RAILROAD COMMISSION OF TEXAS
HEARINGS DIVISION

OIL AND GAS DOCKET NO. 08-0317254

APPLICATION OF BOYKIN ENERGY LLC (085182) PURSUANT TO STATEWIDE RULE 9 FOR A COMMERCIAL PERMIT TO DISPOSE OF OIL AND GAS WASTE BY INJECTION INTO A POROUS FORMATION NOT PRODUCTIVE OF OIL AND GAS FOR THE LANDMARK SWD LEASE, WELL NO. 2, PHANTOM (WOLFCAMP) FIELD, REEVES COUNTY, TEXAS

OIL AND GAS DOCKET NO. 08-0317258

APPLICATION OF BOYKIN ENERGY LLC (085182) PURSUANT TO STATEWIDE RULE 9 FOR A COMMERCIAL PERMIT TO DISPOSE OF OIL AND GAS WASTE BY INJECTION INTO A POROUS FORMATION NOT PRODUCTIVE OF OIL AND GAS FOR THE LANDMARK SWD LEASE, WELL NO. 1, PHANTOM (WOLFCAMP) FIELD, REEVES COUNTY, TEXAS

PROPOSAL FOR DECISION

ISSUED: October 30, 2019

HEARD BY: John L. Moore – Technical Examiner
Jennifer N. Cook – Administrative Law Judge

APPEARANCES:

APPLICANT:	Boykin Energy, LLC
George C. Neale, Attorney Christopher S. Hotchkiss, Attorney Seth Crawford, President	Rick Johnston, Consulting Engineer David Scolman, Consulting Geophysicists Keith Wheeler, Consulting Hydrogeologist
PROTESTANT:	Apache Corporation
Brian R. Sullivan, Attorney Bill Hayenga, Attorney Adam Friedman, Attorney	McKennon Laas, Senior Landman Randy Earley, Eng./Regulatory Consultant Brian Bohm, Environ. Sustainability Advisor Brian Stachitus, Geophysical Manager

TABLE OF CONTENTS

I. CASE SUMMARY 3
II. PROCEDURAL HISTORY 4
III. JURISDICTION 4
IV. APPLICABLE LAW 4
V. DISCUSSION OF THE EVIDENCE 5
A. Notice 5
B. Geologic Formations 6
C. The Application 6
1. Seismic Information 7
2. Form W-14 7
a. Field and Lease Name (W-14) 7
b. Reservoir Data (W-14) 7
c. Injection Project Data (W-14) 8
d. General Well Data (W-14) 8
e. Well casing and completion program (W-14) 8
f. Injection interval, volumes and pressures (W-14) 8
g. Special Conditions to Permit 8
D. Applicant's Case 9
E. Protestant's Case 14
VI. EXAMINER'S ANALYSIS 21
A. The Examiners recommend the Commission deny Applicant's motion to dismiss Apache for lack of standing 22
B. The use or installation of the injection well will not endanger or injure any oil, gas, or other mineral formation. 24
C. Applicant did not establish that ground and surface water can be adequately protected from pollution. 24
D. Applicant failed to show the use or installation of the proposed Landmark SWD wells are in the public interest. 26
E. Applicant has made a satisfactory showing of financial responsibility as required by Texas Natural Resources Code, § 91.142. 26
VII. EXAMINER'S RECOMMENDATION, PROPOSED FINDINGS OF FACT AND PROPOSED CONCLUSIONS OF LAW 26

I. CASE SUMMARY

Boykin Energy, LLC (Operator No. 085182) ("Boykin" or "Applicant") filed two identical applications ("Applications") with the Railroad Commission of Texas ("Commission" or "RRC") requesting commercial disposal authority, pursuant to Statewide Rule 9[1], to inject fluid into a formation not productive of oil and gas on the Landmark Lease, salt water disposal Well No. 1 and salt water disposal Well No. 2 (the "Landmark Lease SWDs" or individually the "Landmark SWD"), in the Phantom (Wolfcamp) Field, in Reeves County, Texas. The Landmark Lease SWDs would be located on a fifty-eight (58) acre tract about 3 miles northwest of Toyah, Texas. The applications were protested by Apache Corporation ("Apache" or "Protestant").

Boykin asserts that the geologic location and injection interval selected for the installation and use of the two Landmark Lease SWDs is ideal for the disposal of injected fluids. Applicant's expert witnesses testified that there are no geologic complexities, such as faulting, that would otherwise not confine injected fluids to the injection interval.

Apache asserts that the geologic location and injection interval selected for the installation and use of the two Landmark Lease SWDs is geologically complex due to a fault in the proximity of the proposed injection wells. Protestant's expert witnesses testified there is a fault approximately 900 feet from the proposed injection wells and that the fault extends through the injection interval up into the Rustler Aquifer. The Rustler Aquifer is a source of water Protestant uses in its oil and gas development and operations for the Alpine High Field. Protestant contends that the disposal operation will exert enough pressure on the fault to cause a fault slip forming a conduit for injected fluids to migrate into and contaminate the Rustler Aquifer.

Boykin failed to demonstrate that the installation and operation of the proposed SWD well was in the public interest, that the injected fluids would be constrained to the injection interval, and that useable quality groundwater would be protected. Protestant demonstrated the existence of a nearby fault. The fault could become transmissive with the installation and use of the Landmark Lease SWDs and act as conduit for the migration of injected fluids to contaminate useable quality water in the Rustler Aquafer.

The Administrative Law Judge and Technical Examiner (collectively "Examiners") respectfully submit this Proposal for Decision ("PFD") and recommend the Commission deny the Applications.

---

[1] 16 Tex. Admin. Code § 3.9.

II. PROCEDURAL HISTORY

August 17, 2018	Two applications for disposal permits filed with the Commission for the Landmark Lease SWDs.
August 31, 2018	Apache Corporation filed protests of Boykin's applications.
December 3, 2018	Commission's Injection-Storage Permits Unit issues a letter stating the applications are "administratively complete."
December 5, 2018	Boykin submits a request for hearing.
February 20, 2019	Commission's Hearings Division ("HD") issues Joint Notice of Prehearing Conference for Docket Nos. 08-0317258 and 08-0317254, referencing Boykin's Landmark SWD Wells No. 1 and No. 2, respectively. The prehearing conference date is set for March 12, 2019.
March 19, 2019	HD issues Order Setting Hearing on the Merits. Hearing is set for May 1-2, 2019.
April 15, 2019	Boykin files a Motion to Dismiss Protest for Lack of Standing.
April 17, 2019	HD issues Docket Control Order.
April 25, 2019	Apache files its response to Boykin's Motion to Dismiss Protest for Lack of Standing.
April 26, 2019	Agreed Protective Order filed with HD.
May 1, 2, 6, 7 2019	Hearing on the merits held.
June 28, 2019	Boykin and Apache each file an initial closing statement.
July 19, 2019	Boykin and Apache each file responsive closing statements.
August 2, 2019	Boykin files a final Closing statement and the record closed.

III. JURISDICTION

Sections 81.051 and 81.052 of the Texas Natural Resources Code provide the Commission with jurisdiction over all persons owning or engaged in drilling or operating oil or gas wells in Texas and the authority to adopt all necessary rules for governing and regulating persons and their operations under the jurisdiction of the Commission.

IV. APPLICABLE LAW

Section 27.031 of the Texas Water Code states that no person may continue using a disposal well or begin drilling a disposal well or converting an existing well into a disposal well to dispose of oil and gas waste without first obtaining a permit from the Commission.

The Railroad Commission may grant an application for a disposal well permit under Texas Water Code § 27.051(b) and may issue a permit if it finds:

1. The use or installation of the injection well will not endanger or injure any oil, gas, or other mineral formation;

2. With proper safeguards, both ground and surface fresh water can be adequately protected from pollution;

3. The use or installation of the injection well is in the public interest; and

4. The applicant has made a satisfactory showing of financial responsibility as required by section 27.073.

Additionally, the applicant must comply with the Commission's Statewide Rules. For example, Statewide Rule 9 states:

> (1) General. Saltwater or other oil and gas waste, as that term is defined in the Texas Water Code, Chapter 27, may be disposed of, upon application to and approval by the commission, by injection into nonproducing zones of oil, gas, or geothermal resources bearing formations that contain water mineralized by processes of nature to such a degree that the water is unfit for domestic, stock, irrigation, or other general uses. Every applicant who proposes to dispose of saltwater or other oil and gas waste into a formation not productive of oil, gas, or geothermal resources must obtain a permit from the commission authorizing the disposal in accordance with this section.[2]

V. DISCUSSION OF THE EVIDENCE

A. Notice[3]

Notice of the Applications for the Landmark Lease SWDs were published in the in the *Pecos Enterprise*, a newspaper having general circulation in Reeves County, on August 16, 2018. On August 17, 2018, copies of Commission Form W-14 for the Landmark Lease SWDs were mailed to the surface owners of adjacent tracts and the Reeves County Clerk. There are no operators of record within one-half mile of the Landmark Lease SWDs. The Applications are protested by Apache Corporation, whose nearest production is approximately three (3) miles from the Landmark Lease and whose leaseholds are approximately two (2) miles from the Landmark Lease. The initial published notice of the Applications in the *Pecos Enterprise* did not include the words "COMMERCIAL DISPOSAL WELL" as required. This notice deficiency was corrected by republishing the corrected notice in the *Pecos Enterprise*.[4]

On February 20, 2019, the Hearings Division of the Commission sent a Joint Notice of Prehearing Conference ("Notice") via first-class mail to Applicant and all affected parties setting a pre-hearing conference date of March 12, 2019.[5] The Notice contains (1) a statement of the time, place, and nature of the pre-hearing conference; (2) a statement of the legal authority and jurisdiction under which the hearing is to be held; (3) a reference

---

[2] 16 Tex. Admin. Code § 3.9(1).
[3] Applicant's Exhibits 13, 14.
[4] Applicant's Exhibit 3.
[5] *See* Joint Notice of Prehearing Conference issued February 20, 2019.

to the particular sections of the statutes and rules involved; and (4) a short and plain statement of the matters asserted.[6] The prehearing conference was held on March 12, 2019. Both Applicant and Protestant appeared and participated. At the prehearing conference, the parties agreed to commence the hearing on the merits on May 1, 2019. The hearing on the merits was held on May 1, 2, 6, and 7, 2019. Applicant and Protestant attended and participated in the hearing on the merits. Consequently, all parties received more than 10 days' notice of the hearing and an opportunity for hearing.

B. Geologic Formations

The following table represents the geologic formations in the vicinity of the Landmark Lease, in descending order from the surface:

FORMATION	COMMENT
Edwards-Trinity	Primary Aquifer
Rustler	Brackish Aquifer – designated base of useable quality water at 1,750 feet
Salado	Anhydrite-Halite
Castile	Anhydrite-Halite
Lamar Lime	Geologic marker
Bell Canyon	
Cherry Canyon	Proposed disposal interval
Brushy Creek	Proposed disposal interval
Bone Springs	
Wolfcamp	Phantom (Wolfcamp) Field
Pennsylvanian Shale	Alpine High (Cons) Field
Barnett	Alpine High (Cons) Field
Mississippian Lime	Alpine High (Cons) Field
Wooodford	Alpine High (Cons) Field
Devonian Lime	Alpine High (Cons) Field

C. The Application[7]

Applicant revised the Applications for the Landmark Lease SWDs, a total of three (3) times during the hearing proceedings in efforts to mitigate Protestant's concerns and allegations. Briefly, the concessions in order of their occurrence are:

a. Amending the injection interval from 3,725 ft. – 6,400 ft. to 4,800 ft. – 6,400 ft., thereby eliminating the Bell Canyon formation.[8]

---

[6] *See* Tex. Gov't Code §§ 2001.051, .052; 16 Tex. Admin. Code §§ 1.41, 1.42, 1.45, 3.46.
[7] Applicant submitted identical applications (original and revised) for the Landmark Lease, Well No. 1 and Well No. 2.
[8] Applicant's Exhibit 2, 3 and Applicant's Exhibits 34, 35.

b. Amending the maximum daily injection volume from 30,000 barrels per day ("bpd") to 15,000 bpd for each proposed disposal well.[9]
c. Offering to install two (2) groundwater monitoring wells.[10]

1. Seismic Information[11]

A review of U.S. Geological Survey seismic data shows no earthquakes have been reported within 100 square miles (a 9.08 km radius circle) of the Landmark Lease location.

2. Form W-14[12]

The following information is taken from Applicant's revised Form W-14, *Application To Dispose of Oil and Gas Waste into a Porous Formation Not Productive of Oil and Gas* ("W-14") submitted to the Commission on May 16, 2019, and on June 28, 2019, as late filed Exhibit 34A (Well No. 1) and late filed Exhibit 35A (Well No. 2). Boykin revised the original W-14 for both disposal wells by reducing the maximum daily injection volume from 30,000 bpd to 15,000 bpd,and amending the injection interval of 3,725 feet to 6,400 feet down to 4,800 feet to 6,400 feet, thereby eliminating the Bell Canyon formation from the injection interval. Further, Boykin amended the length of the injection tubing string and the packer depth. Originally, the injection tubing would be run to a depth of 3,625 feet and the packer set at 3,625 feet. The amended Form W-14 now reflects that the injection tubing will terminate at 4,700 feet and the packer will set at 4,700 feet. All other aspects of the original Form W-14 for the two disposal wells remain unchanged.

a. Field and Lease Name (W-14)[13]

The field name identified on line 6 is the Phantom (Wolfcamp) Field (71052900). The lease name identified on line 8 is the Landmark SWD.

b. Reservoir Data (W-14)[14]

The name of the formations identified on line 34 are Cherry Canyon and the Brushy Creek formations.

---

[9] Applicant's Exhibits 34A, 35A.
[10] Applicant's Exhibit 43.
[11] Applicant's Exhibit 46.
[12] Applicant submitted late filed exhibits on May 16, 2019, wherein Boykin amended the Form W-14 for the Landmark Lease SWD Well No. 1 and Well No. 2.
[13] Applies to application for each disposal well.
[14] Applies to application for each disposal well.

c. Injection Project Data (W-14)[15]

The proposed injection is identified as a commercial disposal well on line 42. The types of injection fluids are stated to be salt-water and Resource Conservation and Recovery Act (RCRA) exempt wastes.

d. General Well Data (W-14)

The proposed disposal wells are to be drilled and completed for the purpose of injecting oil and gas waste, limited to salt-water and Resource Conservation and Recovery Act (RCRA) exempt wastes. The proposed Landmark Lease SWD Well No. 1 API number is 42-389-37405 and is proposed to be drilled to a total depth of 6,400 feet. The proposed Landmark Lease SWD Well No. 2 API number is 42-389-37406 and is proposed to be drilled to a total depth of 6,400 feet.

e. Well casing and completion program (W-14)[16]

Line 26 states the base of useable quality water is 1,750 feet. The Landmark Lease SWDs are proposed to be identically drilled and completed. The wells are proposed to be completed with 10-3/4-inch surface casing to a depth of 1,850 feet with 1,150 sacks of 40.5-pound/foot cement circulated to surface. The long string 7-5/8-inch casing is proposed to be set from surface to a depth of 6,400 feet and cemented with 810 sacks of 29.7-pounds/foot cement up to a depth of 3,750 feet. A deferential valve ("DV") tool will be set at 3,750 feet and 535 sacks of 29.7-pounds/foot cement will be pumped up to a depth of 2,000 feet. The 5.5-inch tubing would be run from surface to a depth of 4,700 feet with the injection tubing packer set at 4,700 feet.

f. Injection interval, volumes and pressures (W-14)[17]

Line 33 states the proposed injection interval is from 4,800 to 6,400 feet. The proposed maximum injection volume per day is 15,000 barrels and the proposed average is 12,500 bpd. The proposed maximum injection pressure is stated to be 1,860 pounds per square inch.

g. Special Conditions to Permit

In response to a Commission letter dated October 25, 2018, Boykin agreed to the inclusion of a special permit condition requiring an injectivity test be run on each of the Landmark Lease SWDs after the wells are drilled and completed.[18]

---

[15] Applies to application for each disposal well.
[16] Applies to application for each disposal well.
[17] Applies to application for each disposal well.
[18] Applicant's Exhibits 3,9.

D. Applicant's Case[19]

Mr. Rick Johnston, Consulting Engineer, testified regarding the preparation and content of the Applications submitted to the Commission for the Landmark Lease SWDs. Mr. Johnston asserted that the Protestant, Apache, was neither a surface owner adjacent to the fifty-eight (58) acre tract where the Landmark Lease SWDs are proposed to be located, nor did Apache operate a well within a one-half (1/2) mile radius of the proposed disposal wells.

Mr. Johnston testified that the proposed Landmark Lease SWDs would be sited 607 feet apart on the Landmark Lease, and that the contents of the respective commercial disposal permit applications submitted to the Commission were identical. Mr. Johnston stated, "the two wells are duplicates of one another."[20]

Mr. Johnston provided an electric well log[21] of the C. J. Lee State #1H to demonstrate the thickness of the formation overlying the top of the Bell Canyon formation at a measured depth of 3,760 feet. This well is approximately 4,000 feet west of the Landmark Lease. Mr. Johnston testified "from 3,700 feet up to 1,830 feet, that is the anhydrite section that will act as a good confining interval."[22] Mr. Johnston further opined that the top of the Lamar Lime formation, an interpreted geologic marker, is at about 3710 to 3715 feet overlaying the Bell Canyon formation at 3,760 feet.

Mr. Johnston offered a cross-section of representative wells logs extending approximately 7.5 miles and correlated on the top of the Lamar Lime to demonstrate "that the upper confining interval, the anhydrite section, is pretty consistent and it's very thick, and it does not have any salt in it."[23] Mr. Johnston testified that because the signatures of the caliper tool were relatively smooth, as depicted in the well logs of the cross-section, "I don't see any indications of any salt sections present in any of these logs."[24]

Mr. Johnston testified regarding the abandoned Ramsey, Well No. 1, to the west and inside of the one-half mile radius of the Landmark Lease SWDs. He provided the Commission plugging report indicating that the well was originally plugged in 1954 and later re-plugged by the Commission in 1989.[25] Mr. Johnston testified that "the bottom plug goes from 1,516 feet to 1823,"[26] and "the base of the useable-quality water in this area is at 1,750 feet,"[27] and "this well is plugged in such a fashion that the injected fluids will not get into the useable quality ground water,"[28] and finally "it's also plugged in such a

---

[19] The hearing transcript in this case is referred to as "Volume [Vol.], Page [Pages], Line [Lines]."
[20] Vol. 1, Page 33, lines 14,15.
[21] Applicant's Exhibit 13.
[22] Vol. 1, Page 37, Lines 17-19.
[23] Vol. 1, Page 40, Lines 15-18.
[24] Vol.1, Page 41, Lines 17-19.
[25] Applicant's Exhibit 16.
[26] Vol. 1, Page 42, Line 21.
[27] Vol. 1, Page 42, Lines 22, 23.
[28] Vol. 1, Page 42, Line 25. Page 43, Line 1, 2.

fashion that the only thing open in the open hole portion of this well is the anhydrite and a portion of the Bell Canyon."[29]

Mr. Johnston opined regarding the Toyah SWD, a commercial disposal well that began injecting in 2009 and "is located a little more than two miles away."[30] Mr. Johnston testified that cumulative injection into this well is "16.6 million barrels of water,"[31] and "they are using the same interval that we propose to use."[32] Regarding the Toyah SWD' injection interval, he further reiterated "it's probably gonna be very close stratigraphically to being the same interval that we seek two-and-a-half miles up dip and to the west."[33]

Mr. Johnston presented an amended Form W-14's for each of the two Landmark Lease SWDs lowering the top of the injection zone from 3,725 to 4,800 feet, thereby eliminating the Bell Canyon section.[34] Referring to the Landmark SWD No. 1, Mr. Johnston testified "...we've dropped the top of the [disposal] interval from 3,725 to 4,800 feet."[35] "Just in an abundance of caution to take the Ramsey No. 1 issue out of the case."[36] Mr. Johnston explained that the Protestant had implied that the Ramsey well was improperly plugged and presented a possible conduit for the migration of injected fluids. Mr. Johnston further stated the total drilled depth of the Ramsey well is 3,974 feet. Mr. Johnston testified "It puts an interval between the TD [total depth] of that well and the top of our disposal interval such that now the revised disposal operations will not potentially put fluid into that open wellbore."[37] Referencing a chart from the *Schlumberger Chart Book*[38] and an AAPG paper titled *Reservoir Characterization of a Permian Deepwater Sandstone, East Ford Field, Delaware Basin,*[39] Mr. Johnston testified that that the confining layer above the revised injection interval was on the order of 4% porosity and 0.06 millidarcies.

Mr. Johnston testified that the Applicant is further amending the application forms. Mr. Johnston stated, "We want to reduce the injection – maximum injection volume for each well from 30,000 each to 15,000 each. And, we want to change the maximum surface injection pressure to 2,400 psi on both."[40] The Applicant subsequently withdrew its request to increase the maximum surface injection pressure, as this would have required both applications to be remanded to the Commission's underground injection control department for administrative review.

Mr. Johnston testified regarding the validity and practicality of the Protestant's pressure front calculations when projecting increased formation pressures. Mr. Johnston

---

[29] Vol. 1, Page 43, Line 2-5.
[30] Vol. 1, Page 45, Line 8.
[31] Vol. 1, Page 44, Line 24.
[32] Vol. 1, Page 45, Line 1,2.
[33] Vol. 1, Page 47, Lines 12-14.
[34] Applicant's Exhibits 34, 35.
[35] Vol. 3, Page 11, Lines 14,15.
[36] Vol 3, Page 11, Lines 18, 19.
[37] Vol. 3, Page 15, Lines 20-23.
[38] Applicant's Exhibit 38.
[39] Applicant's Exhibit 39.
[40] Vol. 3, Page 22, Lines 15-18.

contends that the requested maximum surface injection pressure of 1,860 psi, plus the weight of the column of injected fluids in the disposal well will be approximately 4,100 psi. Mr. Johnston reiterated that a formation pressure of 5,500 psi or 11,000 psi, as calculated by the Protestant, isn't realistic due to the permit-limited injection pressure.

Mr. Keith Wheeler, Consulting Hydrogeologist, testified regarding the suitability of the geology in the upper confining layer above the proposed injection interval. Mr. Wheeler stated, "I think this is an ideal location hydro-geologically for the proposed disposal activities,"[41] and "there's about 1,900 feet of the Castile anhydrite above the injection interval. It's a massive hydrogeologic interval, low permeability."[42]

In support of his expert testimony, Mr. Wheeler referenced his evaluation of a published work by Steven Lambert titled *Dissolution of Evaporites in And Around the Delaware Basin, Southern New Mexico and West Texas.*[43] Mr. Wheeler testified that at the location of the Landmark Lease "the halite (salt) beds are gone. They're absent."[44] The implication being that if the halite were present, and if there were adequate flows of undersaturated fluids, the halite would preferentially dissolve. The halite dissolution could cause paths for the migration of disposed injection fluids from the injection interval of the proposed Landmark SWDs. Mr. Wheeler surmised from Lambert's work, "I think this is an excellent location, and that this anhydrite will provide an excellent seal for any injection activities."[45]

Mr. Wheeler provided a map from the Lambert publication depicting the relative distance from the Landmark Lease to the Toyah Trough.[46] The marked map indicates that it is about twenty-five miles from the Landmark Lease to the Toyah Trough. Mr. Wheeler then testified regarding the Applicant's proposal to install a groundwater monitoring system on the Landmark Lease. Mr. Wheeler explained why the Applicant is offering the monitoring plan as follows, "I guess the primary reason is that I do not believe that the useable ground water is threatened by the disposal activity. Apache has expressed that concern and in an abundance of caution, we're proposing a monitoring network to be able to evaluate and alleviate their concerns."[47]

The plan includes quarterly monitoring of two new wells drilled to the base of the useable quality water at 1,750 feet in the Rustler formation. The monitoring wells would be drilled at locations to detect the migration of injected fluids. Referring to the locations of the monitoring wells, Mr. Wheeler testified "I think these wells are appropriately located downgradient of the Rustler aquafer at this location."[48] In reference to the monitoring well in the southern portion of the Landmark Lease, Mr. Wheeler stated "The well to the south would be almost in direct line between the disposal wells and their (Protestant) water

---

[41] Vol. 1, Page 53, Lines 5,6.
[42] Page 53, Lines 8-10.
[43] Applicant's Exhibit 22.
[44] Vol. 1, Page 59. Line 6.
[45] Vol. 1, Page 59, Lines 17-19.
[46] Applicant's Exhibit 42.
[47] Vol. 3, Page 37, Lines 7-14.
[48] Vol. 3, Page 38, Lines

supply well."[49] Regarding the monitoring well in close proximity to Protestant's fault interpretation, Mr. Wheeler testified "...in the unlikely event that there were fluids to come up to the Castile anhydrite that well would be, you know, well positioned to identify that potential impact."[50]

Mr. Wheeler testified regarding his interpretation regarding the existence and formation of the Cenozoic troughs in the Delaware Basin. Mr. Wheeler explained, "...these Cenozoic troughs occurred when there was dissolution of halites in this thing called the Rustler Aquifer and the Salado formation."[51] Mr. Wheeler continued, "...somehow fresh water got down into this Rustler formation and Salado."[52] Mr. Wheeler stated, "Once this dissolution front went down to the Rustler and down to the Salado, when it got to the top of the Castile anhydrite it stopped. And, it's basically perched on top of this relatively impermeable anhydrite bed that's not prone to dissolution."[53] Mr. Wheeler's interpretation and testimony is that anything that occurred above the Castile formation he described as "this 1,900 foot section of low permeability material"[54] and "our low permeability anhydrite layer"[55] "has very little relevance at all."[56]

Mr. Seth Crawford, Owner of Boykin Energy, LLC, offered his opinion that there was a commercial need for the two Landmark SWDs. Mr. Crawford stated, "Definitely a need for additional disposal capacity in this area."[57] Mr. Crawford's business model is to permit, drill and complete the disposal wells in full compliance with all applicable regulations and laws. Having fully compliant and operational disposal wells, Mr. Crawford would then seek a purchaser of the respective disposal well(s) to continue longer-term operations. Mr. Crawford, stated "a majority of the wells we drill are then purchased by NGL."[58]

Mr. David Scolman, Geophysical Consultant, testified regarding his review of the geology and geophysics around the two proposed Landmark Lease SWDs. Mr. Scolman provided a one mile 2-D seismic line, extending south to north in close proximity to the Landmark Lease, which represents the seismic signature from the surface down through the proposed injection interval to the Fusselman formation.[59] Mr. Scolman's interpretation of the seismic data is that the Wolfcamp formation is "continuous and unbroken,"[60] that the top of the Bone Springs lime interval is "continuous and unbroken,"[61] that the top of the Cherry Canyon is "continuous and unbroken,"[62] that the reflectors of the Bell Canyon

---

[49] Vol. 3, Page 38, Lines 19-21.
[50] Vol. 3, Page 39, Lines 5-8.
[51] Vol. 4, Page 96, Lines 13-15.
[52] Vol. 4, Page 96, Lines 18-19.
[53] Vol. 4, Page 97, Lines 5-9.
[54] Vol. 4, Page 98, Line 5.
[55] Vol. 4, Page 98, Line 9.
[56] Vol. 4, Page 98, Line 3.
[57] Vol. 1, Page 67, Lines 24, 25.
[58] Vol. 1, Page 87, Lines 19, 20.
[59] Applicant's Exhibit 29A.
[60] Vol. 1, Page 75, Line 2.
[61] Vol. 1, Page 75, Line 6.
[62] Vol. 1, Page 75, Line 8.

are "continuous and unbroken,"[63] and finally, that the top seal of the proposed injection interval, the Castile formation, is "continuous and unbroken."[64]

Mr. Scolman testified, "There is no evidence of faulting from the seismic data here, any significant faulting that would endanger the seal of the Castile anhydrites."[65] Mr. Scolman concurred with Mr. Johnston and with Mr. Wheeler that there is a very substantial upper confining interval to keep injected fluids from migrating from the injection interval.[66] Mr. Scolman provided a structure map depicting his interpretation of the top of the Bell Canyon formation.[67] The structure map depicts a relatively smooth dip to the southeast with no evidence of faulting. Mr. Scolman stated, "The contours across the entire map are smooth and uniformly dipping down into the basin," further supporting his testimony about the lack of faulting in the area.[68]

Mr. Scolman elaborated on his previous testimony and his interpretation of the geologic and seismic data to conclude there was no fault in the proximity of the Landmark Lease SWDs. Mr. Scolman contended that his interpretation of the seismic data demonstrates a channel cut as opposed to a fault. Mr. Scolman also contended that the Protestant's well log cross-section in the vicinity of the Landmark Lease did not demonstrate an up-dip/down-dip representation of a fault. Mr. Scolman testified, "When I take their cross section and I place a straight edge as defined by this blue line, and those tops are ruler straight from the wells on the south side to the wells on the north side as it crosses through where they – where they propose their fault, there's no change, there's no displacement in the tops."[69] Mr. Scolman provided exhibits wherein he overlaid his interpretation of a channel cut on the seismic reflections interpreted by the Protestant to be evidence of a fault.[70] Referring to the seismic reflectors, Mr. Scolman testified, "Just to – to emphasize again, that you can see the channel cut nicely from the cross section through here, and you can see the seismic following those changes quite nicely, quiet accurately."[71] Mr. Scolman reiterated his belief that both Applicant and Protestant had purchased and evaluated the same 2D seismic line data which ran through the Landmark Lease from the same source. Mr. Scolman stated, "It appears that we have both received exactly the same seismic line from the same company."[72]

Mr. Scolman reiterated the technical basis for his interpretation of the seismic data and demonstrated the physical characteristics of sub-surface sonic reflection. Mr. Scolman elaborated on his interpretation of the geologic depositional model for the region, including the impact of the Capitan reef structure on the alluvial channel deposits. Mr. Scolman concluded his testimony by stating,

---

[63] Vol. 1, Page 75, line 10, 11.
[64] Vol. 1, Page 75, Line 14.
[65] Vol. 1, Page 76, Lines 7-10.
[66] Vol. 1, Page 76, Line 15.
[67] Applicant's Exhibit 30.
[68] Vol. 1, Page 82, Lines 13,14.
[69] Vol. 3, Page 48, Lines 10-15.
[70] Applicant's Exhibits 48. 49. 50.
[71] Vol. 3, Page 72, Lines 2-5.
[72] Vol. 3, Page 75, Lines 17-19.

> "The hearing has been about whether there's a fault here. We have seen – I have presented my evidence of how I believe the geology and the geophysics are better interpreted as channel sands, which we know are the known depositional model out here. I believe that to be the best interpretation of this seismic data."[73]

E. Protestant's Case

Mr. McKennon Laas, Senior Landman, testified regarding his knowledge of Apache's ongoing leasing efforts in southern Reeves County to develop their interests in the Alpine High field. Mr. Laas stated that he had personally contacted Mr. Crawford regarding the proposed Landmark SWDs and informed him that "we [Apache] felt there was significant faulting in the area that would have communication with groundwater."[74]

Mr. Brian Stachitus, Geophysical Manager, testified regarding his interpretation of the geology, geophysics and seismic data in the Delaware Basin, including the area in and around the Landmark Lease. Mr. Stachitus stated "Apache has a protocol to review wells, and when we see what we consider high structural complexity, those areas where we would recommend not putting a well or not sending any fluids through the well if that well is already permitted or used by other people."[75]

Mr. Stachitus provided exhibits demonstrating the petrophysical analysis of three (3) wells in the vicinity of the Landmark Lease and one (1) in the Pecos Bend area about thirty-five (35) miles north of the Landmark Lease. These four wells were selected to demonstrate the differences in the rock properties of the Bell Canyon and Cherry Canyon formations across the basin. Mr. Stachitus' stated conclusions pertaining to the petrophysical analysis of the wells closest to the Landmark Lease were that there are limited segments of the Bell Canyon and Cherry Canyon formations that demonstrate suitable porosity for injection. In contrast, Mr. Stachitus referred to the petrophysical analysis of the Buzzard 23-1 Well in the Pecos Bend area "there's a much thicker unit part of Bell Canyon unit that has higher porosity, and also the Cherry Canyon has increased porosity over a greater thickness in the wellbore."[76] Referring to the petrophysical analysis conducted by the Protestant on the log of the nearby State Warren Wright No. 1 Well,[77] within 2.5 miles of the Landmark Lease, Mr. Stachitus testified, "There is some halite in the upper portion of that Salado/Castile formation,"[78] and "the most porous zones (of the Bell Canyon) are very close to the overlying anhydrite layer,"[79] and "from ... 2,600 down to the top of the Bell Canyon, you are seeing some slight

---

[73] Vol. 4, Page 154, Lines 13-18.
[74] Vol. 1, Page 262, Lines 15-17.
[75] Vol. 1, Page 273, Lines 1-6.
[76] Vol. 1, Page 282, Lines 23-25. Page 283, Lines 1, 2.
[77] Protestant's Exhibit 4F
[78] Vol. 1, Page 280, Lines 24, 25.
[79] Vol. 1, Page 284, Lines 17, 18.

amounts of halite in that wellbore."[80] Mr. Stachitus reiterated, "So it's not just there's no salt. It's not all anhydrite."[81]

Mr. Stachitus did not agree with the Applicant that the layer right above the disposal interval is one massive confining layer.[82] Mr. Stachitus opined,

> "We really have to start looking at the fault seismic data I've interpreted – I have a different interpretation – and also the presence of some percentage of salt in that overlying area. And, I see faults propagating up through the top of the Bell Canyon into that basal Lamar/Castile zone. So, I feel that there's plenty of migration pathways where injected fluids could migrate out of the injection zone and move upward."[83]

Mr. Stachitus sponsored regional structure maps based on the interpretation of at least 600 well logs and incorporating 2D and proprietary 3D seismic data. Mr. Stachitus' structure maps of the Bell Canyon and Cherry Canyon formations illustrate a general dip from northwest to southeast, a northwest-southeast trending fault in the vicinity of the Landmark Lease, and a northwest-southeast trending fault corridor approximately 2.5 miles south of the Landmark Lease.[84] Based on his interpretation of the 2D seismic data, Mr. Stachitus stated, "I interpret a fault just north of the Landmark location".[85] Referring to his interpreted fault north of the proposed Landmark SWDs, Mr. Stachitus testified, "I estimate the throw on that fault is about 90 feet,"[86] and "I estimate the zone of disruption by this fault is about 350 feet wide."[87] Mr. Stachitus further testified, "I've interpreted the fault in the 2D data to lie about 500 feet north of the (Landmark) SWD 1 location,"[88] and "at the Bell Canyon and Cherry Canyon level and into the basal part of the Castile, I'm confident that the seismic data is illustrative of the structural complexity."[89]

Mr. Stachitus supported his analysis of the seismic data: "Well, we defined a fracture corridor from in-depth analysis of 3D seismic data that's derived along each of these horizons. In Apache's operations we look at the fracture detection algorithm that we run, what's called the Lisle attribute. We use that information to plan and drill our wells. So, we use that information to avoid faults, and it's enabled us to drill our wells much more efficiently without problems."[90] Mr. Stachitus testified, "We've used it to drill over a hundred wells in the last few years, and it's increased our ability to drill wells faster, quicker and cheaper because we're avoiding problems drilling."[91] Mr. Stachitus further stated, "But, you can only use that technology with 3D seismic, so we cannot do that

---

[80] Vol. 1, Page 281, Lines 20-22.
[81] Vol. 1, Page 281, Lines 4, 5.
[82] Vol. 1, Page 283, Lines 25. Page 284, Lines 1-5.
[83] Vol. 1, Page 284, Lines 7-15.
[84] Applicant's Exhibits 6C, 6D.
[85] Page 290, Lines 20, 21.
[86] Vol. 2, Page 42, Lines 4, 5.
[87] Vol. 2, Page 43, lines 12, 13.
[88] Vol. 2, Page 19, Lines 13-15.
[89] Vol. 2, Page 20, Lines 6-10.
[90] Vol.2, Page 23, Lines18-25. Page 24, line 1.
[91] Vol. 2, Page 24, Lines 5-8.

analysis on 2D seismic."[92] Later in his testimony, Mr. Stachitus did state that Apache had licensed 3D seismic data up to a certain point south of the Landmark Lease, but not across the Landmark Lease.[93]

Essentially, both the Applicant and the Protestant licensed and evaluated the same 2D seismic data in the vicinity of the Landmark Lease SWDs, which had been initially shot in 1976 and reprocessed in 2013. The Protestant used generally available software to enhance and magnify the 2D seismic data to assist in its interpretation. Additionally, Applicant corroborated the 2D seismic date with its 3D seismic data. Without the Applicant applying the enhancement software to the 2D seismic data in the vicinity of the Landmark Lease SWDs, Mr. Stachitus testified, "You would be prone to perhaps oversimplify the structural complexity".[94]

Mr. Stachitus reiterated his interpretation of the seismic data relating to the Landmark Lease: "The critical fault closest to the proposed wellbore does extend from just above the top of the Bell Canyon, through the Cherry Canyon, and down – I've got it projected to the top of the first Bone Springs."[95] Mr. Stachitus stated, "And so that's the message here is that the evidence for a fault is very, very strong, very high confidence. And, it doesn't involve complicated geologic interpretation to explain the offset and the attenuation."[96]

Mr. Stachitus presented additional structural contour maps separately depicting the tops of the Rustler, Bell Canyon, and Cherry Canyon formations. Mr. Stachitus included a structural contour map which depicted the Protestant's interpretation overlaid with the Applicant's structural interpretation. When questioned why the interpretation of the structural contours was so different between the Applicant and the Protestant, Mr. Stachitus replied, "I've analyzed a much larger area."[97] Mr. Stachitus further replied, "So, Boykin in their map, without relying on the seismic data at all for fault interpretation, they've ignored the fault completely."[98] Mr. Stachitus explained, "...That's the first thing you do when you go into an area. You map it and you may not have information on faulting... But then when you introduce seismic data, which is – allows you to interpret between the widely spaced wellbores, that's why we shoot seismic. Because we can't always tell what's happening between wellbores which have a 9-inch or whatever data points. So, that gives us a lot information in between those wellbores."[99] When questioned regarding the inadequacy of well bore cross sectional analysis to determine the fault, Mr. Stachitus replied, "Yeah, you wouldn't see a near vertical fault between two wells without seismic data."[100] Mr. Stachitus concluded his testimony by stating, "I think our

---

[92] Vol. 2, Page 24, Lines 11-13.
[93] Vol. 2, Page 33, lines 12-14.
[94] Vol. 2, Page 46, Lines 6, 7.
[95] Vol. 3, Page 121, Lines 1-5.
[96] Vol. 3, Page 131, Lines 15-19.
[97] Vol. 3, Page 151, Lines 4, 5.
[98] Vol. 3, Page 152, Lines 23-25.
[99] Vol. 3, Page 153, Lines 2-11.
[100] Vol. 3, Page 167, Lines 6, 7.

interpretation of the fault is very high confidence; and I think it's real; and I think it presents a very significant risk for any SWD locations in the immediate area."[101]

Mr. Randy Early, Regional Regulatory Manger, testified regarding the Commission's standards and procedures relating to disposal wells and faulting, the precedent established in Commission orders referencing the presence of faulting as a basis for denying or rescinding disposal permit applications and ceasing such operations, the calculation of a pressure front induced by the Landmark Lease's injected liquids on Protestant's alleged fault, and the general state of private and commercial disposal wells within eleven miles of the proposed Landmark Lease SWDs.

Mr. Early reiterated his understanding of the Commission's policy that no injection or disposal permit will be permitted where faults, fractures, structure, or other geologic factors indicate that isolation of the authorized injection or disposal zone is jeopardized.[102] Referring to Oil and Gas Docket No. 01-0295061, Mr. Early testified, "They [the Examiners] found that faulting in this area provided for non-containment of the injected fluid and, therefore, provided a hazard that was improper."[103] The Examiners recommended denial of the disposal permit application in that case. In Oil and Gas Docket No. 03-0266270, Mr. Early related the Examiners recommendation that the Commission rescind its previously issued 'no-harm' letter due to hearing evidence indicating the presence of faulting in the operator's permitted disposal zone.[104]

Mr. Early provided pressure front calculations to illustrate the pressure that would be exerted on the alleged fault as a result of injecting fluids into one or two of the proposed disposal wells on the Landmark Lease.[105] Using the formation variables derived from previous testimony and the Protestant's geologic team over a 650 foot injection interval, Mr. Early testified that if 30,000 bpd were injected, the formation pressure exerted on the fault 500 feet away would be 4,808 psi.[106] If both wells on the Landmark Lease were injecting the equivalent of 48,000 bpd for one year, Mr. Early's exhibit reflects that the formation pressure exerted on the fault 500 feet away would be 6,451 psi. This type of pressure front calculation becomes part of the fault slip analysis by Protestant's Mr. Brian Bohm in later testimony to evaluate the probability of the injected fluids causing a seismic event [fault slip] and the possible migration of injected fluids along the fault into useable quality ground water.

Mr. Early testified that the two nearest commercial disposal wells to the proposed Landmark Lease SWDs, the Toyah SWD No. 1 and the Shurtleff Unit No. 1, had never exceeded, in annual injected volumes, more than 40% of their respective permitted capacity.[107] In testimony, Mr. Early agreed that Applicant's representation that there were

---

[101] Vol. 3, Page 174, Lines 7-11.
[102] Protestant's Exhibit 12A.
[103] Vol 2, Page 12-14
[104] Protestant's Exhibit 13B.
[105] Protestant's Exhibit 14.
[106] Vol. 2, Page 83, Lines 4-7.
[107] Vol. 2, Page 88, Lines 7-9.

only four disposal wells within a 10-mile radius of the Landmark Lease was incorrect.[108] Protestant's exhibit indicates that there are a total of twelve active disposal wells within an eleven mile radius of the proposed Landmark Lease SWDs, of which five are non-commercial disposal wells not accepting fluids from third-parties.[109]

Mr. Early testified regarding his revised pressure front calculations using the amended injection interval and maximum daily injection volumes.[110] Using adjusted inputs to account for the change in depth, the injection interval height, the distance to the fault and the injection volume, Mr. Early calculated the formation pressure on the fault in the injection interval to be 4,098 psi after one year of injecting 15,000 bpd. This represents an increase of 1,938 psi over the estimated formation pressure of 2,160 psi without any injection activity.

Mr. Brian Bohm, Environmental Sustainability Advisor, testified regarding the lithology of the Salado formation and the Castile formation and the proposed injection interval [Bell Canyon, Cherry Canyon and Brushy Creek segments], Protestant's waste-water recycling and disposal efforts, and a fault slip analysis evaluating the effect on the fault caused by increased formation pressure due to injected disposal fluids.

Mr. Bohm affirmed that based on the petrophysical data analysis conducted by the Protestant, the upper-most 200 – 250 feet of the Bell Canyon demonstrated the highest porosity and the most likely to take water throughout the proposed injection interval. When testifying about the Castile/Salado formation directly overlying the Bell Canyon formation, Mr. Bohm stated, "They're anhydrites and halites."[111] Mr. Bohm explained that anhydrites are a calcium sulfate mineral, and that gypsum is the hydrated form of the anhydrite. He stated gypsum tends to be softer, anhydrite tends to be stiffer and more brittle. Mr. Bohm further explained that halite is sodium chloride, a different chemical compound from an anhydrite. Mr. Bohm stated, "So, you got two different chemistries, which is why when they're [anhydrite and halite] deposited you tend to see layering, lamination."[112]

Mr. Bohm then testified about the solubility of halite and anhydrite, and corroborated a paper published by Kenneth Johnson titled *Subsidence Hazards Due to Evaporite Dissolution in the United States*.[113] Referring to the author of the paper, Mr. Bohm states, "He notes them [halite and anhydrite] as evaporate rocks and then notes that evaporite rocks are the most soluble of the common rocks throughout the world."[114] Mr. Bohm contends that dissolution in the vicinity of the Landmark Lease has resulted in collapse and brecciation within the Salado/Castile formation. Referring to Protestant's seismic data from the Pecos Bend area compared to the seismic data of the Landmark Lease, Mr. Bohm concluded, "I don't see that continuous bedding. I don't see an indication that I've got a thick, continuous anhydrites that are – they appear broken. They have

---

[108] Vol. 2, Page 93, Lines 4-8.
[109] Protestant's Exhibit 16.
[110] Protestant's Exhibit 40.
[111] Vol. 2, Page 114, Lines 19,20.
[112] Vol. 2, Page 117, Lines 19-22.
[113] Protestant's Exhibit 27.
[114] Vol. 2, Page 120, Lines 9-11.

different dips. They show different angles. They don't appear flat."[115] Mr. Bohm stated, "the brecciated anhydrites would be not quite a gravel but maybe a broken permeability similar to sand where they would allow fluid to migrate."[116]

Mr. Bohm testified regarding the dissolution of halite and anhydrite by injected fluids "anything that's not fully saturated relative to either one of those minerals tends to dissolve it."[117] Referring to the Lambert paper offered into evidence by the Applicant, "Lambert identifies water in the Delaware Mountain Group as being saturated relative to sodium chloride at 300,000 milligrams per liter TDS. It would be essentially in equilibrium with whatever halites are still present."[118] When questioned about the concentration of water he anticipates to be injected by the Landmark SWDs, Mr. Bohm replied, "Oil and gas produced water in the Delaware Basin is not much over – from what we've seen in our wells – 100,000 TDS. And that's the worst of the worst water we have. ...we bring a lot of our produced water together into a single pit. If I look at the average TDS in my pit, it's somewhere between 50,000 and 80,000 [TDS] depending on how old the wells are."[119]

Mr. Bohm asserts, "you've lost half the volume of the basin on the west side,"[120] attributed to the dissolution of the anhydrites and halites in the Salado/Castile formation. Mr. Bohm supported his dissolution testimony with an exhibit depicting excerpts from a book authored by Carol Hill titled *Geology of the Delaware Basin Guadalupe, Apache, and Glass Mountains New Mexico and West Texas.*[121] The excerpts discuss the presence of deep-seated dissolution features or troughs in the Salado/Castile formation, including the nearby Toyah Trough. Mr. Bohm stated, "But, you know, the Toyah Trough is named the Toyah Trough because it coincides with the town of Toyah. These wells [the Landmark Lease SWDs) are located just to the northwest of the town of Toyah."[122] Mr. Bohm affirmed Protestant's petrophysical analysis which determined the presence of ancient halite beds in the vicinity of the Landmark Lease. Mr. Bohm concluded that if an observer only evaluates well logs "the gamma ray signature for an anhydrite is very similar to what it would be for a halite. So, if it's continuous or blocky, or brecciated, it's gonna have a similar signature."[123]

Mr. Bohm identified two potential conduits that would expedite the vertical migration of injected fluids, namely the Ramsey No. 1 Well and the fault identified by Mr. Stachitus. Regarding the Ramsey No. 1 Well, Mr. Bohm testified, "...it's an open hole completion down into the upper Bell Canyon. If there's not a plug filling that borehole or if there's not something preventing fluid migration, it could easily – especially at the pressures we're looking at that Randy Early presented – have fluid migration up this wellbore."[124] In reference to the fault identified by Mr. Stachitus, Mr. Bohm stated, "...even

---

[115] Vol 2, Page 125, Lines 21-25. Vol. 2 Page 126, Line1.
[116] Vol. 2, Page 133, Lines 19-21.
[117] Vol. 2, Page 146, Lines 7,8.
[118] Vol. 2, Page 146, Lines 7-18.
[119] Vol. 2, Page 147, lines
[120] Vol. 2, Page 131, Lines 2, 3.
[121] Protestant's Exhibit 30.
[122] Vol. 2, Page 141, Lines 13-16.
[123] Vol. 2, Page 137, Lines 5-8.
[124] Vol. 2, Page 151, Lines 21-25. Vol. 2, Page 152, Line 1.

if the fault's currently sealed, if the fault is critically stressed and we increase the pressure in the injection formation, we can cause that fault to slip and move. So, if that fault slips and moves, it has the potential to create a wider pathway or change its orientation to allow fluids to migrate more easily."[125]

Mr. Bohm sponsored an exhibit depicting his fault slip analysis on the fault identified by Mr. Stachitus to be about 500 feet north of the Landmark Lease SWDs.[126] Mr. Bohm's fault slip analysis is based on a software package developed by the Stanford Center for Induced and Triggered Seismicity, located at Stanford University. The software package is a model used to determine if and when the increase in pressure from injected fluids might cause a slip in an existing fault. Inputting the characteristics of the fault, such as the primary stress orientation, the expected fault slip type, the friction coefficient, and the fault depth midpoint, and inputting formation variables such as lithology, porosity, permeability, and injection interval height, the software produces an estimate of the incremental pressure on the fault that will induce slip on the fault. Having run the model, Mr. Bohm testified, "So, in this case, we estimate that pressure to be somewhere around 380 psi increase in pressure, the model predicts that you would have the potential to induce slip on this fault.'[127] Mr. Bohm further stated, "...we're seeing that we would exceed the 380 psi pressure that would potentially cause this fault to slip by injection at the subject wells in less than a year."[128] Regarding the effect of the injected fluids on the anhydrite and halite, Mr. Bohm testified, "If the fluids that are injected are not saturated with respect to the mineral – the halites, the anhydrites, you have the potential for dissolution along that fault. So, potentially in addition to the fault slip, you could also have additional dissolution, and create an even bigger flow path...."[129]

Mr. Bohm testified regarding the Protestant's use of water from the Rustler formation for construction, drilling and completion operations and the Protestant's waste-water piping and recycling infrastructure. Mr. Bohm stated that the Protestant has drilled three wells on the northern extent of the Alpine High Field to extract water from the Rustler formation, with plans to complete a fourth Rustler water well. Mr. Bohm testified, "Anything that impacts the water quality from the Rustler or all the way up to the Pecos Valley alluvium would potentially be an impact...to Apache."[130] Mr. Bohm voiced his concern regarding the injected fluids reaching the Protestant's Rustler water wells, "What I do know is based on the volume yields that I get out of these wells, that the Rustler moves a lot of water very fast. So, there's the potential to move water a great distance over a short time."[131] Mr. Bohm opined that if injected fluids migrated into the Rustler formation, that the likely flow of the contaminated water would be down-dip into the flow path of one of the Protestant's Rustler water wells, thereby directly impacting them.

---

[125] Vol. 2, Page 153, Lines 9-15.
[126] Protestant's Exhibit 31.
[127] Vol. 2, Page 162, Line 25. Vol. 2, Page 163, Lines 1-4.
[128] Vol. 2, Page 164, Lines 19-22.
[129] Vol. 2, Page 165, lines 2-7.
[130] Vol. 2, Page 171, Lines 20-23.
[131] Vol. 2, Page 172, Lines 5-9.

Referring to the Protestant's waste-water program, Mr. Bohm stated, "In the Alpine High, we are shooting for the goal of 100 percent reuse/recycle. We have not drilled our own salt-water disposal well because we have not found a location where we find structurally suitable. So again, we tried – we've set the same assessment criteria for our own well that we've put forward for this well. And, we've not been able to find a location where we feel comfortable drilling our own salt-water well."[132] Mr. Bohm explained that in the Alpine High Field the Protestant has installed 2.5 MM Bbls of brackish water storage, 9.5 MM Bbls of produced water storage and has 2.6 MM Bbls of storage under construction.

Mr. Bohm offered his opinion that the Applicant's proposed well monitoring program is inadequate. He stated, "This is not the monitoring program that we install for our baseline monitoring program to monitor shallow groundwaters associated with activities around our wells."[133] Mr. Bohm opined that, at a minimum, a third monitoring well would be necessary to triangulate the general direction of ground water flow. Mr. Bohm admitted that the Protestant had sent waste-water to the Toyah No. 1 SWD prior to March 2019. Referring to waste-water disposal at the Toyah No. 1 SWD, Mr. Bohn confirmed, "...we've put a stop to it based on our concerns of the locations of these wells."[134]

Mr. Bohm sponsored a revised fault slip analysis based on the revised injection interval eliminating the Bell Canyon formation and the decreased maximum daily maximum injection volume from 30,000 down to 15,000 Bbls/d for each of the Landmark Lease SWDs. Referring to the revised fault slip analysis, Mr. Bohm stated, "So, previously with the thicker interval, that [incremental] pressure [to induce a fault slip] was around 390 psi. In this thinner interval, slightly deeper, that is reduced to 287 psi. So, by eliminating part of the injection interval, even with the reduction in volume, the – necessary pressure change to induce potential fault slip is still reduced. So again, essentially what we're really showing here is anything over 290 rounding up has the potential to induce fault slip."[135] Mr. Bohm further concluded, "...within one year the potential, even with the reduced volume and reduced injection interval, it has the potential to induce slip on the fault that Brian's [Stachitus] mapped."[136] Mr. Bohm added, "In the new [Commission] guidance for disposal into the Delaware Mountain Group and the Delaware basin, the fault slip potential modeling is part of the recommended analysis."[137] Mr. Bohm further elaborated on the conditions that would trigger a fault slip analysis as part of the disposal application, such as reported seismic events or geologic complexities.

VI. EXAMINER'S ANALYSIS

The Examiners' recommendation is to deny the Applications based on the evidence and testimony presented at the hearing. The Applicant failed to provide

[132] Vol. 2, Page 179, Lines 20-25. Vol. 2, Page 180, Lines 1,2.
[133] Vol. 4, Page 14, Lines 11-14.
[134] Vol 4, Page 16, Lines 11, 12.
[135] Vol. 4, Page 29, Lines 2-10.
[136] Vol. 4, Page 30, Lines 10-13.
[137] Vol. 4, Page 30, Lines 17-20.

sufficient evidence that all statutory requirements will be met for the Commission to issue the requested permits for the proposed two Landmark SWD wells.

A. The Examiners recommend the Commission deny Applicant's motion to dismiss Apache for lack of standing.

On April 15, 2019, Applicant filed *Boykin Energy LLC's Motion to Dismiss Protest for Lack of Standing* ("Motion") against Apache claiming Apache lacks standing as a protestant. On April 25, 2019, Apache filed *Apache Corporation's Response to Boykin Energy, LLC's Motion to Dismiss* ("Response") in response to the Motion. The Motion was heard in conjunction with the hearing on the merits starting May 1, 2019.

Applicant claims Apache is not an "affected person" as that term is defined in Statewide Rule 9. According to the rule, a valid protest can only be made by an affected person.[138] An affected person is defined as:

> a person who has suffered or will suffer actual injury or economic damage other than as a member of the general public or as a competitor, and includes surface owners of property on which the well is located and commission-designated operators of wells located within one-half mile of the proposed disposal well.[139]

Further, in the preamble to Statewide Rule 9 it states:

> [T]he rule has also been changed to make it clear that only "affected persons," as now defined in the adopted rule, or local governments, are entitled to a hearing on the application unless the director of the underground injection control determines that a hearing is in the public interest.[140]

Applicant maintains that while Apache is an operator, Apache is not a commission-designated operator of wells located within one-half mile of the proposed Landmark Lease SWDs, which Rule 9 expressly states is included as an affected person.[141] Thus, Apache must show that it is "a person who has suffered or will suffer actual injury or economic damage other than as a member of the general public." [142]

The proposed well is in the vicinity of the Alpine High (Cons) Field, which was recognized by the Commission on February 14, 2017.[143] Apache is the biggest operator of the field, and Apache claims it has invested substantial sums to lease mineral rights and produce hydrocarbons in the area. Apache asserts it is leasing and operating and

---

[138] See 16 Tex. Admin. Code § 3.9(E).
[139] 16 Tex. Admin. Code § 3.9(E)(ii); *see also* 16 Tex. Admin. Code § 3.46(c)(5)(B).
[140] *See* 7 Tex. Reg. 651, 653 (1982) (adopting amendment to Statewide Rule 9); 7 Tex. Reg. 655, 656 (1982) (adopting amendment to Statewide Rule 46).
[141] *See* Motion at 1-3.
[142] 16 Tex. Admin. Code § 3.9(E)(ii); *see also* 16 Tex. Admin. Code § 3.46(c)(5)(B).
[143] *See* Response at 2; O&G Docket No. 08-0302080 (Final Order February 14, 2017).

Apache's footprint of productive wells and leasehold expands daily. Apache has a mineral interest within approximately 2 miles and productive wells approximately 3 miles from the proposed Landmark Lease SWDs' location.

Apache also affirms it has engaged with the communities in the area to address concerns about potential groundwater contamination and has invested in those communities to address concerns. Apache claims it uses and invests millions of dollars in studies of the groundwater in Reeves County. Apache argues that contamination would directly harm Apache as a consumer of groundwater in the area.

As part of its operation, Apache has studied the area where the proposed Landmark Lease SWDs would be located. Based on studies, Apache concluded that the area is geologically complex (i.e. not continuous and unbroken strata), and there is faulting in the proximity of the location of the proposed Landmark Lease SWDs. Also, as part of its studies, Apache obtained scientific information—including seismic studies, fracture detection algorithms and petrophysical analysis—established internal protocol to avoid geologic complexities, such as faulting, that complicate their drilling and production operations.

Apache also provided evidence that it uses water from the Rustler Aquifer for construction, drilling and completion operations and the Protestant's waste-water piping and recycling infrastructure. Protestant has drilled three wells on the northern extent of the Alpine High Field to extract water from the Rustler Aquifer, with plans to complete a fourth Rustler water well. Apache asserts that anything that impacts the water quality from the Rustler or all the way up to the Pecos Valley alluvium would impact and cause harm to Apache.[144] Apache provided testimony that Apache has concern regarding the injected fluids reaching Apache's Rustler water wells and that based on the volume yields that Apache gets out of its wells, the Rustler rapidly moves a significant volume of water. Apache provided further testimony that if injected fluids migrated into the Rustler formation, that the likely flow of the contaminated water would be down-dip into the flow path of one of the Protestant's Rustler water wells, thereby directly impacting Apache. Apache has wells approximately 3 to 4 miles from the proposed location of the Landmark Lease SWDs.

In addition to contamination causing harm to Apache through the use of water from the Rustler Aquifer, Apache claims that contamination of the Rustler Aquifer would have a chilling or stifling effect on Apache's ability to produce its leaseholds and obtain more leaseholds. It will be more costly, the contamination would have to be addressed, there would be community fallout and it would tarnish the reputation of the operations in the area—the area where Apache has made considerable investment and has a substantial and growing operation.

Neither party provided any precedent of a Commission prior determination addressing a similar standing issue. The Examiners are reluctant to narrowly construe

---

[144] Vol. 2, Page 171, Lines 20-23.

the definition of affected person so as to prevent persons from participating in this process. The Examiners find Apache has provided sufficient information that it is not merely a member of the general public and could suffer harm if the proposed disposal wells are drilled and there is contamination. Consequently, the Examiners recommend the Commission find, based solely on the facts of this case, that Apache has met the threshold required to be classified as an affected person. The Examiners recommend the Commission deny the Motion.

B. The use or installation of the injection well will not endanger or injure any oil, gas, or other mineral formation.

The Examiners find that the use or installation of the proposed Landmark Lease SWDs will not endanger or injure any oil, gas, or other mineral formation.

Neither party presented any evidence to suggest or indicate that the proposed injection interval for the Landmark Lease SWDs in the Cherry Canyon and the Brushy Creek formation contained any recoverable hydrocarbons. Protestant's interpreted fault extends from the base of the injection interval up through the Salado/Castile formations and into the Rustler Aquifer. This interpreted fault represents the most likely conduit for the migration of injected fluids, however, none of formations in the injection interval or those formations overlying the injection interval contain any recoverable hydrocarbons in the proximity of the Landmark Lease SWDs. Furthermore, the fault is not interpreted to extend through the base of the Brushy Creek formation and into the Bone Springs formation directly underlying the proposed injection interval.

For these reasons, the Examiners recommend the Commission find that that the use or installation of the proposed Landmark Lease SWDs wells will not endanger or injure any oil, gas, or other mineral formation.

C. Applicant did not establish that ground and surface water can be adequately protected from pollution.

The Examiners find there is insufficient evidence that the injected fluids will not migrate from the proposed injection interval through the overlying Salado/Castile formation and subsequently into the Rustler Aquifer containing useable groundwater.

There is a clear distinction between the geophysical and structural interpretations offered by the Applicant and that offered by the Protestant. The Applicant's witnesses testified that based on the review of published data and well log interpretations there is no halite (salt) in the Salado/Castile over laying the Bell Canyon formation. The Salado/Castile formation is considered by the Applicant to be an impenetrable layer of anhydrite between the revised injection zone and useable ground water.

Conversely, in additional to typical well log interpretation and the evaluation of published data, the Protestant conducted a petrophysical examination of a representative well log and determined that halite is present in the Salado/Castile formation in the vicinity

of the Landmark Lease. There is sufficient evidence that halite is present in the Salado/Castile formation. This is significant because if injected fluids, which would be relatively undersaturated with respect to salt, migrated to the Salado/Castile formation, dissolution of the halite would occur and conduits for fluid migration outside of the injection interval would further develop.

The Applicant contends that all of the geologic sections in the vicinity of the Landmark Lease are continuous and unbroken, including the those in the revised injection interval and the overlying confining Salado/Castile formation. Applicant's assumptions for stratigraphic continuity are based upon the interpretation of a single 3-mile 2D seismic line extending north and south through the Landmark Lease and well log interpretations. The Applicant contends that the seismic signatures are typical of channel cuts and alluvial deposits, and that there is no evidence of faulting.

The Protestant contends that while there are likely channel deposits within the injection interval, there is also a fault 900 feet from the Landmark Lease SWDs that extends from the base of the injection interval up through the Bell Canyon and into the Salado/Castile formation. The Protestant testified that it has an in-house protocol to identify and avoid faults that would complicate their drilling development of the Alpine High Field. The Protestant has employed this type of fault evaluation on the drilling of over one hundred wells in the Alpine High Field. The Protestant applies this same evaluation protocol to disposal wells that are in the vicinity of its lease holds to determine what effect, if any, a disposal well may have on the groundwater or the Protestant's operations.

The Protestant's evidence is that the injected fluids will exert enough pressure on the fault to cause it to slip and form a conduit for injected fluids to migrate up through the fault, causing dissolution of the halite and anhydrite in the Salado/Castile formation along the fault, and reach the Rustler Aquifer, a source of useable quality ground water.

While both parties presented evidence regarding the existence of a fault in the proximity of the Landmark Lease SWDs, the Examiners found Apache's evidence to be more compelling. This leads to the Examiners concluding that there is sufficient evidence that the injected fluids will exert enough pressure on the subject fault to cause a conduit for the migration of injected fluids to eventually reach and contaminate the Rustler Aquifer.

The Applicant offered to install a network of monitor wells into the Rustler aquifer to detect any contamination by injected fluids. The Examiners reject this proposal as it does not prevent the migration of injected fluids, but only detects the contamination of the Rustler Aquifer after it has occurred.

For these reasons, the Examiners recommend the Commission find that Applicant failed to establish that the use or installation of the two proposed Landmark Lease SWD wells will adequately protect useable quality ground water from pollution.

D. Applicant failed to show the use or installation of the proposed Landmark SWD wells are in the public interest.

Applicant failed to establish that the proposed Landmark Lease SWDs are in the public interest. While there is a need for the compliant disposition of waste-water in the Delaware Basin, Applicant failed to prove that the proposed Landmark Lease SWDs would not contribute to useable-quality groundwater contamination. Protection of groundwater is in the public interest. For these reasons, the Examiners recommend the Commission find the proposed Landmark Lease SWDs are not in the public interest.

E. Applicant has made a satisfactory showing of financial responsibility as required by Texas Natural Resources Code, § 91.142.

Except as may be specifically excluded, Statewide Rule 78 states that any person, including any firm, partnership, joint stock association, corporation, or other organization, is required by Texas Natural Resources Code, § 91.142, to file an organization report with the Commission must also file financial security. Boykin meets this requirement.

VII. EXAMINER'S RECOMMENDATION, PROPOSED FINDINGS OF FACT AND PROPOSED CONCLUSIONS OF LAW

Based on the evidence, the Examiners recommend that the Commission deny the application of Boykin Energy, LLC for commercial disposal authority pursuant to Statewide Rule 9 for the Landmark Lease SWDs and adopt the following findings of fact and conclusions of law.

Proposed Findings of Fact

1. Boykin Energy, LLC (Operator No. 085182) filed separate applications requesting commercial disposal authority pursuant to Statewide Rule 9 *Dispose of Oil and Gas Waste into a Formation Not Productive of Oil and Gas* for the Landmark SWD No. 1 Well and the Landmark SWD No. 2 Well ("Landmark Lease SWDs"). The applications for the two SWDs are identical.

2. A review of U.S. Geologic Survey seismic data shows no earthquakes have been reported within 100 square miles (a 9.08 km radius circle) of the proposed Landmark Lease SWDs.

3. Notice of the applications for Landmark Lease SWDS were published in the *Pecos Enterprise*, a newspaper having general circulation in Reeves County, on August 16, 2018. On August 17, 2018, a copy of Form W-14 for the Landmark Lease SWDs was mailed to the surface owners of adjacent tracts and the Reeves County Clerk. There are no operators or record within one-half mile of the Landmark Lease SWDs. The initial published notice of the applications in the *Pecos Enterprise* did not include the words "COMMERCIAL DISPOSAL WELL", as required. This notice

deficiency was corrected by republishing the corrected notice in the *Pecos Enterprise.*

4. The applications are protested by Apache Corporation, an operator whose nearest production is approximately three (3) miles from the Landmark Lease and whose leaseholds are approximately two (2) miles from the Landmark Lease.

5. On February 20, 2019, the Hearings Division of the Commission sent a Joint Notice of Prehearing Conference ("Notice") via first-class mail to Applicant and all affected parties setting a prehearing conference date of March 12, 2019.

   a. The Notice contains (1) a statement of the time, place, and nature of the pre-hearing conference; (2) a statement of the legal authority and jurisdiction under which the hearing is to be held; (3) a reference to the particular sections of the statutes and rules involved; and (4) a short and plain statement of the matters asserted.

   b. The prehearing conference was held on March 12, 2019. Both Applicant and Protestant appeared and participated.

   c. At the pre-hearing conference, the parties agreed to commence the hearing on the merits on May 1, 2019.

   d. The hearing on the merits was held on May 1, 2, 6, and 7, 2019.

   e. Applicant and Protestant attended and participated in the hearing on the merits.

   f. All parties received more than 10 days' notice of the hearings and an opportunity for hearing.

6. The injection site for the two proposed Landmark Lease SWDs is a fifty-eight (58) acre tract and the injection interval is proposed to be into the Cherry Canyon and Brushy Creek formations at measured depths from 4,800 feet to 6,400 feet.

7. On April 15, 2019, Applicant filed *Boykin Energy LLC's Motion to Dismiss Protest for Lack of Standing* ("Motion") against Apache claiming Apache lacks standing as a protestant. On April 25, 2019, Apache filed *Apache Corporation's Response to Boykin Energy, LLC's Motion to Dismiss* ("Response") in response to the Motion. The Motion was heard in conjunction with the hearing on the merits starting May 1, 2019.

8. Applicant claims Apache is not an "affected person" as that term is defined in Statewide Rule 9. According to the rule, a valid protest can only be made by an affected person. An affected person is defined as:

> a person who has suffered or will suffer actual injury or economic damage other than as a member of the general public or as a competitor, and includes surface owners of property on which the well is located and commission-designated operators of wells located within one-half mile of the proposed disposal well.[145]

To qualify as an affected person, Apache must show that it is "a person who has suffered or will suffer actual injury or economic damage other than as a member of the general public."

9. The proposed well is in the vicinity of the Alpine High Field, which was recognized by the Commission on February 14, 2017. Apache is the biggest operator in the field and Apache has invested substantial sums to lease mineral rights and produce hydrocarbons in the area. Apache is expanding its leasing, operating and Apache's footprint of productive wells and leaseholds.

10. Apache has an offset mineral interest within approximately 2 miles and productive wells approximately 3 miles from the proposed Landmark Lease SWDs' location.

11. As part of its operation, Apache has studied the area where the proposed Landmark Lease SWDs would be located. Based on studies, Apache concluded that the area is geologically complex (i.e. not continuous and unbroken strata) and there is faulting in the proximity of the location of the proposed Landmark Lease SWDs. Also, as part of its studies, Apache obtained or developed scientific information—including seismic studies, fracture detection algorithms and petrophysical analysis— and has established internal protocol to avoid geologic complexities, such as faulting, that complicate their drilling and production operations. Protestant has an in-house protocol to identify and avoid faults that would complicate their drilling development of the Alpine High Field.

12. Apache is a consumer of groundwater in the area. Apache uses water from the Rustler Aquifer for construction, drilling and completion operations and its waste-water piping and recycling infrastructure. Protestant has drilled three wells on the northern extent of the Alpine High Field to extract water from the Rustler Aquifer, with plans to complete a fourth Rustler water well. Apache has concern regarding the injected fluids reaching Apache's Rustler water wells and that based on the volume yields that Apache gets out of its wells, the Rustler rapidly moves a significant volume of water. Apache provided testimony that if injected fluids migrated into the Rustler formation, that the likely flow of the contaminated water would be down-dip into the flow path of one of the Protestant's Rustler water wells, thereby directly impacting Apache. Apache has wells approximately 3 to 4 miles from the proposed location of the Landmark Lease SWDs.

---

[145] 16 Tex. Admin. Code § 3.9(E)(ii); *see also* 16 Tex. Admin. Code § 3.46(c)(5)(B).

13. Apache has engaged with the communities in the area to address concerns about potential groundwater contamination and has invested in those communities to address concerns. Apache uses and invests substantial sums of money in studies of the groundwater in Reeves County.

14. In addition to contamination causing harm to Apache through the use of water from the Rustler Aquifer, Apache has concern and provided evidence that contamination of the Rustler Aquifer would have a stifling effect on Apache's ability to produce its leaseholds and obtain more leaseholds. It will be more costly, the contamination would have to be addressed, there would be community fallout and it would tarnish the reputation of the operations in the area—the area where Apache has made considerable investment and has a substantial and growing operation.

15. Apache is an affected person entitled to protest.

16. The use or installation of the proposed Landmark Lease SWDs well will not endanger or injure any oil, gas, or other mineral formation:

    a. In the proximity of the proposed Landmark SWDs, the injection interval in the Cherry Canyon and the Brushy Creek formation does not contain any recoverable hydrocarbons.

    b. The interpreted fault represents the most likely conduit for the migration of injected fluids, however, none of formations impacted by the fault and the migration of injected fluids contain any recoverable hydrocarbons or other minerals in the proximity of the Landmark Lease SWDs.

    c. The Bone Springs formation directly underlying the proposed injection interval does not contain any recoverable hydrocarbons or other minerals in the proximity of the Landmark Lease SWDs.

17. Applicant did not establish that groundwater can be adequately protected from pollution.

    a. There is insufficient evidence of a confining barrier for the injection interval. Faulting exists in the vicinity of the Landmark Lease SWDs injection interval which could become transmissive with the use of the Landmark SWD Well No. 1 and/or the Landmark SWD Well No. 2.

    b. There is insufficient evidence the injected fluids will not migrate from the proposed injection interval into strata containing useable ground water. The injected fluids from the use of the Landmark SWDs will exert enough pressure on the nearby fault to cause it to slip and form a conduit for injected fluids to migrate up through the fault, causing dissolution of the halite and

anhydrite in the Salado/Castile formation along the fault, and reach the Rustler Aquifer, a source of useable quality ground water.

c. There is insufficient evidence that the geologic sections overlying the proposed injection zone in the vicinity of the Landmark SWDs are continuous and unbroken.

18. Applicant failed to show the use or installation of the proposed Landmark SWD wells is in the public interest.

a. There is insufficient sufficient evidence that the proposed Landmark Lease SWDs would not contribute to groundwater contamination.

b. Protection of groundwater is in the public interest.

19. Applicant has made a satisfactory showing of financial responsibility as required by Texas Natural Resources Code, § 91.142. Applicant has an active P-5 organizational Report, and a $25,000 bond as financial assurance.

Proposed Conclusions of Law

1. Proper notice of hearing was timely issued to persons entitled to notice. *See, e.g.*, Tex. Gov't Code § 2001.051; 16 Tex. Admin. Code §§ 1.41, 1.42, 1.45, 3.46.

2. The Commission has jurisdiction in this case. *See, e.g.,* Tex. Nat. Res. Code § 81.051; Tex. Water Code §§ 27.031, 27.051(b).

3. Apache is an affected person and its protest of these applications are proper pursuant to Statewide Rule 9.

4. In accordance with Statewide Rule 9, Applicant's motion to dismiss should be denied.

5. The proposed fluid disposal operations will not endanger oil, gas, or geothermal resources. Tex. Water Code § 27.051(b)(2); 16 Tex. Admin. Code § 3.46(a).

6. Applicant failed to demonstrate groundwater and surface fresh water can be adequately protected from pollution.

7. Applicant failed to demonstrate approval of the proposed injection well is in the public interest.

8. Applicant failed to demonstrate the applications for the Landmark Lease SWDs, meets the requirements of chapter 27 of the Texas Water Code and the Railroad Commission's Statewide Rule 9.

Recommendations

The Examiners recommend that the application of Boykin Energy, LLC for commercial disposal authority pursuant to Statewide Rule 9 for the Landmark Lease SWDs be denied, as set out in the attached proposed Final Order.

Respectfully submitted,

John L. Moore
Technical Examiner

Jennifer N. Cook
Administrative Law Judge