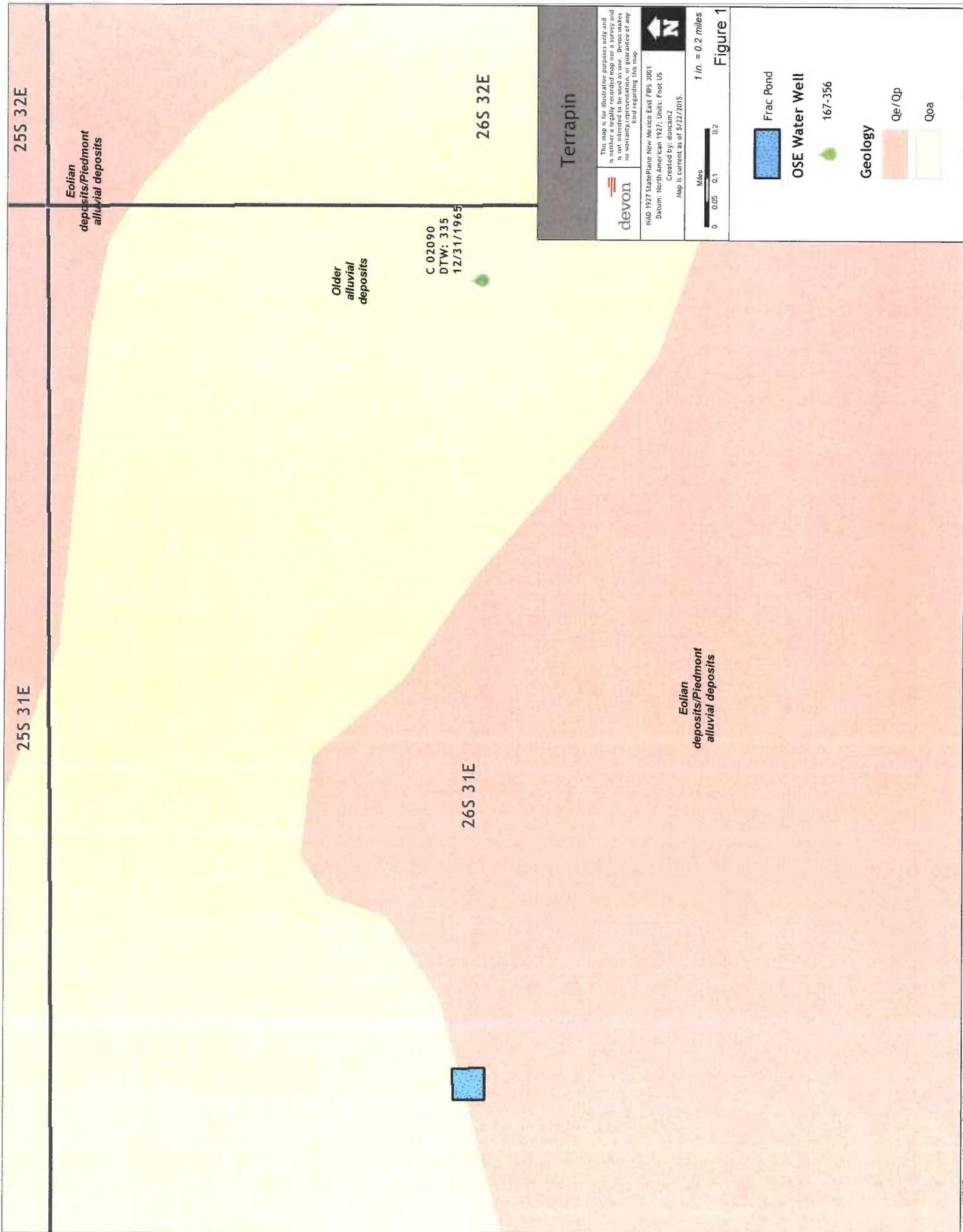
- The proposed temporary containment is located within a “medium” potential karst area.
- The nearest “high” or “critical” potential karst area is located approximately 7 miles southwest of the site.
- No evidence of solution voids were observed near the site during the field inspection.

Distance to 100-Year Floodplain

Figure 6 demonstrates that the location is within Zone D as designated by the Federal Emergency Management Agency with respect to the Flood Insurance Rate 100-Year Floodplain.

- Zone D is described as areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted.
- Our field inspection and examination of the topography permits a conclusion that the location is not within any floodplain and has low risk for flooding.

Figures



25S 32E

Eolian
deposits/Piedmont
alluvial deposits

26S 32E

Older
alluvial
deposits

C 02090
DTW: 335
12/31/1965

25S 31E

26S 31E

Eolian
deposits/Piedmont
alluvial deposits

Terrapin



This map is for illustrative purposes only and is neither a legally recorded map nor a survey and is not intended to be used as one. Devon makes no warranty, representation or guarantee of any kind regarding this map.

WHD 1927 StatePlane New Mexico East FIPS 3001
Datum: North American 1927; Units: Foot US
Created by: duncam2
Map is current as of 3/22/2015.

1 in. = 0.2 miles
Figure 1



Frac Pond



OSE Water Well

167-356

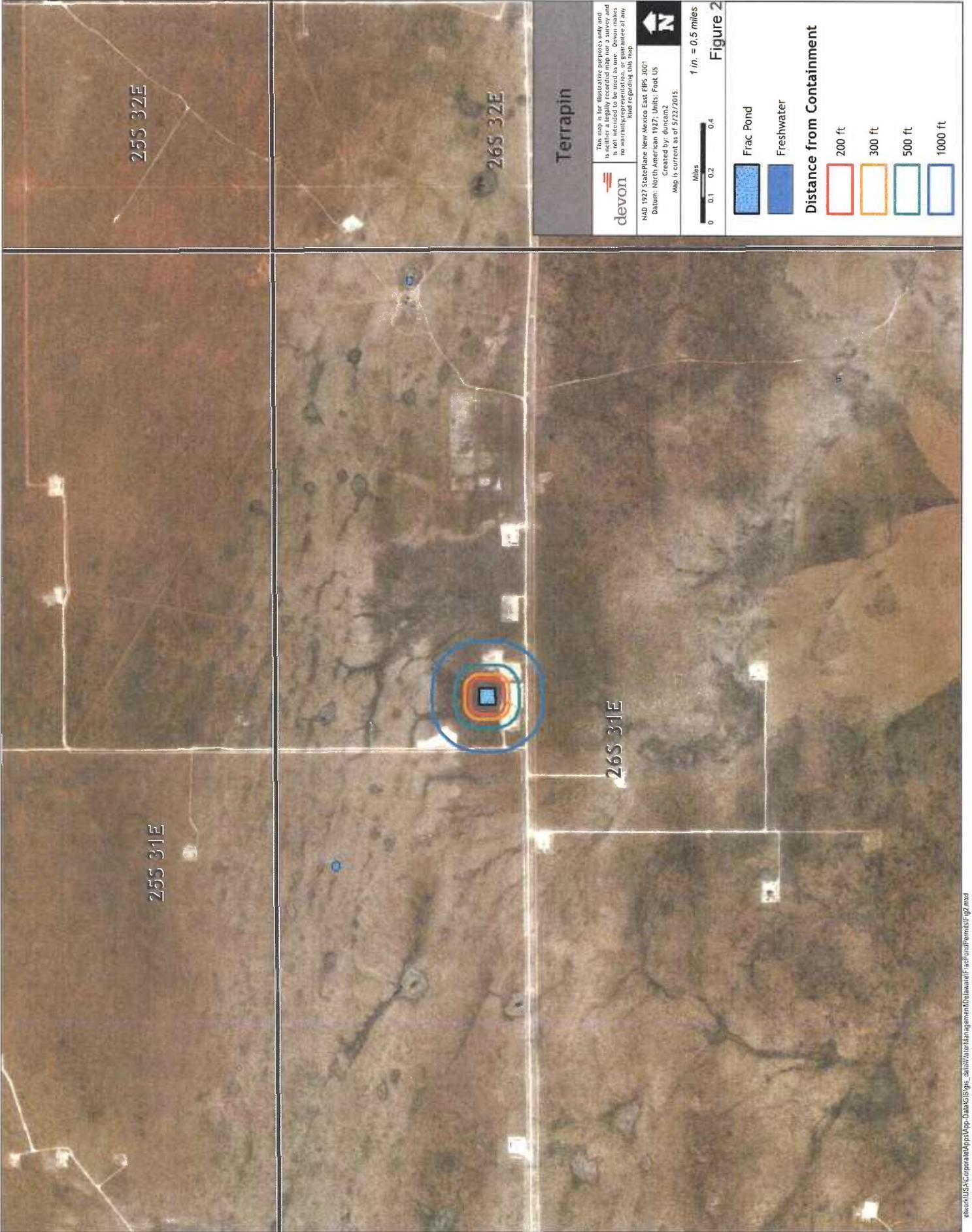
Geology



Qe/Qp



Qoa



255 32E

265 32E

255 31E

265 31E

Terrapin



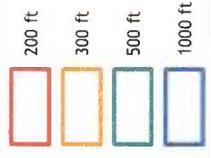
This map is for illustrative purposes only and is neither a legally recorded map nor a survey and is not intended to be used as one. Devon makes no warranty, expressed or implied, regarding this map.

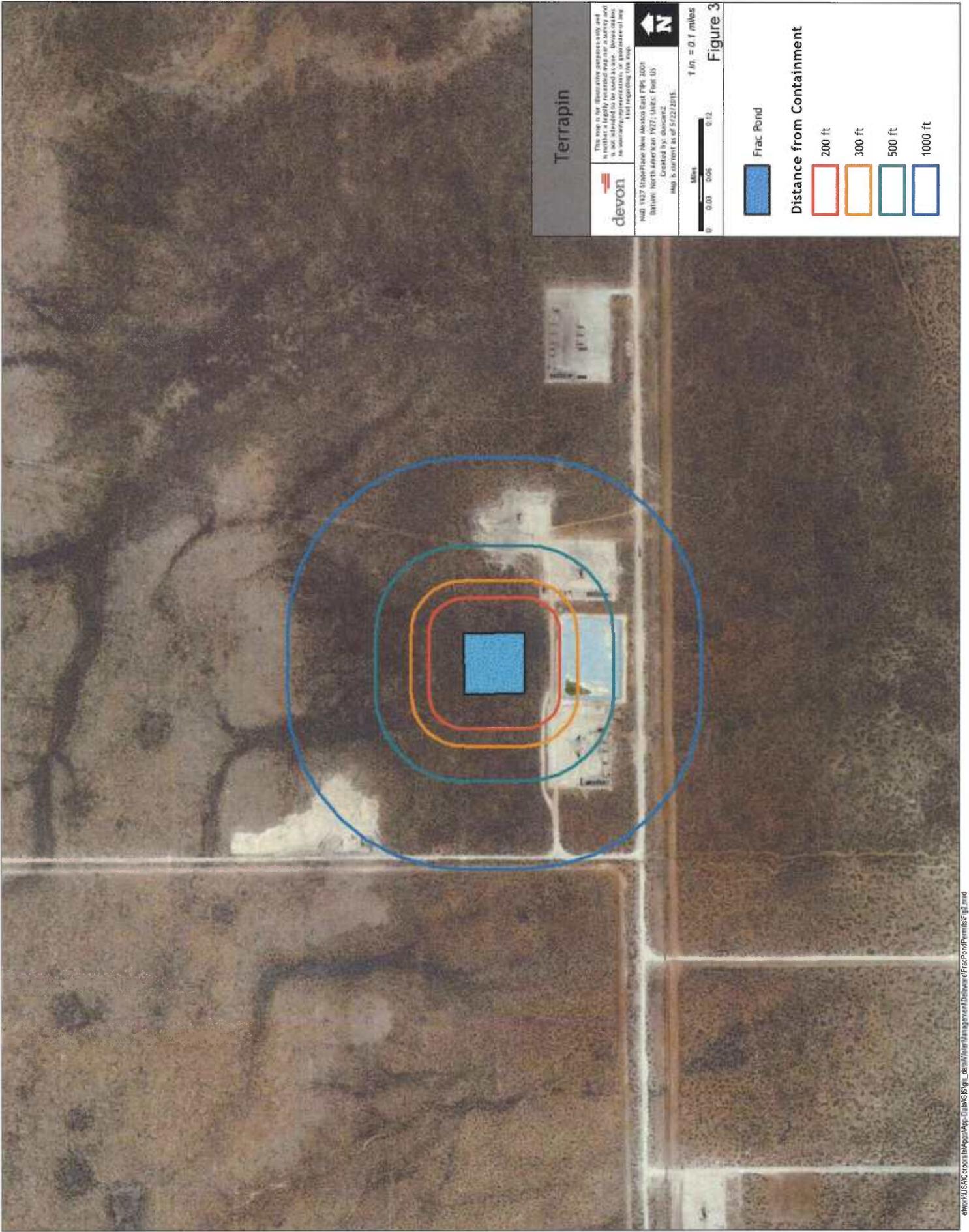
NAD 1927 StatePlane New Mexico East FIPS 3001
 Datum: North American 1927; Units: Foot US
 Created by: duncaimz
 Map is current as of 5/22/2015.

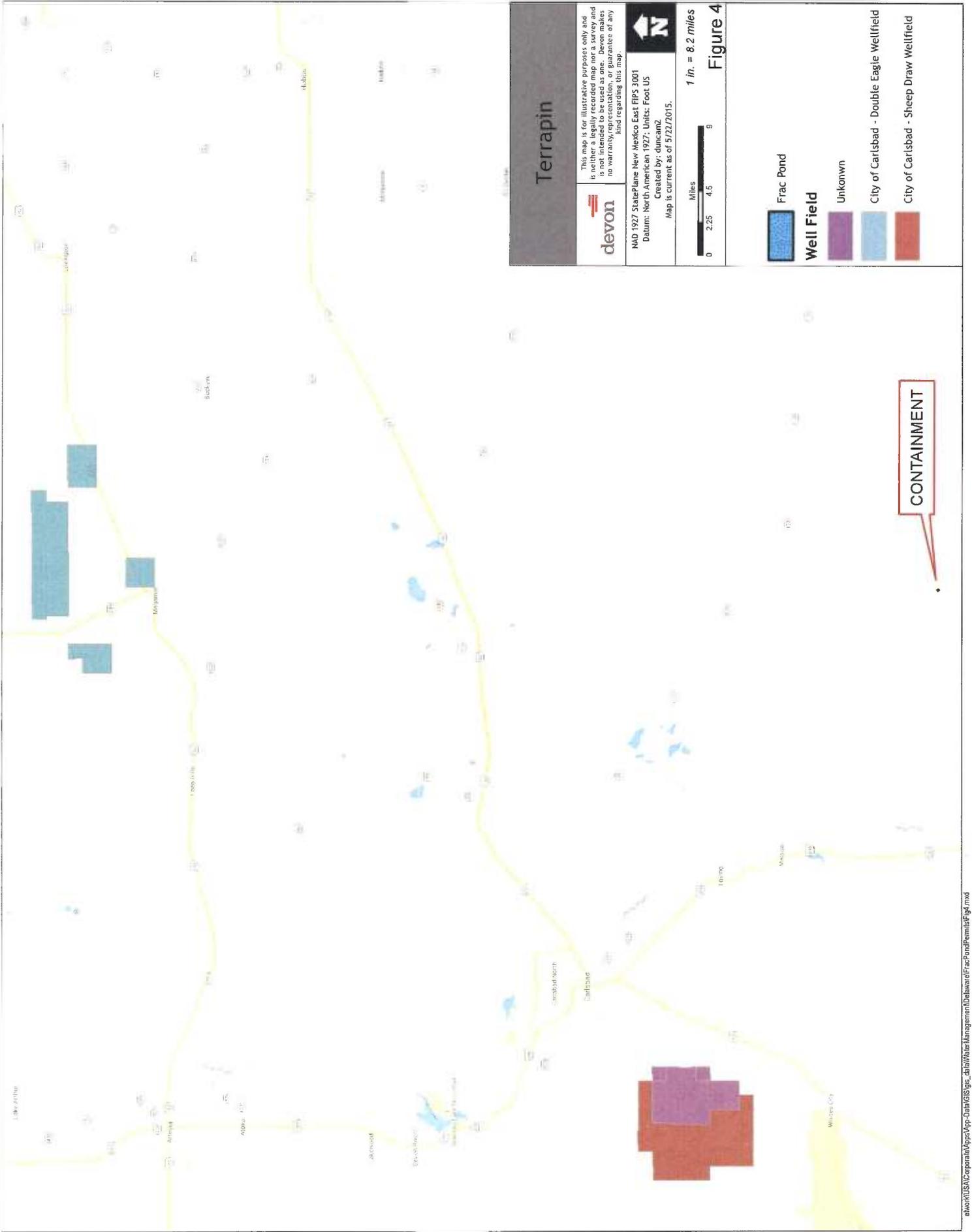
1 in. = 0.5 miles
 Figure 2



Distance from Containment







Terrapin

devon

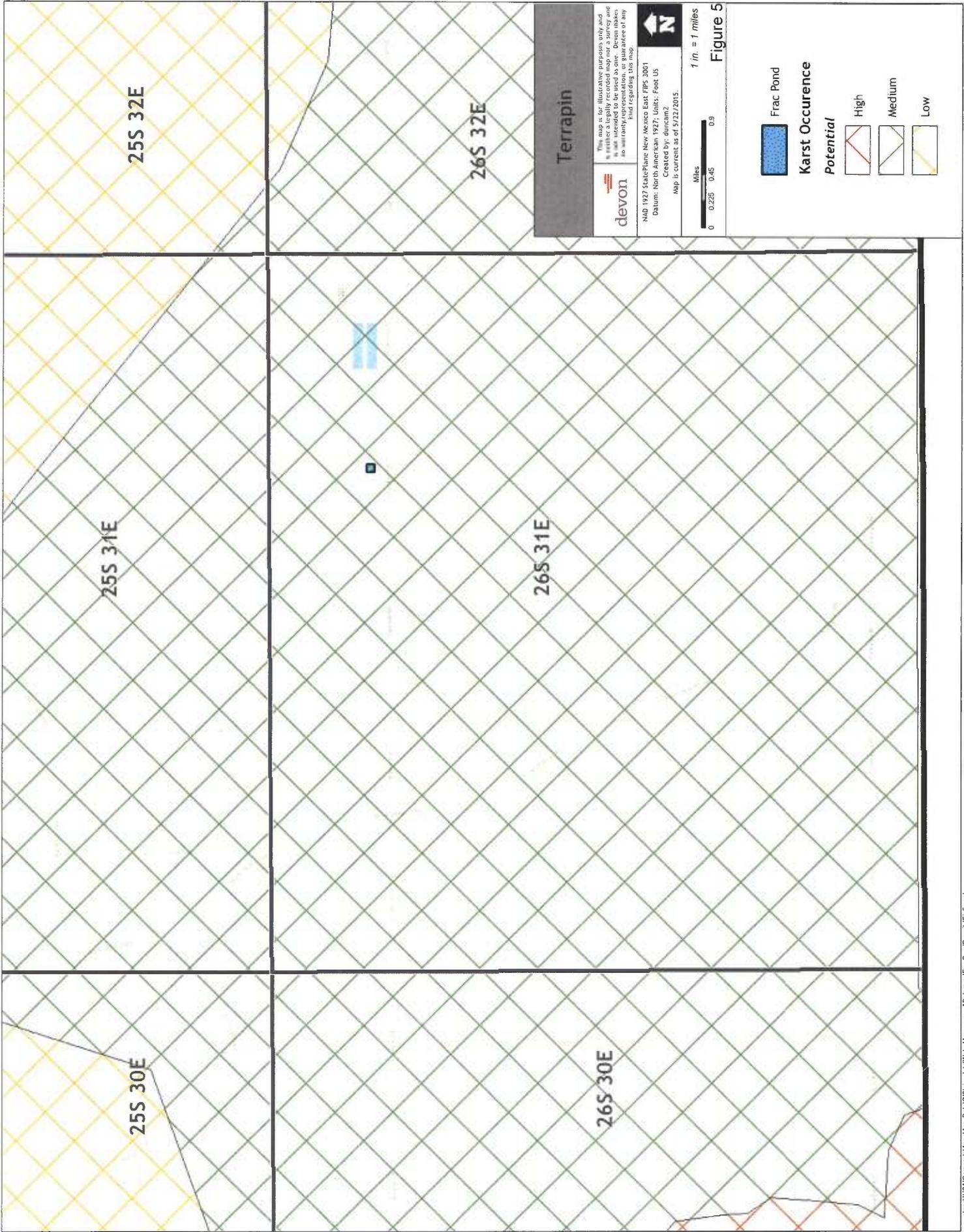
This map is for illustrative purposes only and is neither a legally recorded map nor a survey and should not be used for legal purposes. There are no warranties, representations, or guarantees of any kind regarding this map.

NAD 1927 StatePlane New Mexico East FIPS 3001
 Datum: North American 1927; Units: Foot US
 Created by: duncam2
 Map is current as of 5/22/2015.

1 in. = 8.2 miles

0 2.25 4.5 9 Miles

Figure 4



Terrapin

devon

This map is for illustrative purposes only and is neither a legally recorded map nor a survey and should not be used as one. Devon makes no warranty, representation or assurance of any kind regarding this map.

NAD 1927 StatePlane New Mexico East FIPS 3001
 Datum: North American 1927, Units: Foot US
 Created by: duncan2
 Map is current as of 5/22/2015.

Miles
 0 0.225 0.45 0.9

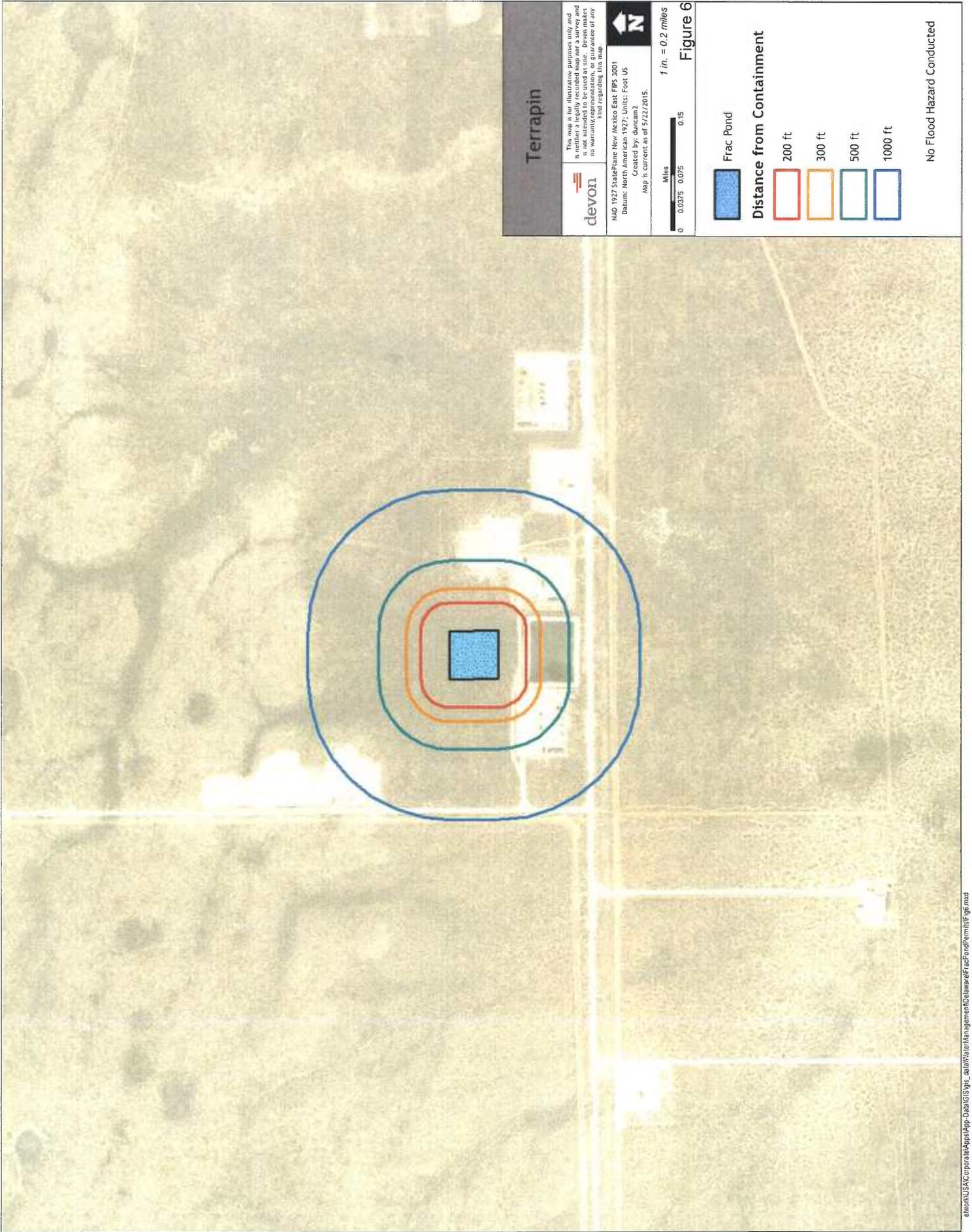
1 in. = 1 miles

Figure 5

Frac Pond

Karst Occurrence Potential

- High
- Medium
- Low



BORING LOG NO. B-4

PROJECT: SNAPPINGS WATER IMPOUNDMENT

**CLIENT: DEVON ENERGY CORPORATION
OKLAHOMA CITY, OK**

**SITE: EDDY COUNTY
CARLSBAD, NEW MEXICO**

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 32.06725° Longitude: -103.75386° Approximate Surface Elev: 3242 (Ft.) +/-	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	DEPTH							ELEVATION (Ft.)	
	SANDY LEAN CLAY (CL) , brown to red, stiff	5			8-5				
	10.0 POORLY GRADED SAND (SP) , brown, loose medium dense	10	X		1-1-4 N=5				
	dense	15	X		2-5-9 N=14				
	25.0 POORLY GRADED SAND (SP) , brown, very dense	25	X		7-12-23 N=35				
		30			8-15-25 N=40				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Figure 7

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS



Boring Started: 5/27/2015

Boring Completed: 5/27/2015

Drill Rig: CME 75

Driller: R. Sosa

Project No.: 68155065

Exhibit: A-7

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 68155065 SNAPPINGS.GPJ

BORING LOG NO. B-4

PROJECT: SNAPPINGS WATER IMPOUNDMENT

**CLIENT: DEVON ENERGY CORPORATION
OKLAHOMA CITY, OK**

**SITE: EDDY COUNTY
CARLSBAD, NEW MEXICO**

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 32.06725° Longitude: -103.75386° Approximate Surface Elev: 3242 (Ft.) +/- ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	
								LL-PL-PI	PERCENT FINES
DEPTH	POORLY GRADED SAND (SP) , brown, very dense <i>(continued)</i>	35		X	11-27-33 N=60				
		40		X	12-32-54 N=86				
		45		X	18-40-44 N=84				
		50		X	15-37-51 N=88				
		52.0	3190+/-	Auger refusal due to very dense carbonate indurated soils at 52 Feet					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).

Notes:

Figure 7

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Exhibit: A-7

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_68155065 SNAPPINGS.GPJ

Site Survey

DESCRIPTION

Being a 8.68 acre tract of land situated in Eddy County, New Mexico, and being a portion of the SW ¼ of Section 2, Township 26 South, Range 31 East, New Mexico Principal Meridian, and being more particularly described as follows:

COMMENCING at a found General Land Office brass cap for the west ¼ corner of said Section 2, from which a found General Land Office brass cap for the northwest corner of said Section 16 bears North 00 degrees 16 minutes 36 seconds West, a distance of 2665.85 feet;

THENCE South 21 degrees 27 minutes 34 seconds East, across said SW ¼ of Section 2, a distance of 2281.70 feet to the southwest corner and POINT OF BEGINNING of the herein described tract;

THENCE North 00 degrees 26 minutes 25 seconds West, a distance of 630.00 feet to the northwest corner of the herein described tract;

THENCE North 89 degrees 33 minutes 35 seconds East, a distance of 600.00 feet to the northeast corner of the herein described tract;

THENCE South 00 degrees 26 minutes 25 seconds East, a distance of 630.00 feet to the southeast corner of the herein described tract;

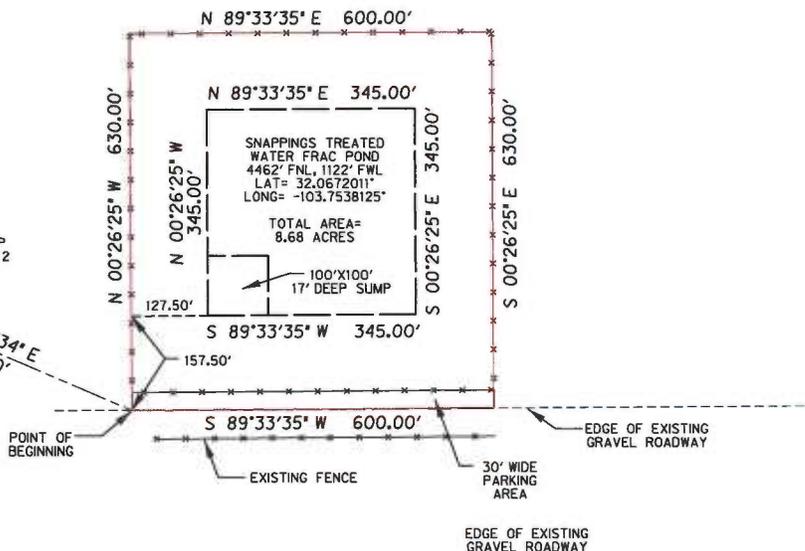
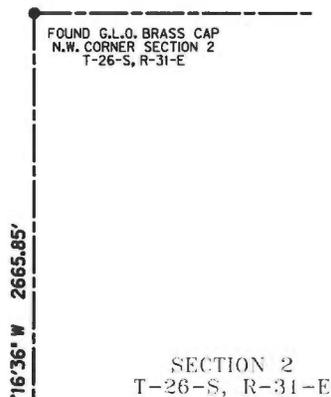
THENCE North 89 degrees 33 minutes 35 seconds West, a distance of 600.00 feet to the POINT OF BEGINNING, and containing 8.68 acres of land, more or less.

CERTIFICATION

I, TIM C. PAPPAS, NEW MEXICO PROFESSIONAL LAND SURVEYOR NO. 21209, DO HEREBY CERTIFY THAT THIS EASEMENT SURVEY PLAT AND THE ACTUAL SURVEY ON THE GROUND UPON WHICH IT IS BASED WERE PERFORMED BY ME OR UNDER MY DIRECT SUPERVISION; THAT I AM RESPONSIBLE FOR THIS SURVEY; THAT THIS SURVEY MEETS THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO; AND THAT IT IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF. I FURTHER CERTIFY THAT THIS SURVEY IS NOT A LAND DIVISION OR SUBDIVISION AS DEFINED IN THE NEW MEXICO SUBDIVISION ACT AND THAT THIS INSTRUMENT IS AN EASEMENT SURVEY PLAT CROSSING AN EXISTING TRACT OR TRACTS.

TIM C. PAPPAS, P.L.S. 21209 DATE:

8 MAY 2015



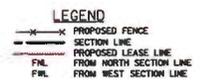
DEVON ENERGY CORPORATION
SNAPPINGS TREATED WATER FRAC POND
LOCATED IN
SECTION 2, T-26-S, R-31-E
N.M.P.M.
EDDY COUNTY, NEW MEXICO



DATED: 5/8/2015
BY: TIM C. PAPPAS

TBPLS FIRM NO. 10193998
HALFF ASSOCIATES, INC., ENGINEERS - SURVEYORS
4500 W Illinois Ave Ste 301 D - Midland, TEXAS - 79703
SCALE: 1"=200' (432)-695-6110 AVO. 30915-W002

NOTES:
THE BASIS OF BEARING IS THE NEW MEXICO COORDINATE SYSTEM OF 1983, EAST ZONE, AS DERIVED BY GPS MEASUREMENTS AND ADJUSTED WITH CORS STATIONS. DISTANCES SHOWN HEREON ARE SURFACE, BASED ON A COMBINED SCALE FACTOR OF 1.0002059 AS DERIVED FROM AN OPUS SOLUTION.
ALL GEOGRAPHIC COORDINATES SHOWN HEREON WERE CONVERTED USING CORPSCON VERSION 6.0.1.
UNLESS OTHERWISE NOTED, ALL MEASUREMENTS TO LEASE, UNIT, AND SURVEY LINES ARE PERPENDICULAR TO SAID LINES.
THIS SURVEY WAS PREPARED WITHOUT THE BENEFIT OF A TITLE REPORT.





0 1500 3000 4500 6000

SCALE: 1"=3000'

DEVON ENERGY CORPORATION
SNAPPINGS TREATED WATER FRAC POND
 LOCATED IN
SECTION 2, T-26-S, R-31-E
 N.M.P.M.
EDDY COUNTY, NEW MEXICO



DATED: 5/8/2015
 BY: TIM C. PAPPAS

TBPLS FIRM NO. 10193998
 HALFF ASSOCIATES INC., ENGINEERS - SURVEYORS
 4500 W Illinois Ave Ste 301 D- Midland, TEXAS - 79703
 SCALE: 1"=3000' (432)-695-6110 AVO. 30915-W002



LEGEND

- x—x— PROPOSED FENCE
- SECTION LINE
- PROPOSED LEASE LINE
- FWL FROM NORTH SECTION LINE
- FWL FROM WEST SECTION LINE

DIRECTIONS TO LOCATION

FROM INTERSECTION OF S.H. 128 AND COUNTY ROAD 1 (ORLA ROAD) WEST OF JAL, TRAVEL SOUTH ON COUNTY ROAD 1 FOR 10.3 MILES TO ROSS LANE ROAD ON RIGHT, TURN RIGHT (TRAVEL DUE WEST) ON ROSS LANE ROAD FOR 5.0 MILES TO A LEASE ROAD ON RIGHT, TURN RIGHT (TRAVEL NORTH) ON LEASE ROAD 0.1 MILE TO SITE.

SHEET 2 OF 4



DEVON ENERGY CORPORATION
SNAPPINGS TREATED
WATER FRAC POND
 LOCATED IN
SECTION 2, T-26-S, R-31-E
N.M.P.M.

EDDY COUNTY, NEW MEXICO

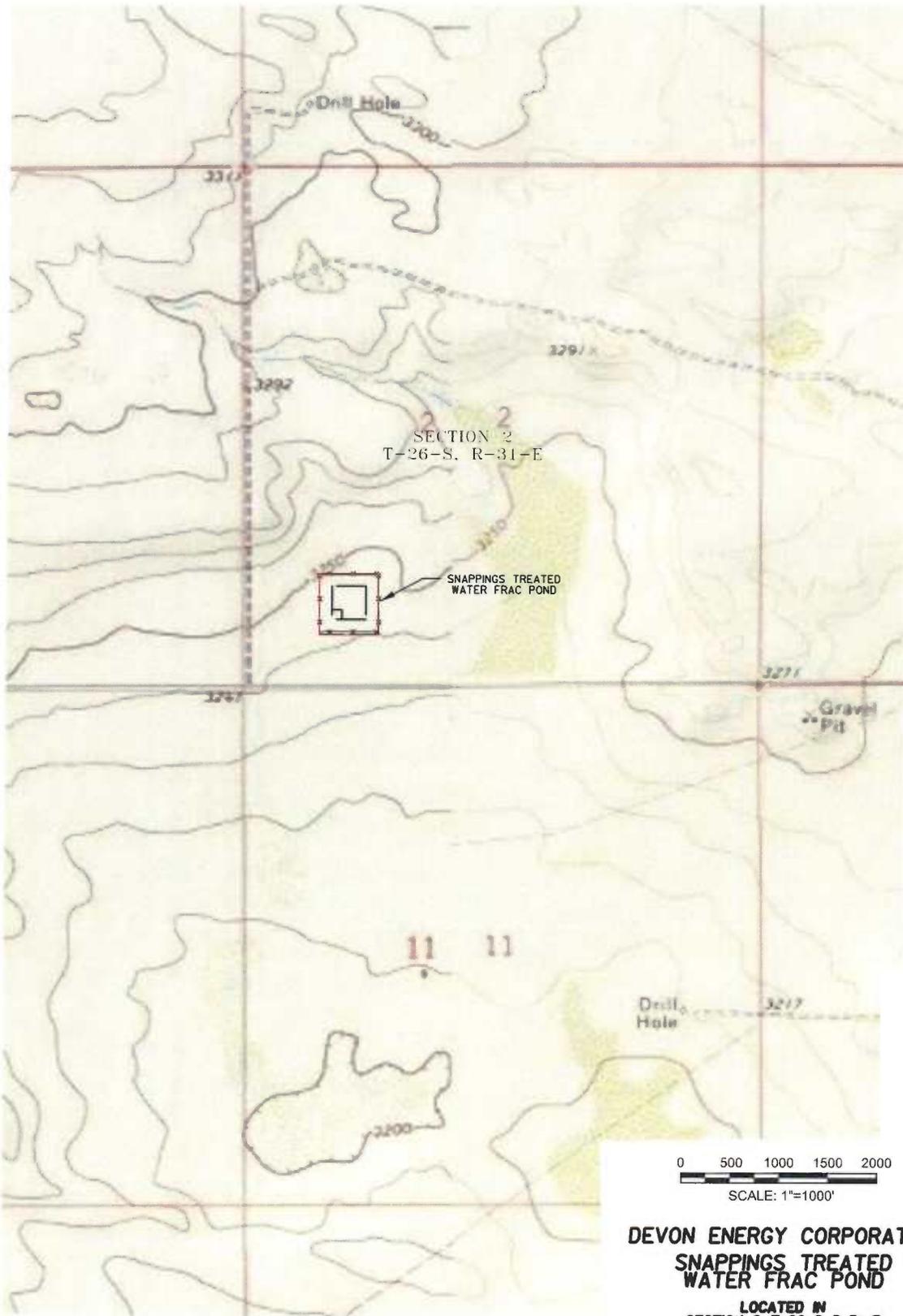


DATED: 5/8/2015
 BY: TIM C. PAPPAS

TBPLS FIRM NO. 10193998
 HALFF ASSOCIATES INC., ENGINEERS - SURVEYORS
 4500 W Illinois Ave Ste 301 D - Midland, TEXAS - 79703
 SCALE: 1"=1000' (432)-695-6110 AVO. 30915-W002

- LEGEND**
- PROPOSED FENCE
 - SECTION LINE
 - PROPOSED LEASE LINE
 - FILL FROM NORTH SECTION LINE
 - FILL FROM WEST SECTION LINE





SECTION 2
T-26-S, R-31-E

SNAPPINGS TREATED
WATER FRAC POND

**DEVON ENERGY CORPORATION
SNAPPINGS TREATED
WATER FRAC POND**

LOCATED IN
SECTION 2, T-26-S, R-31-E
N.M.P.M.

EDDY COUNTY, NEW MEXICO



DATED: 5/8/2015
BY: TIM C. PAPPAS

TBPLS FIRM NO. 10193998
HALFF ASSOCIATES INC., ENGINEERS - SURVEYORS
4500 W Illinois Ave Ste 301 D- Midland, TEXAS - 79703
SCALE: 1"=1000' (432)-695-6110 AVO. 30915-W002

- LEGEND**
- x-x- PROPOSED FENCE
 - - - SECTION LINE
 - - - PROPOSED LEASE LINE FROM NORTH SECTION LINE
 - FHL FROM NORTH SECTION LINE
 - FHL FROM WEST SECTION LINE



Appendix A

Engineering Drawings

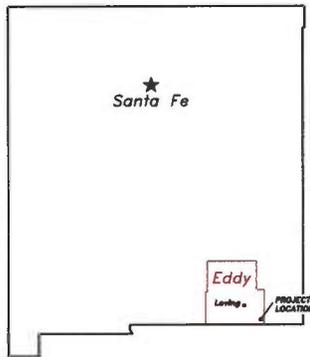
TERRAPIN PRODUCED WATER IMPOUNDMENT DEVON ENERGY CORPORATION

LOVING, NEW MEXICO 88256

MAY 2015



Vicinity Map

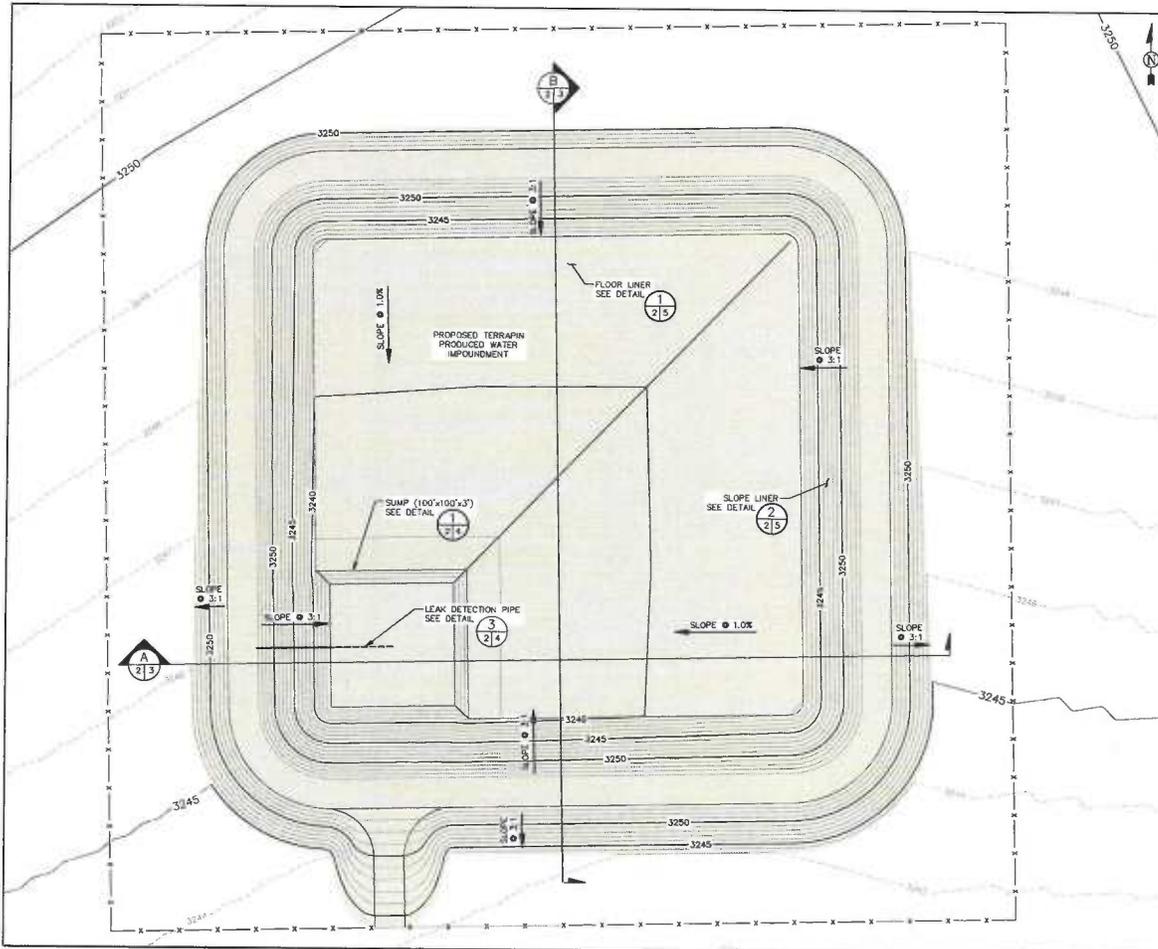


INDEX OF DRAWINGS	
SHT #	SHEET TITLE
1	AERIAL PROJECT OVERVIEW
2	PROPOSED SITE PLAN
3	PROPOSED POND SECTION VIEWS
4	SUMP DETAILS
5	PROJECT DETAILS
6	PROJECT DETAILS



PROJECT NO. DEVO-10020

ISSUED FOR CONSTRUCTION



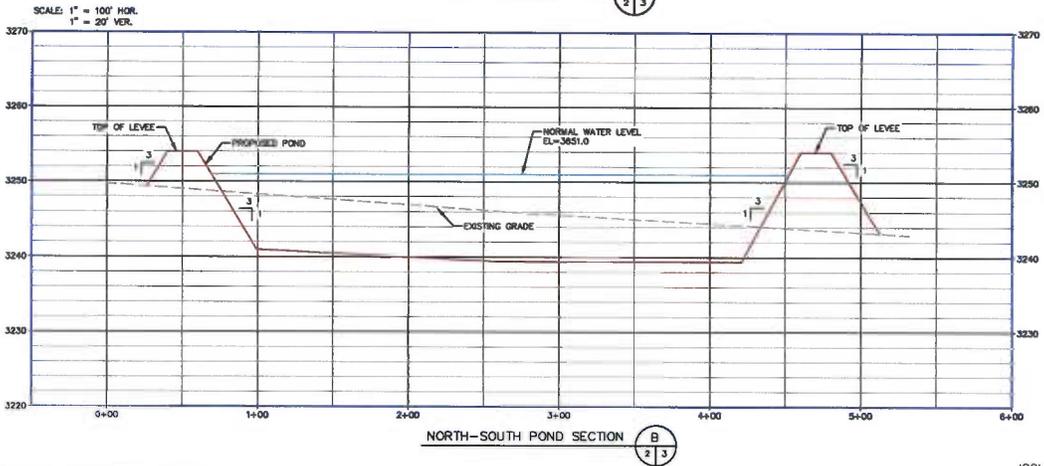
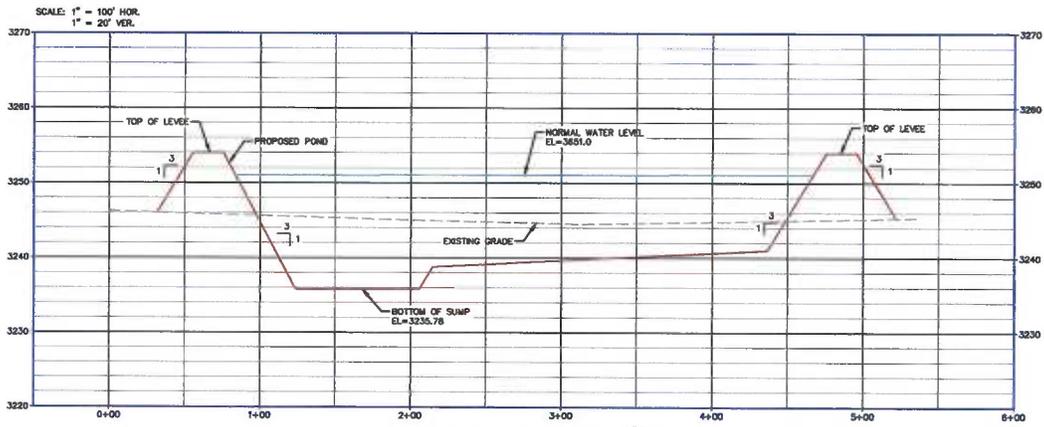
- NOTES:**
- EXISTING TOPOGRAPHY IS FROM USGS DIGITAL ELEVATION MODEL (DEM).
 - LOCATION OF EXISTING SITE ELEMENTS IS APPROXIMATE.
 - EXISTING UTILITIES ARE NOT SHOWN. CONTRACTOR IS RESPONSIBLE FOR LOCATING EXISTING UTILITIES PRIOR TO START OF ANY WORK. CONTRACTOR SHALL REPAIR ANY DAMAGE TO EXISTING UTILITIES DUE TO WORK PERFORMED UNDER THIS CONTRACT.
 - PROPOSED CONTOURS SHOWN ARE TOP OF SUBGRADE.
 - SLOPE FINISHED GRADE AWAY FROM TOP OF LEVEE.

- POND NOTES:**
- CAPACITIES:
TOTAL CAPACITY: 327,435 BBL
3' FREEBOARD CAPACITY: 246,463 BBL
 - BOTTOM OF SUMP ELEVATION IS 3235.78, OR 18.22 FEET FROM TOP OF LEVEE.

- LEGEND:**
- EXISTING MAJOR CONTOURS
 - EXISTING MINOR CONTOURS
 - PROPOSED MAJOR CONTOURS
 - PROPOSED MINOR CONTOURS
 - x- PROPOSED FENCE

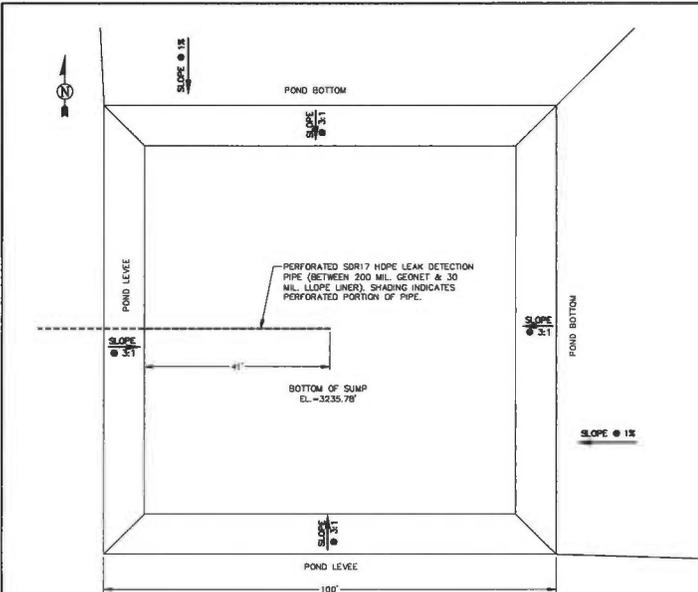
SCALE
0 60'

TERRAPIN PRODUCED WATER IMPOUNDMENT DEVON ENERGY CORPORATION	
PROPOSED SITE PLAN	REVISIONS
DATE: MAY 29, 2015	SCALE: 1" = 60'
DRAWN BY: [Name]	CHECKED BY: [Name]
DESIGNED BY: [Name]	APPROVED BY: [Name]
CIVIL ENGINEERING AND ENVIRONMENTAL SERVICES P.M.I. CONSULTANTS, INC. 1001 WEST 10TH STREET, SUITE 100 DENVER, CO 80202-3100 PHONE: (303) 733-1100 FAX: (303) 733-1172 WWW: WWW.PMI-CONSULTANTS.COM	
JOB NUMBER: DEVO-10020	SHEET NO.: 2
ISSUED FOR CONSTRUCTION	

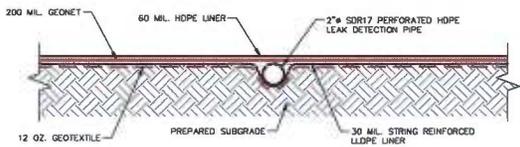


TERRAPIN PRODUCED WATER IMPOUNDMENT
DEVON ENERGY CORPORATION
LOVING, NEW MEXICO 88256

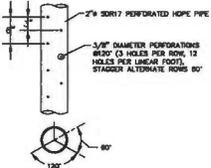
CIVIL ENGINEERING AND SURVEYING		PROPOSED POND SECTIONS	
DATE	SCALE	DATE	SCALE
MAY 29, 2015	1/8" = 1' AS NOTED		
DESIGNED BY	CHECKED BY	DATE	SCALE
JOB NUMBER: DEVO-10020		ISSUED FOR CONSTRUCTION	
SHEET NO. 3		3	



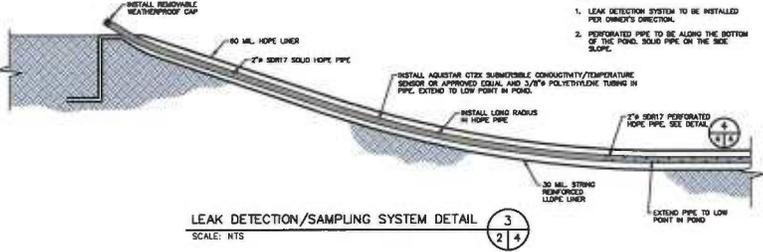
POND SUMP PLAN VIEW
SCALE: NTS



LEAK DETECTION PIPE DETAIL
SCALE: NTS



PERFORATED PIPE DETAIL
SCALE: NTS



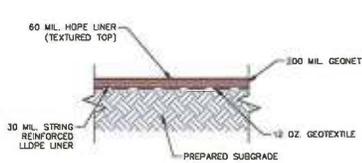
LEAK DETECTION/SAMPLING SYSTEM DETAIL
SCALE: NTS

- NOTES:
1. LEAK DETECTION SYSTEM TO BE INSTALLED PER OWNER'S DIRECTION.
 2. PERFORATED PIPE TO BE ALONG THE BOTTOM OF THE POND. SOLID PIPE ON THE SIDE SLOPE.

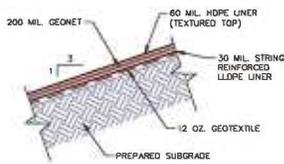
TERRAPIN PRODUCED WATER IMPOUNDMENT
DEVON ENERGY CORPORATION
LOYING, NEW MEXICO 88256

PROJECT TITLE		PROJECT DETAILS	
DATE	DESCRIPTION	DATE	DESCRIPTION
BY DATE	BY DATE	BY DATE	BY DATE
SCALE	SCALE	SCALE	SCALE
AS NOTED	AS NOTED	AS NOTED	AS NOTED
JOB NUMBER: DEV0-10030			
SHEET NO.: 4			

ISSUED FOR CONSTRUCTION



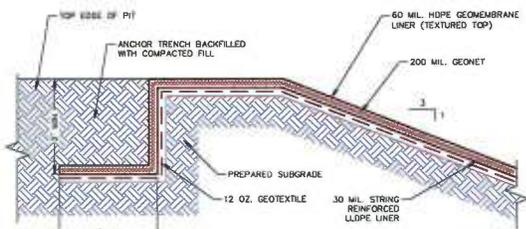
LINER SYSTEM FLOOR DETAIL (1)
SCALE: NTS (2 | 5)



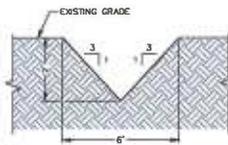
LINER SYSTEM SIDE SLOPE DETAIL (2)
SCALE: NTS (2 | 5)

GENERAL NOTES:

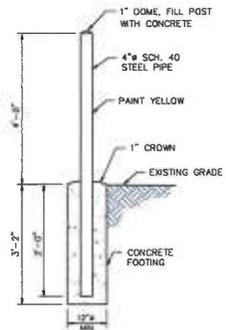
1. PREPARED SUBGRADE MEANS COMPACTED SMOOTH SUBGRADE FREE OF ROCK, ROOTS, WOOD DEBRIS, CONCRETE RUBBLE AND ANY SHARP OBJECTS THAT MIGHT PUNCTURE THE HDPE LINER.
2. IF SUBGRADE IS NOT FREE OF SHARP OBJECTS, THEN 18 OUNCE GEOTEXTILE MATERIAL SHALL BE INSTALLED UNDER ALL HDPE LINER.
3. ALL EMBANKMENT SLOPES SHALL HAVE A RATIO OF 3:1. COMPACTED EARTH EMBANKMENTS TO BE CONSTRUCTED WITH 12 INCH (MAXIMUM) LOOSE LIFTS, COMPACTED TO 90% STANDARD PROCTOR DENSITY.
4. PERFORM GEOTECHNICAL ANALYSIS OF EXISTING SOIL TO CONFIRM SOIL IS SUITABLE FOR USE IN THE LEVEE.



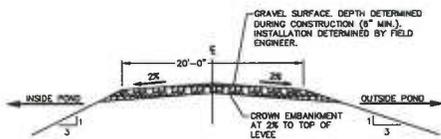
ANCHOR TRENCH DETAIL (3)
SCALE: NTS (2 | 5)



TYPICAL DRAINAGE SWALE DETAIL (4)
SCALE: NTS (2 | 5)



PIPE BOLLARD DETAIL (5)
SCALE: NTS (2 | 5)



TYPICAL CREST DETAIL (6)
SCALE: NTS (2 | 5)

TERRAPIN PRODUCED WATER IMPOUNDMENT
DEVON ENERGY CORPORATION
LOVING, NEW MEXICO 88256

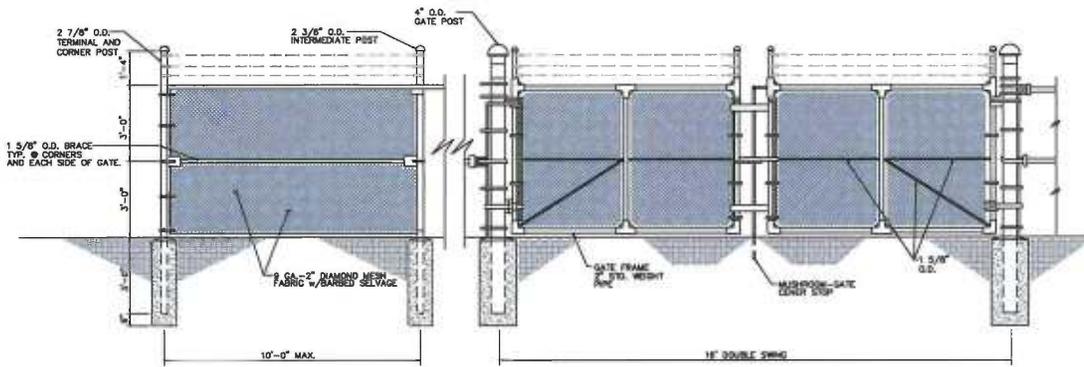
PROJECT DETAILS
REVISIONS

NO.	DATE	DESCRIPTION
1	DATE: MAY 20, 2015	SCALE: AS NOTED

JOB NUMBER
DEW-10030

ISSUED FOR CONSTRUCTION

SHEET NO. 5



FENCE/DBL SWING GATE DETAIL
SCALE: NTS

1
2 6

TERRAPIN PRODUCED WATER IMPROVEMENT
DEVON ENERGY CORPORATION

LOVING, NEW MEXICO 86256

PROJECT DETAILS

DATE: MAY 23, 2015

SCALE: AS NOTED

JOB NUMBER:
DEV-10036

ISSUED FOR CONSTRUCTION SHEET No. 6

Appendix B

Design and Construction Plan

Design and Construction Plan

Applicable mandates in Rule 34 are underlined. This plan addresses construction of lined earthen containments. Appendix A presents Engineering Design Plans. Appendix C provides liner and geotextile specifications.

Field conditions may create the need for minor modification of the containment design (e.g. changing the length, width or depth).

Dike Protection and Structural Integrity

Design elements are addressed in the section of this submission containing the foundation recommendations. The recommendations are based on site-specific data. The operator, engineer, and selected contractor will review the recommendations prior to beginning the earthwork and adhere to the specific recommendations.

The design and operation provide for the confinement of produced water, to prevent releases and to prevent overtopping due to wave action or rainfall. Additionally, the design prevents run-on of surface water as the containment is surrounded by an above-grade levee (berm) and diversion ditch to prevent run-on of surface water.

Stockpile Topsoil

Where topsoil is present, prior to constructing containment, the operator will strip and stockpile the topsoil for use as the final cover or fill at the time of closure. The topsoil will be stockpiled adjacent to perimeter fence surrounding the containment or incorporated into the levee.

Signage

The design calls for an upright sign no less than 12 inches by 24 inches with lettering not less than two inches in height in a conspicuous place on the fence surrounding the containment. The sign is posted in a manner and location such that a person can easily read the legend. The sign will provide the following information:

- the operator's name,
- the location of the site by quarter-quarter or unit letter, section, township and range, and
- emergency telephone numbers

Fencing

The design provides for a fence to enclose the recycling containment in a manner that deters unauthorized wildlife and human access. The design calls for a 7-foot tall chain link and barbed wire fence around the containment to exclude wildlife (see detail on last page of engineering design). This fence provides greater wildlife (and human) deterrence than the minimum required barbed wire fence with four strands evenly spaced in the interval between one foot and four feet above ground level. The fence will be gated to provide access for maintenance and placement of pumps and other necessary equipment. As stated

in the O&M plan, the operator will ensure that all gates associated with the fence are closed and locked when responsible personnel are not onsite.

Netting and Protection of Wildlife

The game fence on the containment levee will be effective in excluding antelope, coyotes and most other terrestrial wildlife.

The containment will contain *treated* produced water that has not shown to be a material threat to birds due to hydrogen sulfide gas or floating, free-phase hydrocarbons. With respect to protection of birds, the operator will regularly inspect the lined earthen containment and report, within 30 days of discovery, any migratory or wildlife death to the appropriate wildlife agency as required by OCD Rules.

An Avian Protection Plan will be implemented by CEHMM as described in detail in the following section.

Thus, the recycling containment is otherwise protective of wildlife, including migratory birds. The O&M plan calls for the operator to inspect for and, within 30 days of discovery, report the discovery of dead migratory birds or other wildlife to the appropriate wildlife agency and to the division district office in order to facilitate assessment and implementation of measures to prevent incidents from reoccurring

As part of this plan, a geotechnical investigation will be performed to provide recommendations regarding the foundation for the containment liner (see following section). The containment will have a properly constructed foundation and interior slopes consisting of a firm, unyielding base, smooth and free of rocks, debris, sharp edges or irregularities to prevent the liner's rupture or tear. Geotextile may be placed under the liner when needed to reduce localized stress-strain or protuberances that otherwise may compromise the liner's integrity.

Appendix A shows the

- a. levee has inside grade no steeper than two horizontal feet to one vertical foot (2H: 1V).
- b. levee outside grade is no steeper than three horizontal feet to one vertical foot (3H: 1V)
- a. top of the levee is wide enough to install an anchor trench and provide adequate room for inspection and maintenance..
- b. caliche gravel placed on the outside levee provides additional erosion control.
- c. The containment is excavated into the ground such that most of fluid force lies against native earth and the engineered foundation (see Appendix A and forthcoming geotechnical report with foundation recommendations)

Field conditions may create the need for changes to the design. Any changes to the construction or grade requirements due to unforeseen conditions will be reviewed and approved prior to initiating installation of the liner system. Any design change that does not conform to the NMOCD Rule will be the subject of a variance request and will be submitted to the OCD for review and approval.

LINER AND DRAINAGE GEOTEXTILE INSTALLATION

The containment has a primary (upper) liner and a secondary (lower) liner with a leak detection system appropriate to the site's conditions.

The primary (upper) liner is a geomembrane liner composed of an impervious, synthetic material that is resistant to ultraviolet light, petroleum hydrocarbons, salts and acidic and alkaline solutions. It is 60-mil HDPE. The secondary liner is 30-mil LLDPE string reinforced. Liner compatibility meets or exceeds a subsequent relevant publication to EPA SW -846 method 9090A.

The recycling containment design has a leak detection system between the upper and lower geomembrane liners of 200-mil geonet to facilitate drainage. The leak detection system consists of a properly designed drainage and collection and removal system placed above the lower geomembrane liner in depressions and sloped to facilitate the earliest possible leak detection. The containment floor design calls for a slope of approximately 1% toward the sump in the northeast corner. This slope combined with the highly transmissive geonet drainage layer provide for the earliest possible leak detection.

The liners and drainage material will be installed consistent with the Manufacturer's specifications (See Appendix C). In addition to any specifications of the Manufacturer, protocols for liner installation include measures to:

- i. minimizing liner seams and orient them up and down, not across, a slope of the levee.
- ii. use factory welded seams where possible.
- iii. use field seams in geosynthetic material are thermally seamed and prior to field seaming, overlap liners four to six inches.
- iv. minimize the number of field seams and comers and irregularly shaped areas.
- v. provide for no horizontal seams within five feet of the slope's toe.
- vi. use qualified personnel to perform field welding and testing.
- vii. avoid excessive stress-strain on the liner
- viii. The edges of all liners are anchored in the bottom of a compacted earth-filled trench that is at least 18 inches deep

At points of discharge into the lined earthen containment the pipe configuration (see Appendix A) effectively protects the liner from excessive hydrostatic force or mechanical damage during filling.

The design show that at any point of discharge into or suction from the recycling containment, the liner is protected from excessive hydrostatic force or mechanical damage. External discharge or suction lines do not penetrate the liner.

Pumping from the containment to hydraulic fracturing operations is the responsibility of stimulation contractors. Typically, numerous lines are permanently placed in the containment with floats attached to prevent damage to the liner system. The containment may be equipped with permanent HDPE stinger (supported by a sacrificial liner or geotextile) for withdrawal of fluid if the owner deems necessary during operations.

External discharge or suction lines do not penetrate the liner.

LEAK DETECTION AND FLUID REMOVAL SYSTEM INSTALLATION

The leak detection system, contains the following design elements

- a. The 200-mil Hypernet drainage material between the primary and secondary liner that is sufficiently permeable to allow the transport of fluids to the observation ports (Appendices A and G).
- b. The containment floor is sloped towards the monitoring riser pipe facilitate the earliest possible leak detection of the containment bottom. A pump may be placed in an observation port to provide for fluid removal.
- c. Piping will withstand chemical attack from any seepage; structural loading from stresses and disturbances from overlying water, cover materials, equipment operation or expansion or contraction (see Appendix A).
- d. The slope of the interior sub-grade is approximately 1%

Appendix C

Material Specifications

GSE HyperNet Geonet

GSE HyperNet geonet is a synthetic drainage material manufactured from a premium grade high density polyethylene (HDPE) resin. The structure of the GSE HyperNet geonet is formed specifically to transmit fluids uniformly under a variety of field conditions. The geonet is formulated to be resistant to ultraviolet light for a period of time necessary to complete the installation.



AT THE CORE:
A synthetic geonet engineered specifically to transmit fluids consistently under a variety of field conditions.

Product Specifications

Tested Property	Test Method	Frequency	Minimum Average Roll Value			
			HyperNet	HyperNet HF	HyperNet HS	HyperNet UF
Transmissivity ⁽¹⁾ , gal/min/ft (m ² /sec)	ASTM D 4716	1/540,000 ft ²	9.66 (2 x 10 ⁻³)	14.49 (3 x 10 ⁻³)	28.98 (6 x 10 ⁻³)	38.64 (8 x 10 ⁻³)
Density, g/cm ³	ASTM D 1505	1/50,000 ft ²	0.94	0.94	0.94	0.94
Tensile Strength (MD), lb/in	ASTM D 5035/7179	1/50,000 ft ²	45	55	65	75
Carbon Black Content, %	ASTM D 1603 ⁽²⁾ /4218	1/50,000 ft ²	2.0	2.0	2.0	2.0
NOMINAL ROLL DIMENSIONS						
Geonet Thickness, mil	ASTM D 5199	1/50,000 ft ²	200	250	275	300
Roll Width ⁽²⁾ , ft			15	15	15	15
Roll Length ⁽²⁾ , ft			330	290	270	250
Roll Area, ft ²			4,950	4,350	4,050	3,750

NOTES:

- ⁽¹⁾Gradient of 0.1, normal load of 10,000 psf, water at 70° F, between steel plates for 15 minutes. Contact GSE for performance transmissivity value for use in design.
- ⁽²⁾Roll widths and lengths have a tolerance of ±1%.
- ⁽³⁾Modified.

GSE is a leading manufacturer and marketer of geosynthetic lining products and services. We've built a reputation of reliability through our dedication to providing consistency of product, price and protection to our global customers.

Our commitment to innovation, our focus on quality and our industry expertise allow us the flexibility to collaborate with our clients to develop a custom, purpose-fit solution.



For more information on this product and others, please visit us at GSEworld.com, call 800.435.2008 or contact your local sales office.



Mirafi® 160N



Mirafi® 160N is a needlepunched nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. Mirafi® 160N is inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids. Mirafi® 160N meets AASHTO M288-06 Class 2 for Elongation > 50%.

TenCate Geosynthetics Americas Laboratories are accredited by a2La (The American Association for Laboratory Accreditation) and Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP). NTPEP Number: GTX-2012-01-003

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Grab Tensile Strength	ASTM D4632	lbs (N)	160 (712)	160 (712)
Grab Tensile Elongation	ASTM D4632	%	50	50
Trapezoid Tear Strength	ASTM D4533	lbs (N)	60 (267)	60 (267)
CBR Puncture Strength	ASTM D6241	lbs (N)	410 (1825)	
Apparent Opening Size (AOS) ¹	ASTM D4751	U.S. Sieve (mm)	70 (0.212)	
Permittivity	ASTM D4491	sec ⁻¹	1.5	
Flow Rate	ASTM D4491	gal/min/ft ² (l/min/m ²)	110 (4481)	
UV Resistance (at 500 hours)	ASTM D4355	% strength retained	70	

¹ ASTM D4751: AOS is a Maximum Opening Diameter Value

Physical Properties	Unit	Typical Value ²
Roll Dimensions (width x length)	ft (m)	15 x 300 (4.5 x 91)
Roll Area	yd ² (m ²)	500 (418)
Estimated Roll Weight	lb (kg)	199 (90)

² ASTM D4439 Standard Terminology for Geosynthetics: typical value, *n*—for geosynthetics, the mean value calculated from documented manufacturing quality control test results for a defined population obtained from one test method associated with on specific property.

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365 South Holland Drive
Pendergrass, GA 30567

Tel 706 693 2226
Tel 888 795 0808

Fax 706 693 4400
www.tencate.com

FGS000361
ETQR83

Brawley Industries, LLC
PO Box 60004
Midland, TX 79711



TENCATE
materials that make a difference

Testing Lab 1291.01 & 1291.02

DURA-SKRIM® K30B, K36B & K45B

Scrim Reinforced Polyethylene - NSF/ANSI Standard 61 Certified



Product Description

DURA-SKRIM® K30B, K36B and K45B are linear low density polyethylene geomembranes reinforced with a heavy dense scrim reinforcement. In addition to excellent dimensional stability the K-Series reinforcement provides unmatched tear and tensile strength. DURA-SKRIM® K-Series membranes are formulated with thermal and UV stabilizers to assure a long service life.

Product Use

DURA-SKRIM® K30B, K36B and K45B are used in applications that require exceptional outdoor life and demand high tear strength and resistance to thermal expansion.

DURA-SKRIM® K30B, K36B and K45B are manufactured from a very chemical-resistant, Linear Low Density Polyethylene with excellent cold crack performance. The DURA-SKRIM®, K30B, K36B & K45B are certified under the NSF/ANSI Standard 61, Drinking Water System Components - Health Effects.



Size & Packaging

DURA-SKRIM® K30B, K36B and K45B are available in a variety of widths and lengths to meet the project requirements. Large diameter mill rolls are available to assure an efficient seaming process. Factory welded panels are accordion folded and tightly rolled on a heavy-duty core for ease of handling and time saving installation.



Containment Liner

Product	Part #
DURA-SKRIM	K30B
DURA-SKRIM	K36B
DURA-SKRIM	K45B

APPLICATIONS

Waste Lagoon Liners	Remediation Covers
Floating Covers	Landfill Caps
Daily Landfill Covers	Erosion Control Covers
Modular Tank Liners	Canal Liners
Tunnel Liners	Disposal Pit Liner
Remediation Liners	Water Containment Ponds
Earthen Liners	Heap Leach Liner
Interim Landfill Covers	Secondary Containment Fertilizer

DURA-SKRIM® K30B, K36B & K45B



Scrim Reinforced Polyethylene - NSF/ANSI Standard 61 Certified

PRO-FORMA DATA SHEET		DURA-SKRIM K30B		DURA-SKRIM K36B		DURA-SKRIM K45B	
PROPERTIES	TEST METHOD	Minimum Roll Averages	Typical Roll Averages	Minimum Roll Averages	Typical Roll Averages	Minimum Roll Averages	Typical Roll Averages
APPEARANCE		Black	Black	Black	Black	Black	Black
THICKNESS		27 mil	30 mil	32 mil	36 mil	40 mil	45 mil
WEIGHT LBS/MSF, (OZ/YD ²)		116 (16.7)	125 (18.0)	136 (19.6)	155 (22.3)	175 (25.2)	200 (28.8)
CONSTRUCTION		Dense scrim reinforced polyethylene					
*PLY ADHESION - LBF/IN	ASTM D 6636	17 or FTB	20 or FTB	21 or FTB	28 or FTB	24 or FTB	32 or FTB
TENSILE STRENGTH - LBF/IN	ASTM D 7003	165 MD 159 TD	182 MD 170 TD	170 MD 166 TD	186 MD 175 TD	178 MD 170 TD	195 MD 180 TD
TENSILE ELONGATION AT BREAK % (FILM BREAK)	ASTM D 7003	480 MD 430 TD	540 MD 500 TD	500 MD 450 TD	575 MD 520 TD	520 MD 470 TD	590 MD 550 TD
TENSILE ELONGATION AT BREAK % (SCRIM BREAK)	ASTM D 7003	32 MD 32 TD	35 MD 35 TD	32 MD 32 TD	35 MD 35 TD	32 MD 32 TD	35 MD 35 TD
TONGUE TEAR STRENGTH - LBF	ASTM D 5884	185 MD 160 TD	195 MD 185 TD	160 MD 120 TD	180 MD 140 TD	140 MD 120 TD	175 MD 145 TD
GRAB TENSILE - LBF (SCRIM BREAK)	ASTM D 7004	260 MD 245 TD	270 MD 255 TD	280 MD 270 TD	300 MD 290 TD	260 MD 245 TD	270 MD 255 TD
GRAB TENSILE ELONGATION AT BREAK % (SCRIM BREAK)	ASTM D 7004	25	32	25	32	25	32
HIGH PRESSURE OIT (HPOIT)	ASTM D 5885	1000 min	2400 min	1000 min	2400 min	1000 min	2400 min
PUNCTURE RESISTANCE - LBF	ASTM D 4833	85	100	110	120	120	133
MAXIMUM USE TEMPERATURE		180° F		180° F		180° F	
MINIMUM USE TEMPERATURE		-70° F		-70° F		-70° F	

*Raven modified QC procedure

PRO-FORMA Sheet Contents:

The data listed in this Pro-Forma data sheet is representative of initial production runs. These values may be revised at anytime without notice as additional test data becomes available.



DURA-SKRIM® K30B, K36B and K45B are linear low density polyethylene geomembranes reinforced with a heavy dense scrim reinforcement. In addition to excellent dimensional stability the K-Series reinforcement provides unmatched tear and tensile strength. DURA-SKRIM® K-Series membranes are formulated with thermal and UV stabilizers to assure a long service life.

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



Scan QR Code to download current technical data sheets via the Raven website.



Engineered Films Division
P.O. Box 5107
Sioux Falls, SD 57117-5107
Ph: (605) 335-0174 • Fx: (605) 331-0333

Toll Free: 800-635-3456
Email: efdsales@ravenind.com
www.ravenefd.com
1/11 EFD 1251

Appendix A

REINFORCED POLYETHYLENE GEOMEMBRANE SPECIFICATION

Reinforced Polyethylene Geomembranes serve as liners and covers to contain water, leachate or other liquids. As a liner they can contain the liquid to prevent leakage or environmental impact and as a cover to minimize evaporation or contamination. It is of great importance that the Reinforced Polyethylene Geomembrane be free from defects and installed without damage.

A. DESCRIPTION

1. General:

The purpose of this specification is to provide details of Manufacturing Quality Control (MQC), Manufacturing Quality Assurance (MQA), Construction Quality Control (CQC), and Construction Quality Assurance (CQA) for the manufacture and pre-assembly of geomembrane products. The Contractor shall furnish all labor, material, and equipment to install the Reinforced Polyethylene Geomembrane including all necessary and incidental items as detailed or required to complete the installation in accordance with the Contract Drawing and these Specifications

2. Related Work:

Related Contract Work is described in the following section of the specification as approved by the CQA Engineer.

3. Reference Standards:

ASTM D5199 *Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.*

ASTM D5261 *Standard Test Method for Measuring Mass per Unit Area of Geotextiles.*

ASTM D6636 *Standard Test Method for Determination of Ply Adhesion Strength of Reinforced Geomembranes.*

ASTM D7003 *Standard Test Method for Strip Tensile Properties of Reinforced Geomembranes.*

ASTM D5884 *Standard Test Method for Determining Tearing Strength of Internally Reinforced Geomembranes.*

ASTM D7004 *Standard Test Method for Grab Tensile Properties of Reinforced Geomembranes.*

ASTM D4533 *Standard Test Method for Trapezoid Tearing Strength of Geotextiles.*

ASTM D4833 *Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.*

4. Quality Assurance:

Quality Assurance during installation of Reinforced Polyethylene Geomembrane will be provided by the Owner as described in the accompanying Project CQA Manual.

5. Manufacturers Qualifications:

- a. The Manufacturer shall have previously demonstrated his ability to produce the required Reinforced Polyethylene Geomembrane by having successfully manufactured a minimum of 10,000,000 ft² of scrim reinforced Polyethylene Geomembrane.
- b. Manufacturer must be ISO 9001 certified

6. Installer Qualifications:

The Reinforced Polyethylene Geomembrane Installer shall have installed a minimum of 500,000 ft² of Reinforced Polyethylene Geomembrane (or similar material).

7. Warranties:

The manufacturer of the Reinforced Polyethylene Geomembrane will warrant the material to the installer on a pro rata basis for up to 20 years after the final acceptance of the work, based on thickness of product, the application and location of the installation. This warranty shall include but not be limited to defects related to workmanship and manufacturing.

B. MATERIALS

1. General:

The materials supplied under these Specifications shall consist of first-quality 100% virgin products designed and manufactured specifically for the purpose of this work, which shall have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes.

2. Reinforced Polyethylene Geomembrane Materials:

- a. Reinforced Polyethylene Geomembrane shall be manufactured to meet the following requirements:
 - (1) Provide finished product free from holes, pin holes, bubbles, blisters, excessive gels, undispersed resins and/or carbon black, or contamination by foreign matter.
 - (2) Reinforced Polyethylene Geomembrane shall be a Linear Low Density Polyethylene Geomembrane composed of a heavy encapsulated 1300 denier polyester tri-directional reinforcement for the 30 ml geomembrane and bi-directional for the 36ml and 45ml geomembrane.
- b. Approved Reinforced Polyethylene Geomembrane:
 - (1) Dura-Skrim J30BB
Dura-Skrim K36B
Dura-Skrim K45B

As manufactured by Raven Industries of Sioux Falls, SD.
 - (2) Equal material, as approved by the Engineer.

C. FACTORY FABRICATION

1. The Reinforced Polyethylene Geomembrane shall be supplied in panels which shall be of maximum size to provide the largest manageable sheet for the fewest seams.
2. Factory seams are produced by thermal sealing methods and shall have a minimum seam width of 1 ½ inch scrim to scrim.
3. Factory seams are 100% visually inspected and destructive testing is done to verify quality compliance.
4. Labels on the panels shall identify the thickness, length, width, lot and panel numbers, and name of Manufacturer.
5. Factory pre-assembled panels are accordion folded and rolled on a cardboard core. Rolled panels are wrapped in a protective layer for shipment.

D. SUBMITTALS

The Contractor shall submit the following to the CQA Engineer:

1. Pre-Installation Requirements:

Prior to Reinforced Polyethylene Geomembrane installation the Contractor shall submit the following:

- a. Certificate of Conformance and Sample: Prior to shipping to the site, the Contractor shall submit a certificate or affidavit signed by a legally authorized official of the Manufacturer for the Reinforced Polyethylene Geomembrane attesting that the Reinforced Polyethylene Geomembrane meets the physical and manufacturing requirements stated in these Specifications. The Contractor shall also submit a sample of the Reinforced Polyethylene Geomembrane to be used (sample may be of different color). The sample shall be labeled with the product name and be accompanied by the Manufacturer's specifications.
- b. Shipping, Handling, and Storage Instructions: The Manufacturer's plan for shipping, handling, and storage shall be submitted for review.
- c. Installation Procedures:

Submit installation procedures for carrying out the work. Installation procedures to be addressed shall include but not be limited to material installation, repair, and protection to be provided in the event of rain or strong winds. With regard to protection, the Contractor shall provide a plan of anchoring the Reinforced Polyethylene Geomembrane sufficient to satisfy the Contractor's Performance Warranty. This plan shall be approved by the Engineer prior to construction.
- d. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into the construction.

2. Post-Installation Requirements:

Upon completion of the Reinforced Polyethylene Geomembrane installation, the Contractor shall submit the following:

- a. Completed material performance warranty.

E. SITE PREPERATION AND INSTALLATION

1. Installation shall be in done in accordance with the manufactures Geomembrane Installation Guidelines.

**TABLE 1:
REQUIRED REINFORCED POLYETHYLENE GEOMEMBRANE
PROPERTIES 30 MIL.**

PROPERTY	TEST METHOD	UNITS	MIMUMUM ROLL AVERAGES	TYPICAL ROLL AVERAGES
Thickness	ASTM D5199	Mils	27	30
Weight	ASTM D5261	Lbs.	126	140
Ply Adhesion	ASTM D6636	Lbs.	16	20
1" strip tensile	ASTM D7003	Lbf.	88 MD 63 DD	110 MD 79 DD
Tongue Tear	ASTM D5884	Lbf.	75 MD 75 DD	97 MD 90 DD
Grab Tensile Strength	ASTM D7004	Lbf.	180 MD 180 DD	218 MD 210 DD
Trap Tear	ASTM D4533	Lbf.	120 MD 120 DD	146 MD 141 DD
Puncture Resistance	ASTM D4833	Lbf.	50	64

MD Machine Direction DD Diagonal Direction

**TABLE 2:
REQUIRED REINFORCED POLYETHYLENE GEOMEMBRANE
PROPERTIES 36 MIL.**

PROPERTY	TEST METHOD	UNITS	MIMUMUM ROLL AVERAGES	TYPICAL ROLL AVERAGES
Thickness	ASTM D5199	Mils	32	36
Weight	ASTM D5261	Lbs.	156	173
Ply Adhesion	ASTM D6636	Lbs.	31	34
1" strip tensile	ASTM D7003	Lbf.	183 MD 165 DD	201 MD 180 DD
Tongue Tear	ASTM D5884	Lbf.	112 MD 96 DD	122 MD 106 DD
Grab Tensile Strength	ASTM D7004	Lbf.	340 MD 325 DD	354 MD 338 DD

Puncture Resistance	ASTM D4833	Lbf.	138	153
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MD Machine Direction DD Diagonal Direction

**TABLE 3:
REQUIRED REINFORCED POLYETHYLENE GEOMEMBRANE
PROPERTIES 45 MIL.**

PROPERTY	TEST METHOD	UNITS	MIMUMUM ROLL AVERAGES	TYPICAL ROLL AVERAGES
Thickness	ASTM D5199	Mils	40	45
Weight	ASTM D5261	Lbs.	198	220
Ply Adhesion	ASTM D6636	Lbs.	34	38
1" strip tensile	ASTM D7003	Lbf.	187 MD 182 DD	211 MD 195 DD
Tongue Tear	ASTM D5884	Lbf.	150 MD 123 DD	159 MD 132 DD
Grab Tensile Strength	ASTM D7004	Lbf.	378 MD 361 DD	408 MD 372 DD
Puncture Resistance	ASTM D4833	Lbf.	144	163

MD Machine Direction DD Diagonal Direction

Notes:

1. The Engineer may allow alternates to these requirements.

Appendix D

Operating and Maintenance Plan

OPERATING AND MAINTENANCE PROCEDURES

In this plan, underlined text represents the language of the Rule.

The operator will operate and maintain the lined earthen containment to contain liquids and solids (blow sand and minimal precipitates from the treated produced water) and maintain the integrity of the liner system in a manner that prevents contamination of fresh water and protects public health and the environment as described below. The purpose of the lined earthen containment is to facilitate recycling, reuse and reclamation of produced water derived from nearby oil and gas wells. During periods when water for E&P operations is not needed, produced water will discharge to one of the injection wells in the operator's SWD system. The containment will not be used for the disposal of produced water or other oilfield waste.

The operation of the containment is summarized below.

- A. Via pipeline, produced water generated from nearby oil and gas wells is delivered to a treatment system located as indicated in the C-147.
- B. After treatment, the produced water discharges into the containment
- C. When required, treated produced water is removed from the containment for E&P operations. At this time, treated produced water will be used for drilling beneath the fresh water zones (beneath surface casing), for well stimulation (e.g. hydraulic fracturing) and other E&P uses as approved by OCD.
- D. Whenever the maximum fluid capacity of the containment is reached, treatment and discharge to the containment ceases (see Freeboard and Overtopping Plan, below)
- E. The operator will keep accurate records and shall report monthly to the division the total volume of water received for recycling, with the amount of fresh water received listed separately, and the total volume of water leaving the facility for disposition by use on form C-148.
- F. The operator will maintain accurate records that identify the sources and disposition of all recycled water that shall be made available for review by the division upon request.
- G. The containment shall be deemed to have ceased operations if less than 20% of the total fluid capacity is used every six months following the first withdrawal of produced water for use. The operator will report cessation of operations to the appropriate division district office. The appropriate division district office may grant an extension to this determination of cessation of operations not to exceed six months.

The operation of the lined earthen containment will follow the mandates listed below:

1. The operator will not discharge into or store any hazardous waste (as defined by 40 CFR 261 and NMAC 19.15.2.7.H.3) in the containments.
2. If the containment's primary liner is compromised above the fluid's surface, the operator will repair the damage or initiate replacement of the primary liner within 48 hours of discovery or seek an extension of time from the division district office.
3. If the primary liner is compromised below the fluid's surface, the operator will remove all fluid above the damage or leak within 48 hours of discovery, notify the division district office and repair the damage or replace the primary liner.
4. If any penetration of the containment liner is confirmed by sampling of fluid in the leak detection system (see Inspection and monitoring plan), The operator will
 - a. Begin and maintain fluid removal from the leak detection/pump-back system
 - b. Notify the district office within 48 hours (phone or email) of the discovery
 - c. Identify the location of the leak and
 - d. Repair the damage or, if necessary, replace the containment liner
5. The operator will install, or maintain on site, an oil absorbent boom or other device to contain an unanticipated release and the operator will remove any visible layer of oil from the surface of the recycling containment.
6. The operator will report releases of fluid in a manner consistent with NMAC 19.15.29
7. The containment will be operated to prevent the collection of surface water run-on.
8. The operator will maintain the containment free of miscellaneous solid waste or debris.
9. The operator will maintain at least three feet of freeboard for the containment and will use a free-standing staff gauge to allow easy determination of the required 3-foot of freeboard.
10. As described in the design/construction plan, the injection or withdrawal of fluids from the containment is accomplished through a hardware that prevents damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes.
11. The operator shall ensure that all gates associated with the fence are closed and locked when responsible personnel are not onsite.
12. The operator will maintain the fences in good repair

MONITORING, INSPECTION, AND REPORTING PLAN

The operator will inspect the recycling containment and associated leak detection systems weekly while it contains fluids. The operator shall maintain a current log of such inspections and make the log available for review by the division upon request.

Weekly inspections consist of

- reading and recording the fluid height of staff gauges

- recording any evidence that the pond surface shows visible oil
- visually inspecting the containment's exposed liners
- checking the leak detection system for any evidence of a loss of integrity of the primary liner.

As stated above, if a liner's integrity is compromised, or if any penetration of the liner occurs above the water surface, then the operator will notify the District office within 48 hours (phone or email).

Monthly, the operator will

- A. Inspect diversion ditches and berms around the containment to check for erosion and collection of surface water run-on.
- B. Inspect the leak detection system for evidence of damage or malfunction and monitor for leakage
- C. Inspect the containment for dead migratory birds and other wildlife. Within 30 days of discovery, report the discovery of dead migratory birds or other wildlife to the appropriate wildlife agency and to the division district office in order to facilitate assessment and implementation of measures to prevent incidents from reoccurring.
- D. Report to the division the total volume of water received for recycling, with the amount of fresh water received listed separately, and the total volume of water leaving the facility for disposition by use on form C-148.
- E. Record sources and disposition of all recycled water

The operator will maintain a log of all inspections and make the log available for the appropriate Division district office's review upon request. An example of the log is attached to this section of the permit application.

FREEBOARD AND OVERTOPPING PREVENTION PLAN

The method of operation of the containment allows for maintaining freeboard with very few potential problems. When the capacity of the containment is reached (3-feet of freeboard), the discharge of treated produced water ceases and the produced water generated by nearby oil and gas wells is managed by one of the injection wells identified in Appendix E.

If rising water levels suggest that 3-feet of freeboard will not be maintained, the operator will implement one or more of the following options

- I. Cease discharging treated produced water to the containment
- II. Accelerate re-use of the treated produced water for purposes approved by the Division
- III. Transfer treated produced water from the containment to injection wells

The reading of the staff gauge typically occurs daily when treatment operations are ongoing and weekly when discharge to the containment is not occurring.

PROTOCOL FOR LEAK DETECTION MONITORING, FLUID REMOVAL AND REPORTING

As shown in Appendix A, the leak detection system includes a monitoring system. Any fluid released from the primary liner will flow to the collection sump where fluid level monitoring is possible at the monitoring riser pipe associated with the leak detection system (see Appendix A).

Staff may employ a portable electronic water level meter to determine if fluid exists in the monitoring riser pipe. Obtaining accurate readings of water levels in a sloped pipe beneath a containment can be a challenge. An electrician's wire snake may be required to push the probe to the bottom of the port and the probe may be fixed in a 2-inch pipe "dry housing" to avoid false readings due to water condensation on the pipe. There are many techniques to determine the existence of water in the sumps - including low flow pumps and a simple small bailer affixed to an electrician's snake. The operator will use the method that works best for this containment.

If seepage from the containment into the leak detection system is suspected by a positive fluid level measurement, the operator will

1. Re-measure fluid levels in the monitoring riser pipe on a daily basis for one week to determine the rate of seepage.
2. Collect a water sample from the monitoring riser pipe to confirm the seepage is treated produced water from the containment via field conductivity and chloride measurements.
3. Notify NMOCD of a confirmed positive detection in the system within 48-hours of sampling (initial notification).
4. Install a pump into the monitoring riser pipe sump to continually (manually on a daily basis or via automatic timers) remove fluids from the leak detection system into the containment until the liner is repaired or replaced.
5. Dispatch a liner professional to inspect the portion of the containment suspected of leakage during a "low water" monitoring event.
6. Provide NMOCD a second report describing the inspection and/or repair within 20 days of the initial notification

If the point of release is obvious from a low water inspection, the liner professional will repair the loss of integrity. If the point of release cannot be determined by the

inspection, the liner professional will develop a more robust plan to identify the point(s) of release. The inspection plan and schedule will be submitted to OCD with the second report. The operator will implement the plan upon OCD approval.

Appendix E

Closure Plan

CLOSURE PLAN

In this plan, underlined text represents the language of the Rule.

After operations cease, the operator will remove all fluids within 60 days and close the containment within six months from the date the operator ceases operations from the containment for use.

The operator shall substantially restore the impacted surface area to

- the condition that existed prior to the construction of the recycling containment or
- to a condition imposed by federal, state trust land or tribal agencies on lands managed by those agencies as these provisions govern the obligations of any operator subject to those provisions,

EXCAVATION AND REMOVAL CLOSURE PLAN – PROTOCOLS AND PROCEDURES

The workover pit is expected to contain a small volume of solids, the majority of which will be windblown sand and dust with some mineral precipitates from the water

1. The operator will remove all liquids from the pits and either:
 - a. Dispose of the liquids in a division-approved facility, or
 - b. Recycle, reuse or reclaim the water for reuse in drilling and stimulation.
2. The operator will close the recycling containment by first removing all fluids, contents and synthetic liners and transferring these materials to a division approved facility:
3. After the removal of the pit contents and liners, soils beneath the workover pit will be tested by collection of a five-point (minimum) composite sample which includes stained or wet soils, if any, and that sample shall be analyzed for the constituents listed in Table I of 19.15.34.14.
4. After review of the laboratory results
 - a. If any contaminant concentration is higher than the parameters listed in Table I, additional delineation may be required and the operator must receive approval before proceeding with closure.
 - b. If all contaminant concentrations are less than or equal to the parameters listed in Table I, then the operator will proceed to
 - i. backfill with non-waste containing, uncontaminated, earthen material. Or
 - ii. undertake an alternative closure process pursuant to a variance request after approval by OCD

- a. The operator will reclaim the containment's location to a safe and stable condition that blends with the surrounding undisturbed area.
- b. Topsoils and subsoils shall be replaced to their original relative positions and contoured so as to achieve erosion control, long-term stability and preservation of surface water flow patterns.
- c. The disturbed area shall then be reseeded in the first favorable growing season following closure of a recycling containment.

CLOSURE DOCUMENTATION

In this plan, underlined text represents the language of the Rule.

After operations cease, the operator will remove all fluids within 60 days and close the containment within six months from the date the operator ceases operations from the containment for use.

The operator shall substantially restore the impacted surface area to

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 - a. If any contaminant concentration is higher than the parameters listed in Table I, additional delineation may be required and the operator must receive approval before proceeding with closure.

- b. If all contaminant concentrations are less than or equal to the parameters listed in Table I, then the operator will proceed to
 - i. backfill with non-waste containing, uncontaminated, earthen material. Or
 - ii. undertake an alternative closure process pursuant to a variance request after approval by OCD

Reclamation and Re-vegetation

- a. The operator will reclaim the containment's location to a safe and stable condition that blends with the surrounding undisturbed area.
- b. Topsoils and subsoils shall be replaced to their original relative positions and contoured so as to achieve erosion control, long-term stability and preservation of surface water flow patterns.
- c. The disturbed area shall then be reseeded in the first favorable growing season following closure of a recycling containment.

CLOSURE DOCUMENTATION

Within 60 days of closure completion, the operator shall submit a closure report on form C-147, including required attachments, to document all closure activities including sampling results and the details on any backfilling, capping or covering, where applicable. The closure report shall certify that all information in the report and attachments is correct and that the operator has complied with all applicable closure requirements and conditions specified in division rules or directives.

The operator shall notify the division when reclamation and re-vegetation are complete. Specifically the notice will document that all ground surface disturbing activities at the site have been completed, and a uniform vegetative cover has been established that reflects a life-form ratio of plus or minus fifty percent (50%) of pre-disturbance levels and a total percent plant cover of at least seventy percent (70%) of pre-disturbance levels, excluding noxious weeds.