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ENGINEERING · ENVIRONMENTAL

April 12, 2022

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

Subject: Blackbuck Resources LLC – Patriot State SWD #1
Application for Authorization to Inject Revised Location Information

To Whom It May Concern,

On behalf of Blackbuck Resources LLC (Blackbuck), ALL Consulting, LLC (ALL) is submitting a revised set of documents that reflect a surface hole location move of approximately three hundred feet to the south. This move did not change the Affected Parties associated with the original application. The proposed Patriot State SWD #1's new proposed location is Section 9 Township 25S Range 27E 300' FSL and 142' FWL in Eddy County, New Mexico.

Per OCD request, the Affected Parties have been re-notified of the application and a Fault Slip Potential Analysis has been conducted.

The document set includes the following items:

- Revised C-102 (preliminary)
- Revised Area of Review Information & Maps
- Confirmations of Affected Party Re-Notification
- Fault Split Potential Analysis

Should you have any questions regarding the enclosed document set, please contact Nate Alleman at (918) 382-7581 or nalleman@all-llc.com.

Sincerely,
ALL Consulting

Nathan Alleman

Nate Alleman
Sr. Regulatory Specialist

**C-102**

District I
1625 N. French Dr., Hobbs, NM 88240
Phone: (575) 393-6161 Fax: (575) 393-0720
District II
811 S. First St., Artesia, NM 88210
Phone: (575) 748-1283 Fax: (575) 748-9720
District III
1000 Rio Brazos Road, Aztec, NM 87410
Phone: (505) 334-6178 Fax: (505) 334-6170
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505
Phone: (505) 476-3460 Fax: (505) 476-3462

# State of New Mexico
# Energy, Minerals & Natural Resources Department
# OIL CONSERVATION DIVISION
# 1220 South St. Francis Dr.
# Santa Fe, NM 87505

Form C-102
Revised August 1, 2011
Submit one copy to appropriate District Office

[X] AMENDED REPORT

## WELL LOCATION AND ACREAGE DEDICATION PLAT

| [1] API Number | [2] Pool Code | [3] Pool Name |
|---|---|---|
| | 97869 | SWD; Devonian - Silurian |

| [4] Property Code | [5] Property Name | [6] Well Number |
|---|---|---|
| | PATRIOT STATE SWD | #1 |

| [7] OGRID No. | [8] Operator Name | [9] Elevation |
|---|---|---|
| | BLACKBUCK NEW MEXICO LLC | 3238.0' |

### [10] Surface Location

| UL or lot no. | Section | Township | Range | Lot Idn | Feet from the | North/South line | Feet from the | East/West line | County |
|---|---|---|---|---|---|---|---|---|---|
| M | 9 | 25S | 27E | | 300 | SOUTH | 142 | WEST | EDDY |

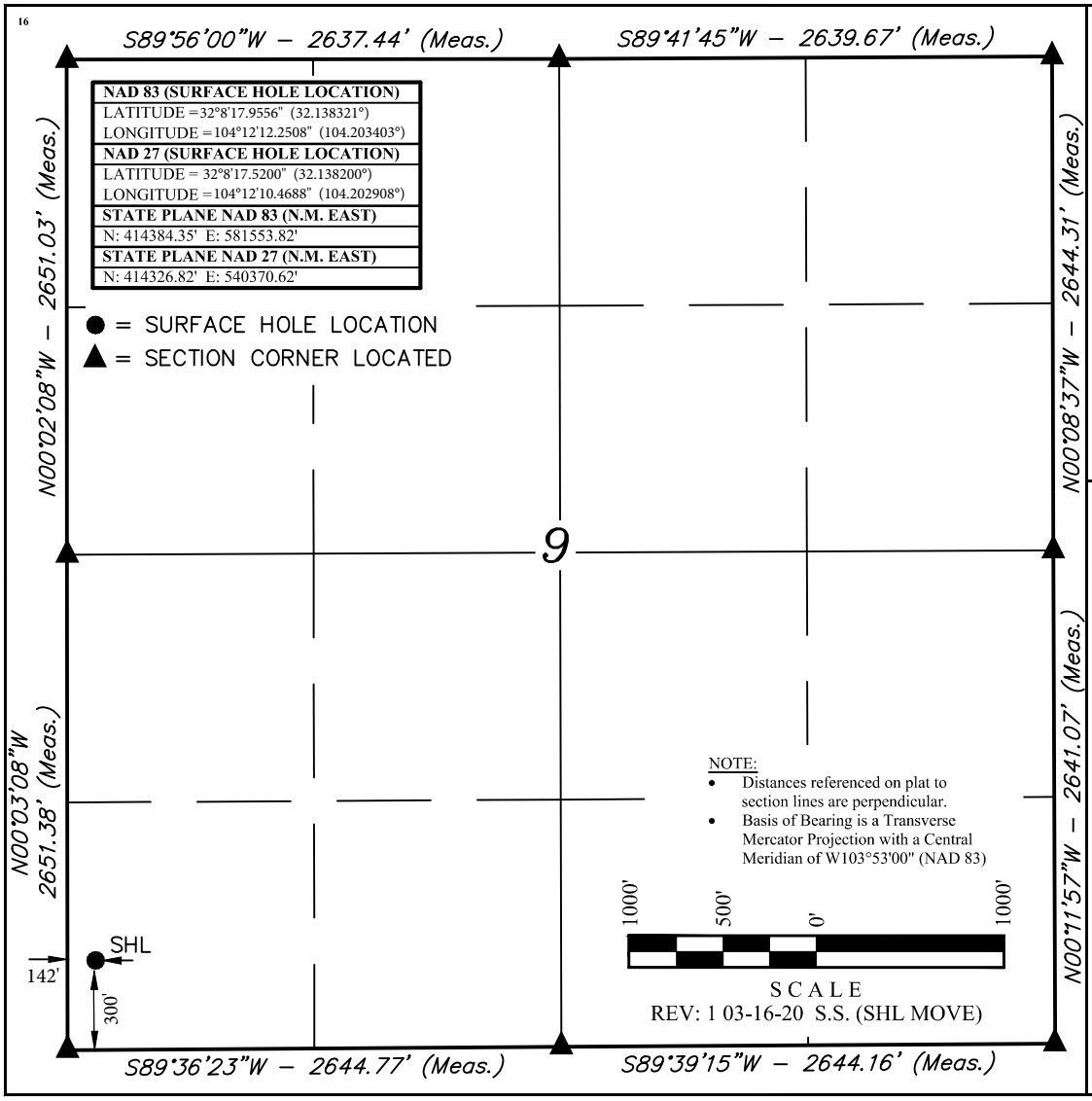
### [11] Bottom Hole Location If Different From Surface

| UL or lot no. | Section | Township | Range | Lot Idn | Feet from the | North/South line | Feet from the | East/West line | County |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

| [12] Dedicated Acres | [13] Joint or Infill | [14] Consolidation Code | [15] Order No. |
|---|---|---|---|
| | | | |

No allowable will be assigned to this completion until all interests have been consolidated or a non-standard unit has been approved by the division.

[16]




### [17] OPERATOR CERTIFICATION

*I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief, and that this organization either owns a working interest or unleased mineral interest in the land including the proposed bottom hole location or has a right to drill this well at this location pursuant to a contract with an owner of such a mineral or working interest, or to a voluntary pooling agreement or a compulsory pooling order heretofore entered by the division.*

Signature Date

Printed Name

E-mail Address

### [18] SURVEYOR CERTIFICATION

*I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.*

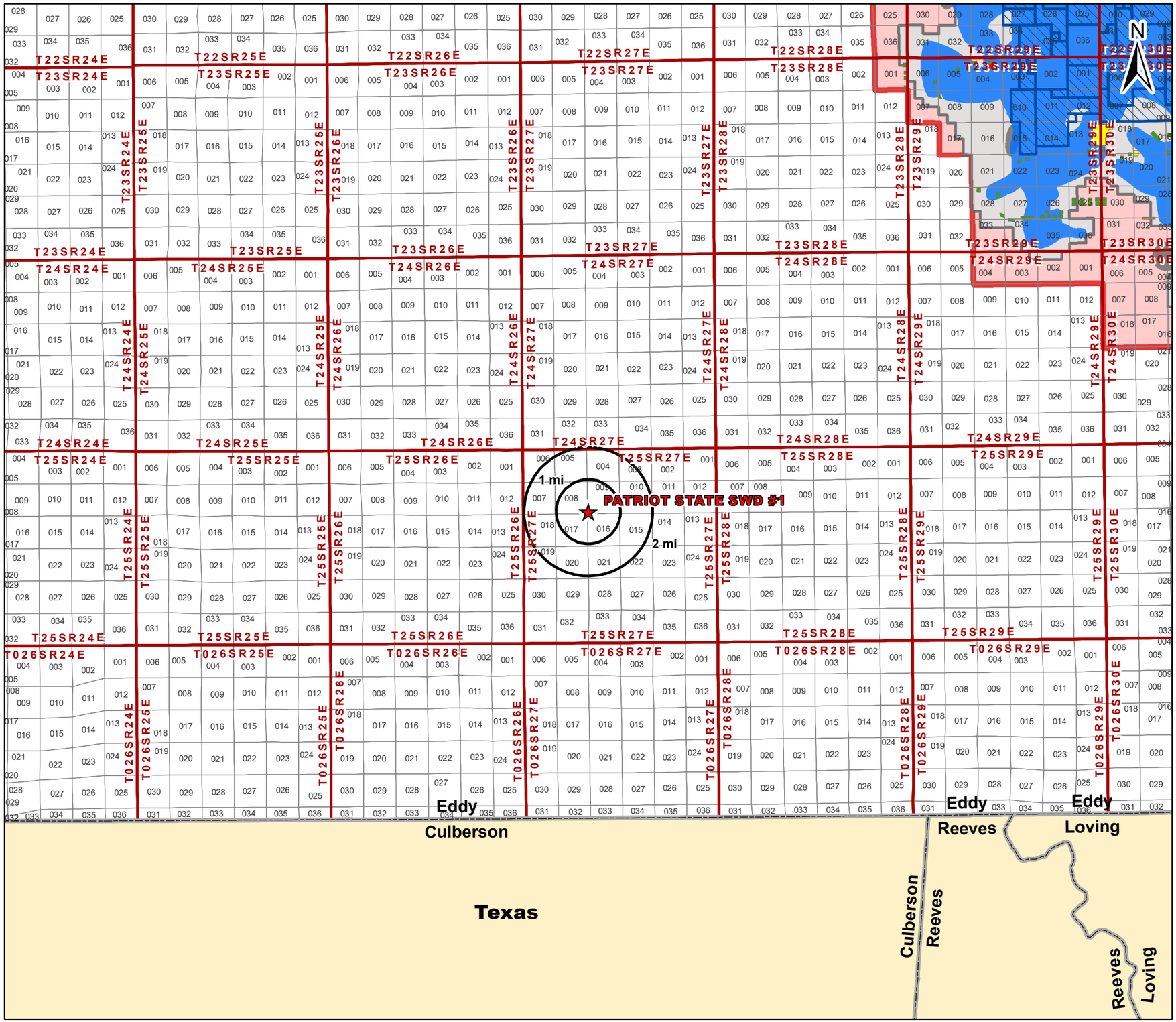
Date of Survey

Signature and Seal of Professional Surveyor:

Certificate Number:

## Area of Review Information:

- Potash Lease Map
- 2-mile Oil & Gas Well Map
- 1-mile Well Detail List
- 2-mile Lease Map
- 2-mile Mineral Ownership Map
- 2-mile Surface Ownership Map
- 1.5-mile Deep SWD Map (Devonian/Silurian SWDs)




## Legend

- Proposed SWD
- Potash Leases
- Ore Type - Measured
- Ore Type - Indicated
- KPLA
- SOPA

**Drill Islands**

**Status**

- Approved
- Denied
- Nominated
- Withdrawn

# Potash Leases
# Area of Review

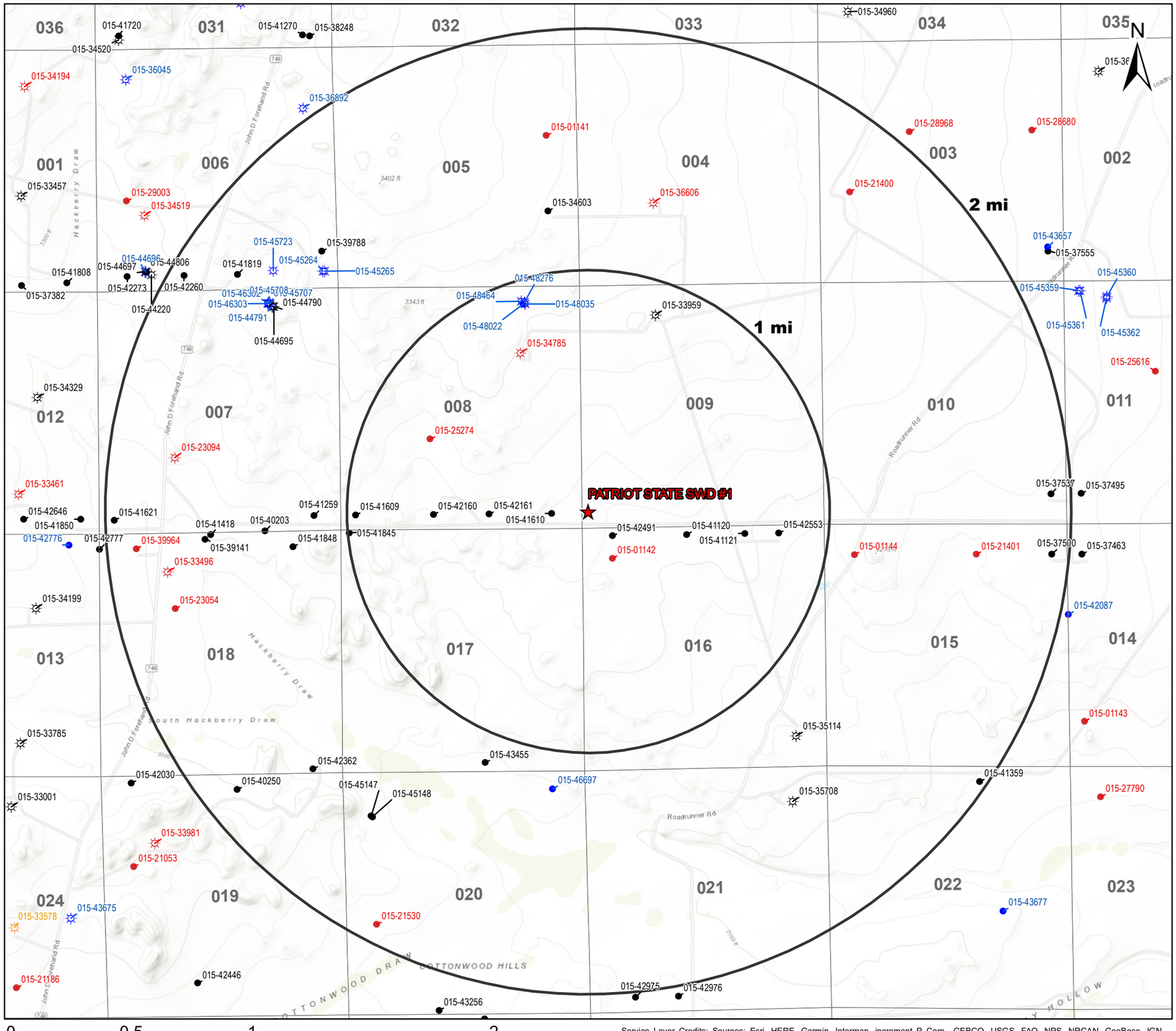
## PATRIOT STATE SWD #1
**Eddy County, New Mexico**

| Proj Mgr: Nate Alleman | January 07, 2022 | Mapped by: Ben Bockelmann |
|---|---|---|

*Prepared for:*
**BLACKBUCK NEW MEXICO LLC**

*Prepared by:*
ALL CONSULTING

*Source Info: BLM CFO Potash (https://www.nm.blm.gov/shapeFiles/cfo/carlsbad_spatial_data.html)*




0 0.5 1 2 Miles

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

## Legend

- Proposed SWD
- Gas, Active (15)
- Gas, New (20)
- Gas, Plugged (8)
- Gas, Temporarily Abandoned (1)
- Oil, Active (46)
- Oil, New (6)
- Oil, Plugged (17)

*Source Info: NMOCD O&G Wells updated 12/9/2021 (https://www.emnrd.nm.gov/ocd/ocd-data/ftp-server/l)*

# O&G Wells Area of Review

## PATRIOT STATE SWD #1

**Eddy County, New Mexico**

| Proj Mgr: Nate Alleman | January 07, 2022 | Mapped by: Ben Bockelmann |
|---|---|---|

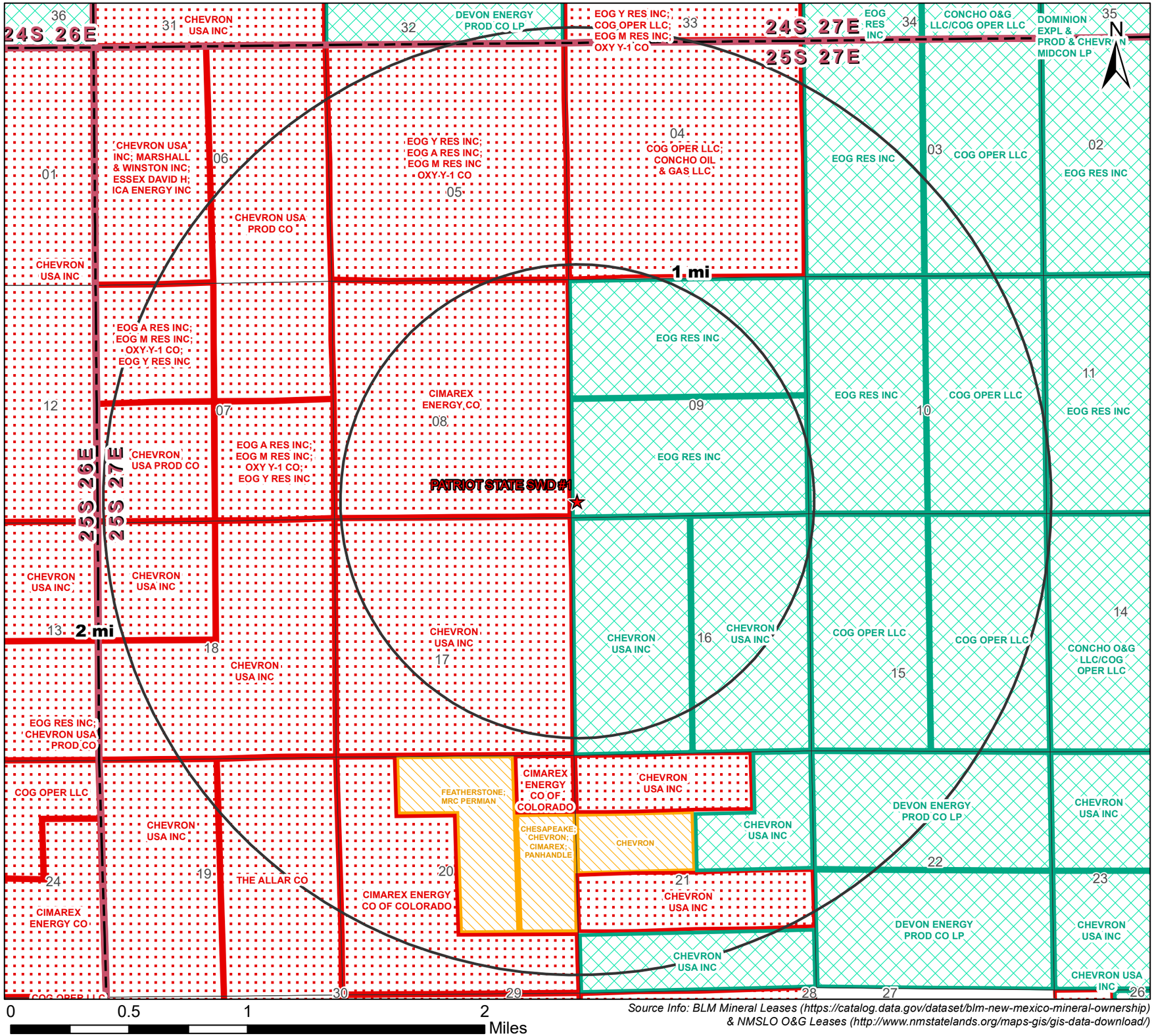
*Prepared for:*
**BLACKBUCK NEW MEXICO LLC**

*Prepared by:*
ALL CONSULTING

# AOR Tabulation for Patriot State SWD #1 (Top of Injection Interval: 13,500')

| Well Name | API# | Well Type | Operator | Spud Date | Location (Sec., Tn., Rng.) | Total Vertical Depth (feet) | Penetrate Inj. Zone? |
|---|---|---|---|---|---|---|---|
| HAYHURST 16 25 27 STATE #003H | 30-015-42491 | Oil | CHEVRON U S A INC | 8/15/2014 | D-16-25S-27E | 7550 | No |
| HAYHURST 16 25 27 STATE #001H | 30-015-41120 | Oil | CHEVRON U S A INC | 5/18/2014 | C-16-25S-27E | 7619 | No |
| HAYHURST 16 25 27 STATE #002H | 30-015-41121 | Oil | CHEVRON U S A INC | 3/23/2014 | B-16-25S-27E | 6907 | No |
| HAYHURST 16 25 27 STATE #004H | 30-015-42553 | Oil | CHEVRON U S A INC | 9/10/2014 | A-16-25S-27E | 7582 | No |
| HAYHURST 17 FEDERAL #001H | 30-015-41845 | Oil | CHEVRON U S A INC | 2/23/2014 | D-17-25S-27E | 12151 | No |
| WHITE CITY 8 FEDERAL #003H | 30-015-42160 | Oil | CIMAREX ENERGY CO. | 7/18/2014 | N-08-25S-27E | 7419 | No |
| WHITE CITY 8 FEDERAL #002H | 30-015-41609 | Oil | CIMAREX ENERGY CO. | 12/19/2013 | M-08-25S-27E | 7354 | No |
| WHITE CITY 8 FEDERAL #001 | 30-015-34785 | Plugged | CIMAREX ENERGY CO. | 7/18/2006 | H-08-25S-27E | Plugged (12405) | No |
| WHITE CITY 8 FEDERAL #004H | 30-015-42161 | Oil | CIMAREX ENERGY CO. | 9/23/2015 | O-08-25S-27E | 7490 | No |
| WHITE CITY 8 FEDERAL #005H | 30-015-41610 | Oil | CIMAREX ENERGY CO. | 9/7/2015 | P-08-25S-27E | 7524 | No |
| WHITE CITY 8 17 FEDERAL COM #017H | 30-015-48022 | Oil | CIMAREX ENERGY CO. | New Drill | A-08-25S-27E | Proposed (9914) | No |
| WHITE CITY 8 17 FEDERAL COM #015H | 30-015-48035 | Gas | CIMAREX ENERGY CO. | New Drill | A-08-25S-27E | Proposed (8961) | No |
| WHITE CITY 8 17 FEDERAL COM #016H | 30-015-48276 | Gas | CIMAREX ENERGY CO. | New Drill | A-08-25S-27E | Proposed (8961) | No |
| WHITE CITY 8 17 FEDERAL COM #018H | 30-015-48464 | Gas | CIMAREX ENERGY CO. | New Drill | A-08-25S-27E | Proposed (9914) | No |
| PADRON BGM STATE COM #001 | 30-015-33959 | Gas | EOG RESOURCES INC | 2/25/2005 | C-09-25S-27E | 12535 | No |
| PRE-ONGARD WELL #001 | 30-015-01142 | Plugged | PRE-ONGARD WELL OPERATOR (R.E. Sutton) | Unknown* | D-16-25S-27E | Plugged (2320) | No |
| PRE-ONGARD WELL #001 | 30-015-25274 | Plugged | PRE-ONGARD WELL OPERATOR (Max Wilson, Inc.) | 5/15/1985 | K-08-25S-27E | Plugged (3609) | No |

**Notes:** No wells within the 1-mile AOR penetrate the injection interval.




*Source Info: BLM Mineral Leases (https://catalog.data.gov/dataset/blm-new-mexico-mineral-ownership) & NMSLO O&G Leases (http://www.nmstatelands.org/maps-gis/gis-data-download/)*

## Legend

- Proposed SWD
- NMSLO Mineral Leases
- BLM Mineral Leases
- Private Mineral Leases

# Mineral Lease Area of Review

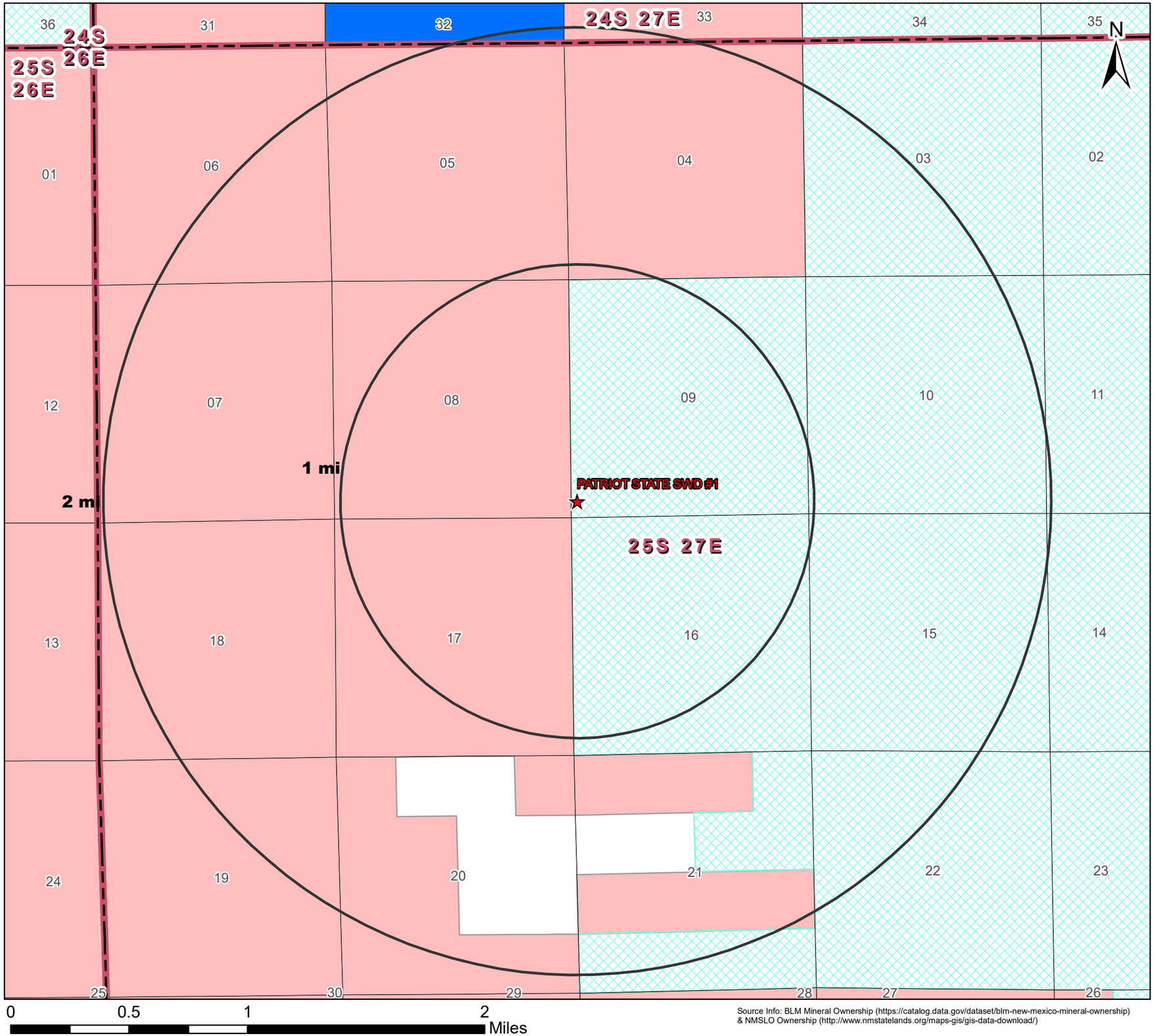
## PATRIOT STATE SWD #1

**Eddy County, New Mexico**

| Proj Mgr: | | Mapped by: |
|---|---|---|
| Nate Alleman | January 07, 2022 | Ben Bockelmann |

*Prepared for:*
**BLACKBUCK NEW MEXICO LLC**

*Prepared by:*
ALL CONSULTING




Source Info: BLM Mineral Ownership (https://catalog.data.gov/dataset/blm-new-mexico-mineral-ownership) & NMSLO Ownership (http://www.nmstatelands.org/maps-gis/gis-data-download/)

## Legend

- Proposed SWD
- Private minerals
- Subsurface minerals (NMSLO)
- Surface and Subsurface minerals (NMSLO)
- All minerals are owned by U.S. (BLM)

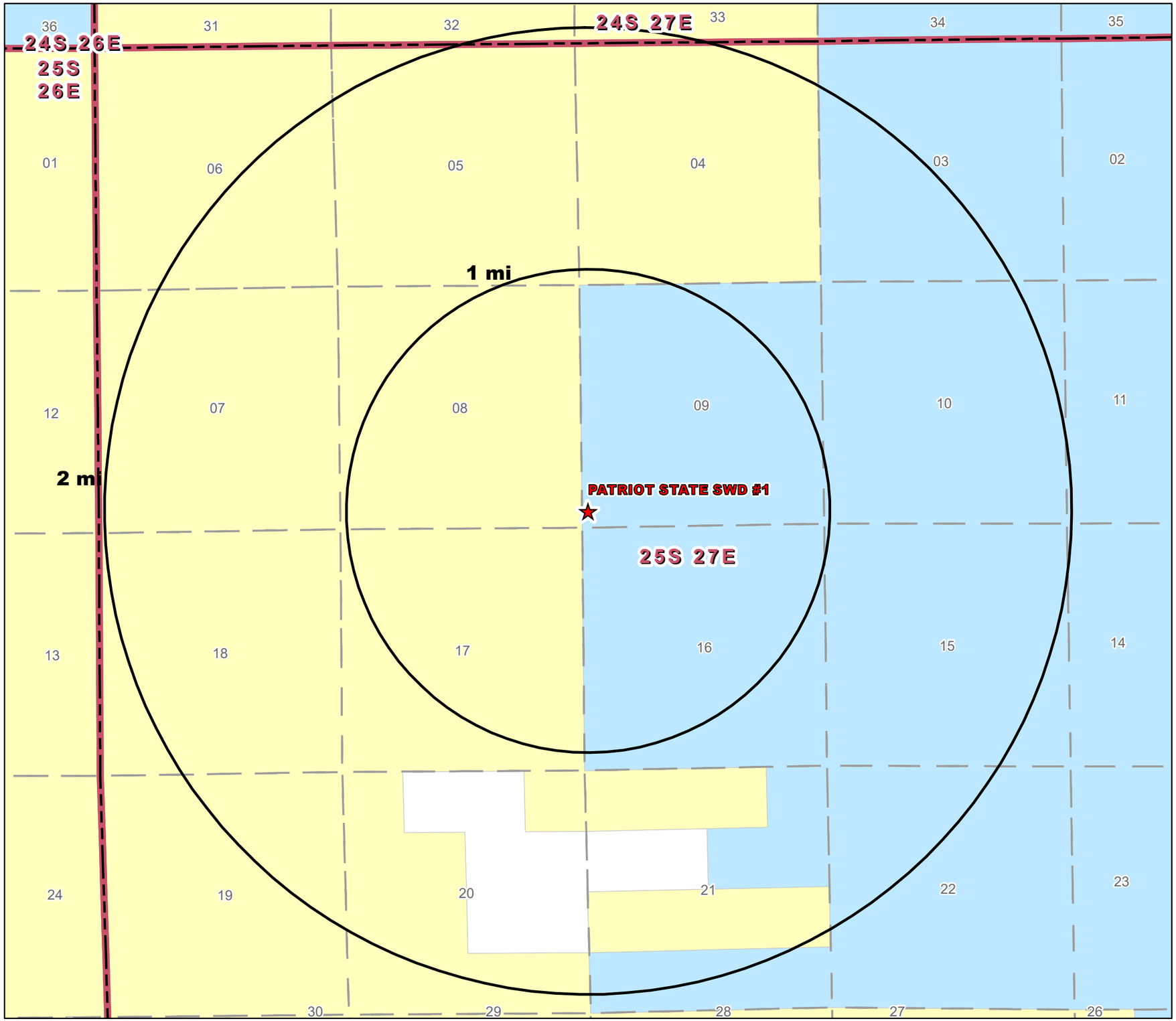
# Mineral Ownership
# Area of Review

## PATRIOT STATE SWD #1
**Eddy County, New Mexico**

| Proj Mgr: Nate Alleman | January 07, 2022 | Mapped by: Ben Bockelmann |
|---|---|---|

*Prepared for:*
**BLACKBUCK NEW MEXICO LLC**

*Prepared by:*
ALL CONSULTING




N

## Legend

- Proposed SWD

**Surface Ownership**

- BLM
- Private
- State

*Source Info: BLM Surface Ownership (https://catalog.data.gov/dataset/blm-new-mexico-surface-ownership)*

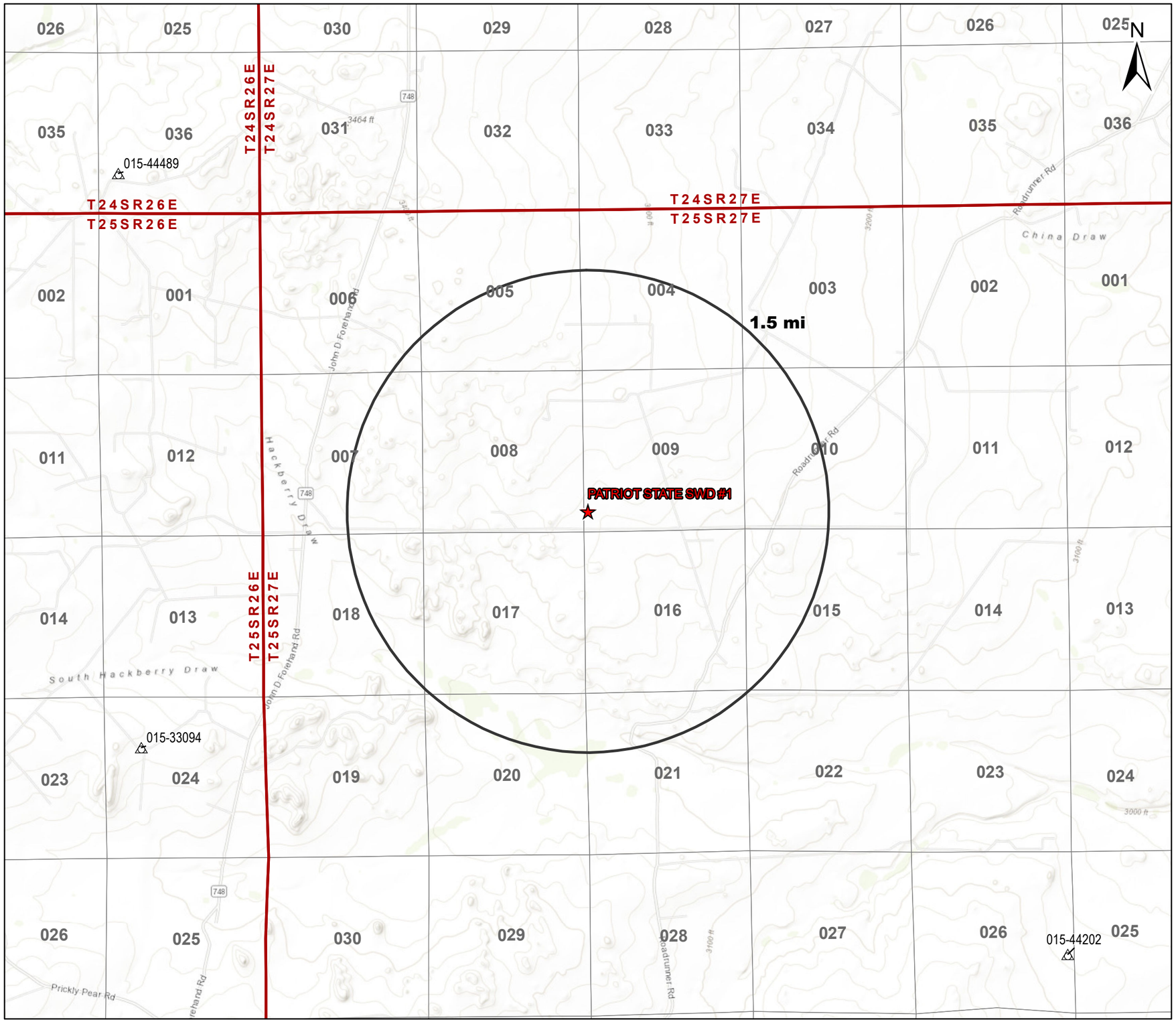
# Surface Ownership
# Area of Review

## PATRIOT STATE SWD #1
**Eddy County, New Mexico**

| Proj Mgr: Nate Alleman | January 07, 2022 | Mapped by: Ben Bockelmann |
|---|---|---|

*Prepared for:*
**BLACKBUCK NEW MEXICO LLC**

*Prepared by:*
ALL CONSULTING




## Legend

- ★ Proposed SWD

**Deep SWDs**

- △ Salt Water Injection, Active (3)

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

*Source Info: NMOCD O&G Wells updated 10/27/2021 (https://www.emnrd.nm.gov/ocd/ocd-data/ftp-server/l)*

# Deep SWDs Area of Review

## PATRIOT STATE SWD #1

**Eddy County, New Mexico**

| Proj Mgr: Nate Alleman | November 30, 2021 | Mapped by: Ben Bockelmann |
|---|---|---|

*Prepared for:*
**BLACKBUCK NEW MEXICO LLC**

*Prepared by:*
ALL CONSULTING

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# Fault Slip Potential Analysis

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GOVERNMENT RELATIONS · ENERGY · PLANNING · TECHNOLOGY
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March 15, 2022

PN 1715.SWD.25

Mr. Phillip Goetze, P.G.
NM EMNRD – Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, NM 87505

Subject: **Blackbuck Resources, LLC Patriot State SWD #1 Fault Slip Potential**

Dear Technical Staff,

ALL has prepared information, including Fault Slip Potential (FSP) models, pertaining to Blackbuck Resources, LLC's (Blackbuck) Patriot State SWD #1 as requested by NMOCD technical staff. Two FSP model runs for the Subject SWD are detailed below. In addition, details pertaining to Blackbuck's proposed seismic monitoring plan in accordance with NMOCD requirements are described.

## Fault Slip Potential Modeling

### Model Run #1

Per NMOCD and industry standards, the initial FSP model for the Subject SWD contained the following parameters:

- All known faults within a six (6) mile radius of the Subject SWD, assumed to penetrate the proposed injection interval & Precambrian basement.
- All active SWDs within a six (6) mile radius of the Subject SWD, assumed to inject at their maximum permitted rate for 25 years.
- All pending SWDs within a six (6) mile radius of the Subject SWD, assumed to inject at their maximum requested rate for 25 years.

The results of Model Run #1, including a list of all parameters, an FSP area map, and model run screenshots, are included as **Attachment 1.**

Model run #1 resulted in FSP values of 0.00 on all known faults within six (6) miles of the Subject SWD.

### Model Run #2

Per NMOCD request, a secondary FSP model was performed with the addition of one (1) hypothetical fault within one (1) mile of the Subject SWD, assumed to penetrate the proposed injection interval & Precambrian basement, and assumed to optimally oriented in the local horizontal stress field.

The results of Model Run #2, including a list of all parameters, an FSP area map, and model run screenshots, are included as **Attachment 2.**

Model run #2 resulted in FSP values of 0.00 on all known faults within six (6) miles of the Subject SWD, and an FSP value of 0.46 on the hypothetical optimally oriented fault.

**Fault Slip Potential Results Discussion**

While FSP model run #2 showed moderate FSP values on the hypothetical optimal oriented fault, all real modeled faults showed no risk of fault slip, using very conservative parameters. All modeled SWDs are assumed to inject constantly for 25 years at their maximum permitted or applied-for rates, which is unrealistically high based on geologic constraints and actual historic injection rates from these SWDs. Additionally, several of the pending SWDs NMOCD requested to be included in the model are never expected to reach active status due to spacing and other constraints.

Further, based on ALL's review of local geology and known faulting, there is no indication that any optimally oriented faults exist withing six (6) miles of the Subject SWD. Per USGS and TexNet seismic data, no seismic events have been recorded within six (6) miles of the Subject SWD, despite active injection occurring in the area. This further supports the known data suggesting it is very unlikely there are unknown optimally oriented faults within the area.

**Conclusion**

As an expert on the issue of induced seismicity, seismic monitoring and mitigation, it is my opinion that the potential for the Subject SWD to contribute to seismicity to be minimal, at best. This conclusion is based on

(1) FSP values of 0.00 on all known faults within six (6) miles of the Subject SWD when using conservative parameters,
(2) Lack of data indicating the presence of an optimally oriented fault within six (6) miles of the Subject SWD,

Although it is expected that the potential for the the Subject SWD to contribute to seismicity is minimal, at best, Blackbuck intends to constantly monitor seismicity in the area through public sources and will fully comply with NMOCD's seismic response protocol (see **Attachment 3**) if triggering events are observed within the given distances.

Sincerely,
ALL Consulting

**Attachment 1**
**Fault Slip Potential Model #1**

# Blackbuck Resources, LLC
# Patriot State SWD #1

## Fault Slip Potential Analysis (FSP)
## Model Run #1

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# FSP Methodology

## Model Methodology

- FSP provides a probabilistic estimate of fault slip due to nearby fluid injection.
  - Calculates probability of a fault exceeding the Mohr-Coulomb slip criteria (failure point between normal and shear stresses).
  - Utilizes Monte Carlo simulation to account for potential errors in input parameters.

## Model Inputs

- Stress gradients and pore pressure gradients derived from previous FSP models performed in the region.
- Injection interval thickness, porosity, and permeability estimated from nearby geophysical logs.
- Two known Precambrian faults in the 6-mile radius area of review (USGS, BEG, and TXRRC Fault Data 2021).

# Parameters

| Parameter | Value | Source |
|---|---|---|
| Vertical Stress Gradient (psi/ft) | 1.05 | ALL Research (2021) |
| Horizontal Stress Direction (degrees azimuth) | 35 | Lund Snee (2020) |
| Reference Depth (ft) | 1,350 | Blackbuck Resources (2021) |
| Initial Reservoir Pressure Gradient (psi/ft) | 0.43 | ALL Research (2021) |
| A Phi Parameter | 0.52 | Lund Snee (2020) |
| Friction Coefficient | 0.6 | Lund Snee (2020) |
| Injection Interval Thickness (ft) | 878 | Blackbuck Resources (2021) |
| Porosity (%) | 5 | ALL Research (2021) |
| Permeability (mD) | 35 | ALL Research (2021) |
| Fault Strike (degrees) | Varies | USGS, BEG, and TXRRC (2021) |
| Fault Dip | 80 | Lund Snee (2020) |
| Fluid Density (kg/m^3) | 1000 | ALL Research and Reynolds (2021) |
| Dynamic Viscosity (Pa*s) | 0.0003 | ALL Research and Reynolds (2021) |
| Fluid Compressibility (Pa^-1) | 4.70E-10 | ALL Research and Reynolds (2021) |
| Rock Compressibility (Pa^-1) | 8.70E-10 | ALL Research and Reynolds (2021) |

# Injection Data

- **Modeled SWDs:** 23 Class II Injection Wells are located within the 6-mile radius area of review (AOR) and were included in this model.
- **Modeled Injection Rates:**
  - Subject SWD: the Patriot State SWD #1 was modeled at 40,000 barrels of water per day (BWPD).
  - Active & Pending SWDs: Modeled at various rates based on maximum requested injection rate within each injection application.
- **Modeled Injection Timeframe:** Each SWD was modeled at the constant rate listed above from 2022 – 2047.

# Injection Data

Pending SWDs within 6 miles of Patriot State SWD #1

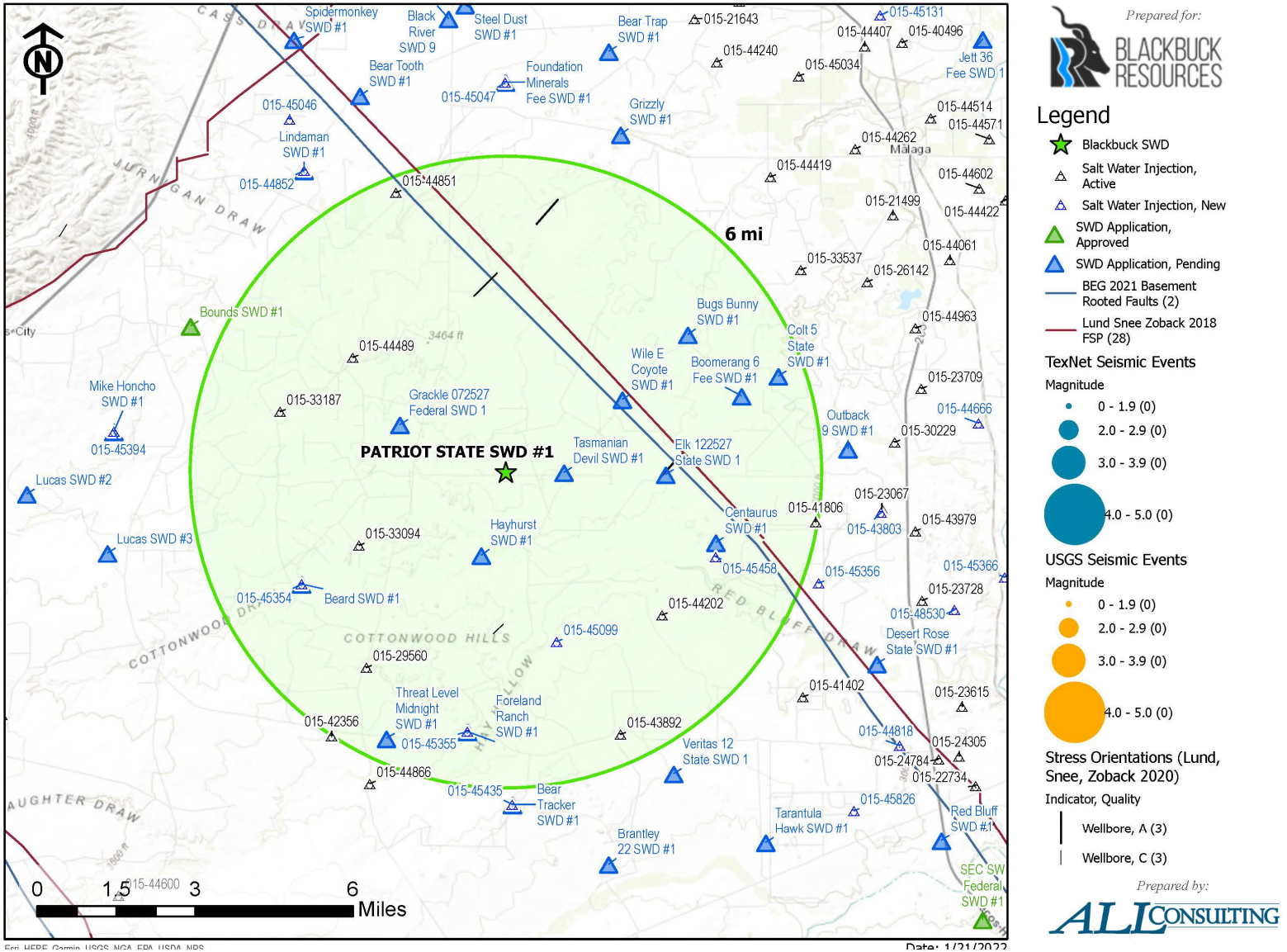
| SWD Name (API) | SWD Status | Injection Rate (BWPD) | Modeled Time Period |
|---|---|---|---|
| Patriot State SWD #1 (015-48074) | Pending | 40,000 | 2022 - 2047 |
| Grackle 072527 Federal SWD 1 | Pending | 30,000 | 2022 - 2047 |
| Wile E Coyote SWD #1 | Pending | 25,000 | 2022-2047 |
| Bugs Bunny SWD #1 | Pending | 25,000 | 2022 - 2047 |
| Boomerang 6 Fee SWD #1 | Pending | 30,000 | 2022 - 2047 |
| Colt 5 State SWD #1 | Pending | 40,000 | 2022 - 2047 |
| Elk 122527 State SWD #1 | Pending | 30,000 | 2022 - 2047 |
| Tasmanian Devil SWD #1 | Pending | 25,000 | 2022 - 2047 |
| Hayhurst SWD #1 | Pending | 40,000 | 2022 - 2047 |
| Threat Level Midnight SWD #1 | Pending | 32,000 | 2022 - 2047 |

# Injection Data

Active SWDs within 6 miles of Patriot State SWD #1

| SWD Name (API) | SWD Status | Injection Rate (BWPD) | Modeled Time Period |
|---|---|---|---|
| Hood SWD #1 (015-44851) | Active | 25,000 | 2022 - 2047 |
| Freedom 36 State SWD #1 (015-44489) | Active | 35,000 | 2022 - 2047 |
| Ringer Federal #6 (015-33187) | Active | 10,000 | 2022-2047 |
| Liberty 24 Federal COM #1 (015-33094) | Active | 4,000 | 2022 - 2047 |
| Beard SWD #1 (015-45354) | Active | 25,000 | 2022 - 2047 |
| Cottonwood 36 State SWD #1 (015-29560) | Active | 5,000 | 2022 - 2047 |
| Cottonwood 2 State SWD #1 (015-42356) | Active | 20,000 | 2022 - 2047 |
| Foreland Ranch SWD #1 (015-45355) | Active | 25,000 | 2022 - 2047 |
| Road Runner SWD #1 (015-45099) | Active | 30,000 | 2022 - 2047 |
| Gravitas 2 State SWD #2 (015-43892) | Active | 37,000 | 2022 - 2047 |
| Dignitas 26 State SWD #1 (015-44202) | Active | 86,000 | 2022 - 2047 |
| Centarus SWD #1 (015-45458) | Active | 35,000 | 2022 - 2047 |
| Willow 17 State SWD #1 (015-41806) | Active | 25,000 | 2022 - 2047 |

# Patriot State SWD #1 FSP Area Map




Prepared for:

BLACKBUCK RESOURCES

## Legend

- Blackbuck SWD
- Salt Water Injection, Active
- Salt Water Injection, New
- SWD Application, Approved
- SWD Application, Pending
- BEG 2021 Basement Rooted Faults (2)
- Lund Snee Zoback 2018 FSP (28)

**TexNet Seismic Events**

Magnitude

- 0 - 1.9 (0)
- 2.0 - 2.9 (0)
- 3.0 - 3.9 (0)
- 4.0 - 5.0 (0)

**USGS Seismic Events**

Magnitude

- 0 - 1.9 (0)
- 2.0 - 2.9 (0)
- 3.0 - 3.9 (0)
- 4.0 - 5.0 (0)

**Stress Orientations (Lund, Snee, Zoback 2020)**

Indicator, Quality

- Wellbore, A (3)
- Wellbore, C (3)

Prepared by:

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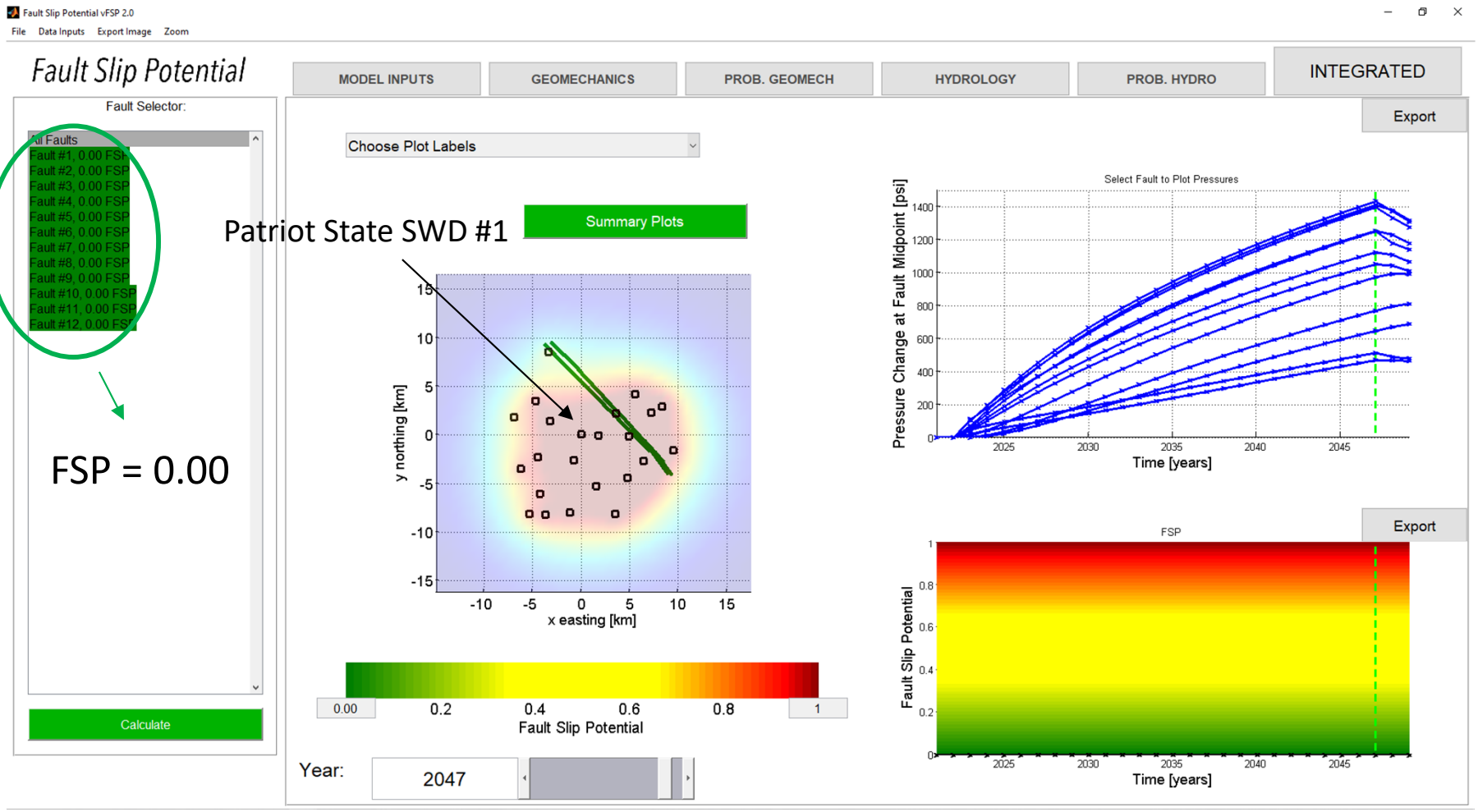
# FSP After 25 Years – Real Faults



# Conclusions

- Two known Precambrian faults exist in the 6-mile radius area of review.
- FSP modeling through 25 years, with injection rates that are likely overestimated, show no risk of potential fault slip in the area on known faults.
- This area presents little to no risk for injection induced seismicity.

# References

U.S. Geological Survey. "Faults." https://earthquake.usgs.gov/hazards/qfaults/ (Accessed December 17, 2021)

NMOCD Well Search. OCD Permitting - Wells. (n.d.). Retrieved January 28, 2022, from https://wwwapps.emnrd.nm.gov/OCD/OCDPermitting/Data/Wells.aspx

Lund Snee, Jens-Erik, 2020, State of Stress in North America: Seismicity, Tectonics, and Unconventional Energy Development [Ph.D. thesis]: Stanford University, 254p.

Reynolds, Todd. 2019. “FSP Analysis (Fault Slip Potential) Exhibits.” New Mexico Oil Conservation Division Case No. 20313, Case No. 20314, and Case No. 20472.

**Attachment 2**
**Fault Slipt Potential Model #2**

# Blackbuck Resources, LLC
# Patriot State SWD #1

## Fault Slip Potential Analysis (FSP)
## Model Run #2

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# FSP Methodology

## Model Methodology

- FSP provides a probabilistic estimate of fault slip due to nearby fluid injection.
  - Calculates probability of a fault exceeding the Mohr-Coulomb slip criteria (failure point between normal and shear stresses).
  - Utilizes Monte Carlo simulation to account for potential errors in input parameters.

## Model Inputs

- Stress gradients and pore pressure gradients derived from previous FSP models performed in the region.
- Injection interval thickness, porosity, and permeability estimated from nearby geophysical logs.
- Two known Precambrian faults in the 6-mile radius area of review (USGS, BEG, and TXRRC Fault Data 2021).

# Parameters

| Parameter | Value | Source |
|---|---|---|
| Vertical Stress Gradient (psi/ft) | 1.05 | ALL Research (2021) |
| Horizontal Stress Direction (degrees azimuth) | 35 | Lund Snee (2020) |
| Reference Depth (ft) | 1,350 | Blackbuck Resources (2021) |
| Initial Reservoir Pressure Gradient (psi/ft) | 0.43 | ALL Research (2021) |
| A Phi Parameter | 0.52 | Lund Snee (2020) |
| Friction Coefficient | 0.6 | Lund Snee (2020) |
| Injection Interval Thickness (ft) | 878 | Blackbuck Resources (2021) |
| Porosity (%) | 5 | ALL Research (2021) |
| Permeability (mD) | 35 | ALL Research (2021) |
| Fault Strike (degrees) | Varies | USGS, BEG, and TXRRC (2021) |
| Fault Dip | 80 | Lund Snee (2020) |
| Fluid Density (kg/m^3) | 1000 | ALL Research and Reynolds (2021) |
| Dynamic Viscosity (Pa*s) | 0.0003 | ALL Research and Reynolds (2021) |
| Fluid Compressibility (Pa^-1) | 4.70E-10 | ALL Research and Reynolds (2021) |
| Rock Compressibility (Pa^-1) | 8.70E-10 | ALL Research and Reynolds (2021) |

# Injection Data

- **Modeled SWDs:** 23 Class II Injection Wells are located within the 6-mile radius area of review (AOR) and were included in this model.
- **Modeled Injection Rates:**
  - Subject SWD: the Patriot State SWD #1 was modeled at 40,000 barrels of water per day (BWPD).
  - Active & Pending SWDs: Modeled at various rates based on maximum requested injection rate within each injection application.
- **Modeled Injection Timeframe:** Each SWD was modeled at the constant rate listed above from 2022 – 2047.

# Injection Data

Pending SWDs within 6 miles of Patriot State SWD #1

| SWD Name (API) | SWD Status | Injection Rate (BWPD) | Modeled Time Period |
|---|---|---|---|
| Patriot State SWD #1 (015-48074) | Pending | 40,000 | 2022 - 2047 |
| Grackle 072527 Federal SWD 1 | Pending | 30,000 | 2022 - 2047 |
| Wile E Coyote SWD #1 | Pending | 25,000 | 2022-2047 |
| Bugs Bunny SWD #1 | Pending | 25,000 | 2022 - 2047 |
| Boomerang 6 Fee SWD #1 | Pending | 30,000 | 2022 - 2047 |
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| Elk 122527 State SWD #1 | Pending | 30,000 | 2022 - 2047 |
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# Injection Data

Active SWDs within 6 miles of Patriot State SWD #1

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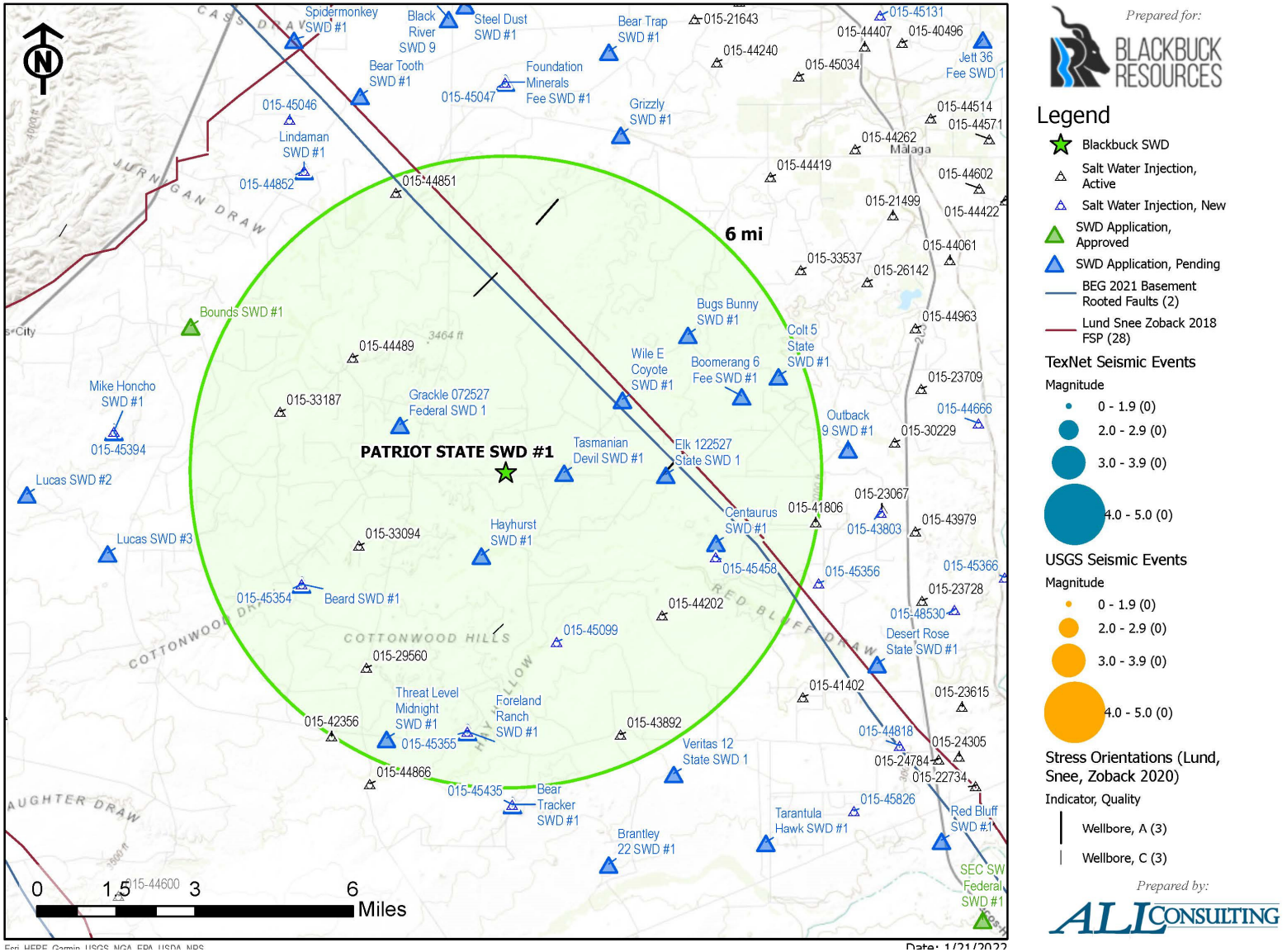
# Patriot State SWD #1 FSP Area Map




Prepared for:

BLACKBUCK RESOURCES

## Legend

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**TexNet Seismic Events**

Magnitude

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- 3.0 - 3.9 (0)
- 4.0 - 5.0 (0)

**USGS Seismic Events**

Magnitude

- 0 - 1.9 (0)
- 2.0 - 2.9 (0)
- 3.0 - 3.9 (0)
- 4.0 - 5.0 (0)

**Stress Orientations (Lund, Snee, Zoback 2020)**

Indicator, Quality

- Wellbore, A (3)
- Wellbore, C (3)

Prepared by:

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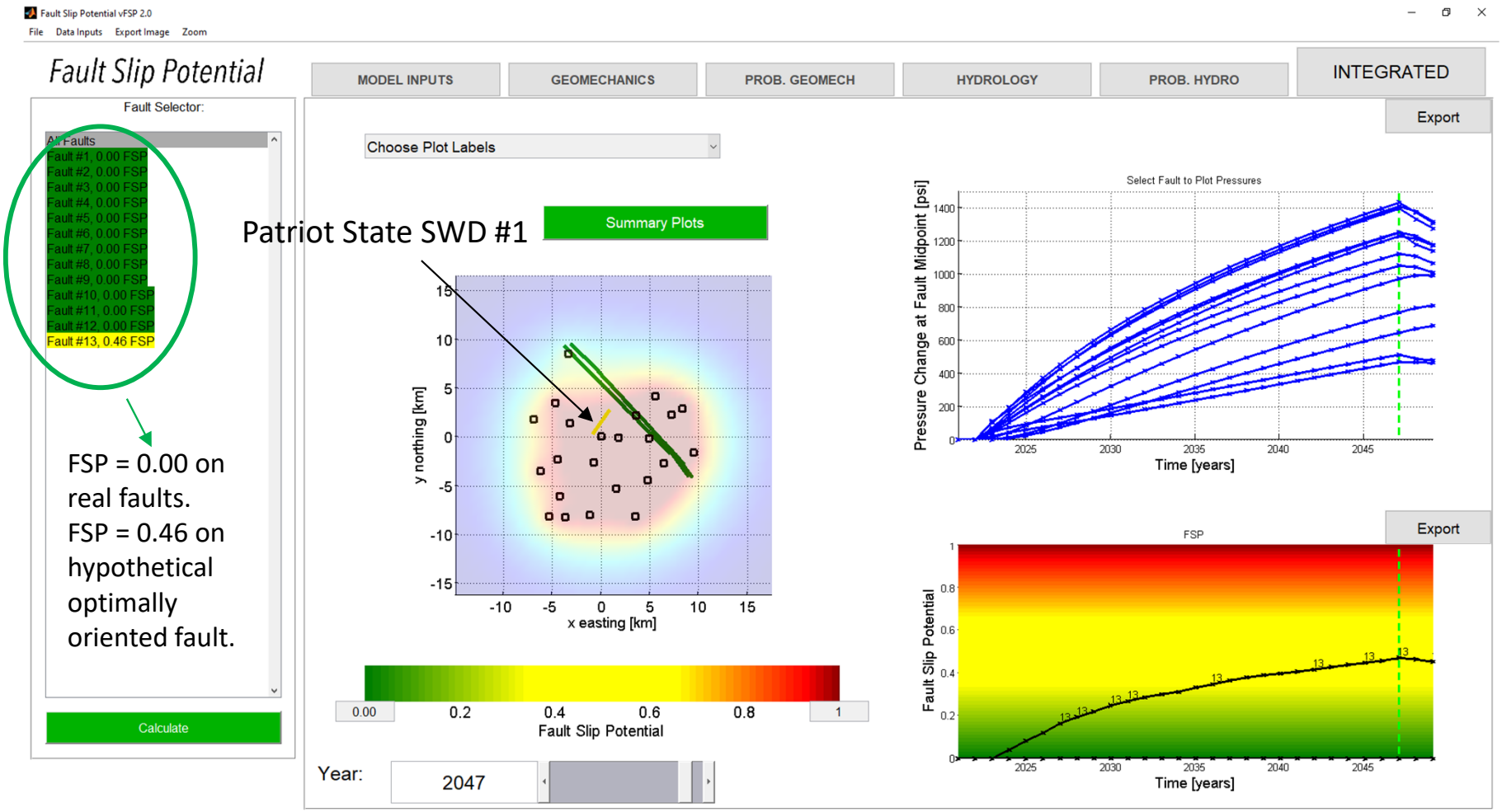
# FSP After 25 Years – Hypothetical Fault




FSP = 0.00 on real faults.
FSP = 0.46 on hypothetical optimally oriented fault.

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# Conclusions

- Two known Precambrian faults exist in the 6-mile radius area of review.
- FSP modeling through 25 years, with injection rates that are likely overestimated, show no risk of potential fault slip in the area on known faults.
- As expected, the simulated optimally oriented fault required to be generated within 1 mile of the proposed SWD resulted in an FSP value of 0.46 after 25 years.
- Actual fault data shows no evidence of optimally oriented faulting within the area of review.
- This area presents little to no risk for injection induced seismicity.

# References

U.S. Geological Survey. "Faults." https://earthquake.usgs.gov/hazards/qfaults/ (Accessed December 17, 2021)

NMOCD Well Search. OCD Permitting - Wells. (n.d.). Retrieved January 28, 2022, from https://wwwapps.emnrd.nm.gov/OCD/OCDPermitting/Data/Wells.aspx

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**Attachment 3**
**Seismic Monitoring Protocol**

# Oil Conservation Division
# Energy, Minerals and Natural Resources Department
# State of New Mexico

## Seismicity Response Protocol (rev. date November 23, 2021)

### Category 1: Seismicity Response Protocol:

### Effective when Two M2.5 Events Occur Within 30 Days and Within a 10 mile Radius

#### Within 10 Miles

**Monitoring & Reporting Protocols**

- Weekly reporting of daily injection volumes and average daily surface pressure
  - Reporting in addition to C-115 reporting, on form provided by OCD
  - Digitally measure injection volume and pressure. The Data must be recorded on an hourly basis at a minimum. Operator shall archive digital injection data and deliver upon request
- Operators must provide an analysis identifying the perforated injection interval and formation tops.
- Operator must monitor seismicity (magnitude >~M2.5 for 10 miles around well using USGS/NMTSO data)
  - Operators shall share monitor data with OCD when requested
- Additional requirements may be added if determined appropriate by the OCD.

### Category 2: Seismicity Response Protocol:

### Effective with one M3.0+ Event

#### M3.0+ event

**All Category 1 Monitoring & Reporting protocols, and**

- 50% rate reduction within 0-3 miles
- 25% reduction between 3-6 miles
- Reductions to rate should start immediately and be completed within a week
- Notify OCD of pertinent information within 24 hours or next business day, whichever is latest, of an event using the OCD form.

#### M3.5+ event

**All Category 1 Monitoring & Reporting protocols, and**

- Shut in at 0-3 miles
- 50% rate reduction at 3-6 miles
- 25% rate reduction at 6-10 miles
- Reductions to rate should start immediately and be completed within a week
- Notify OCD of pertinent information within 24 hours or next business day, whichever is latest, of an event using the OCD form.

- **All rates should be reduced from the previous 6-month daily average of active injection days**
- **Notifications should be made to the OCD by submitting to the OCD Permitting within 24 hours of receiving monitoring data of a seismic event within 10 miles of its facility.**
- **Such notification can be based on private or public seismic network data; however, final actions will be determined by USGS data concerning magnitude and location. All distances in this document are based on determined Epicenter.**
- **Pertinent information will be submitted to the OCD by an OCD form which is in development and will be submitted to the OCD via OCD.Engineer@state.nm.us**
- **OCD my reduce or eliminate disposal volumes within the curtailment radii above, at its sole discretion, if after 6 months no M3.0 events have occurred within 10 mi. of the original triggering event and/or OCD approves an operator/industry response plan within the response radii.**