STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION COMMISSION

BEFORE THE OIL CONSERVATION COMMISSION

Santa Fe, New Mexico

Submitted by: Goodnight Midstream Permian, LLC

Hearing Date: September 23, 2024

Case Nos. 23614-23617, 23775, 24018 – 24020, 24025, 24123

MCGUIRE TESTIMONY AND EXHIBIT PACKET

PART 1 OF 3

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

APPLICATIONS OF GOODNIGHT MIDSTREAM PERMIAN, LLC FOR APPROVAL OF SALTWATER DISPOSAL WELLS LEA COUNTY, NEW MEXICO

CASE NOS. 23614-23617

APPLICATION OF GOODNIGHT MIDSTREAM PERMIAN LLC TO AMEND ORDER NO. R-22026/SWD-2403 TO INCREASE THE APPROVED INJECTION RATE IN ITS ANDRE DAWSON SWD #1, LEA COUNTY, NEW MEXICO.

CASE NO. 23775

APPLICATIONS OF EMPIRE NEW MEXICO LLC TO REVOKE INJECTION AUTHORITY, LEA COUNTY, NEW MEXICO

CASE NOS. 24018-24020, 24025

APPLICATION OF GOODNIGHT MIDSTREAM PERMIAN, LLC FOR APPROVAL OF A SALTWATER DISPOSAL WELL, LEA COUNTY, NEW MEXICO.

DIVISION CASE NO. 22626
ORDER NO. R-22869-A
COMMISSION CASE NO. 24123

SELF-AFFIRMED STATEMENT OF PRESTON MCGUIRE

1. My name is Preston McGuire. I work for Goodnight Midstream Permian, LLC ("Goodnight Midstream") as the Geology and Reservoir Engineering Manager.

2. I am familiar with the applications and motions filed by Goodnight Midstream and Empire in these cases, and I am familiar with the status of the lands and geology in the subject area. I have conducted a study and review of the reservoirs and geology in the area of the proposed

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and active injection wells and of the San Andres formation, which is the saline aquifer that is the disposal zone for Goodnight Midstream's existing and proposed injection.

3. I have not previously testified before the New Mexico Oil Conservation Division as an expert witness in petroleum geology; therefore, I have attached my curriculum vitae as **Goodnight Exhibit B-1**. I believe my credentials qualify me to testify as an expert in petroleum geology and reservoir engineering in these matters.

4. I have a master's degree in geology from Texas Christian University and a bachelor's degree in geology from Western State Colorado University with 9 years of working experience as a geologist in the oil and gas industry, seven years with Goodnight Midstream working Texas, New Mexico, and North Dakota disposal projects, two internships with Antero Resources in the Marcellus and Utica shales, and one internship with Paragon Geophysical Services designing large geophysical surveys in Kansas. As the Geology and Reservoir Engineering manager with Goodnight Midstream, my responsibilities include permitting, geologic support for well location selection and drilling, technical advisor for completion design, testing and injection performance analysis, remediation, and service life projection. Throughout my time at Goodnight Midstream, I have conducted work in the Permian Basin, primarily on produced water disposal projects.

5. In addition to my responsibilities outlined above, I also manage reservoir performance for Goodnight Midstream's SWDs in North Dakota, Texas, and New Mexico. This includes analyzing injection data, fall off tests, bottom hole pressure information, ect. In North Dakota we manage the movement and disposal of more than 250,000 barrels of produced water a day. In Texas, we have drilled and operated 25 saltwater disposal wells. Additionally, we have 11

saltwater disposal wells drilled, 2 approved undrilled permits, and 16 pending applications in New Mexico.

Summary

6. The following are the basic conclusions of my below testimony relating to these cases.

- Goodnight's disposal zone within the San Andres aquifer is characterized by its ability to sustainably accept large volumes of produced water at very low operating pressures.
- Substantial data on the sustained and geographically extensive pressure differentials between the Grayburg and San Andres aquifer confirm (1) the presence of an effective geologic barrier between the two formations, and (2) that the Grayburg reservoir and San Andres aquifer are distinct geologic zones that are functionally severed and do not act, and cannot be considered, as a single reservoir.
- Analysis of core data and historical production tests confirms that the San Andres does not meet the criteria for a ROZ because San Andres oil saturations are well below the defined 20% cutoff as defined by Empire's own ROZ experts, confirming that Goodnight's disposal operations will not cause waste or impair correlative rights in the San Andres disposal zone.
- Because Goodnight's San Andres disposal zone is confined to intervals below any potential ROZ that may exist in the Grayburg and is isolated by a sustained and geographically extensive geologic seal, disposal operations will not interfere with Eunice Monument South Unit ("EMSU") operations in the

Grayburg main pay zone or ROZ intervals based on the effective seal of the disposal zone.

Goodnight Midstream Permian, LLC Company Overview

7. Goodnight Midstream was founded in 2011. The company is based in Dallas, but our initial operations were in North Dakota. We have grown to be the largest third-party disposal company in North Dakota. In 2016, we commenced operations in Texas, and then started in New Mexico in early 2018. In New Mexico, we operate one large high-pressure pipeline system in Lea County called the Llano System.

8. **Goodnight Exhibit B-2** is a map depicting the Llano System along with its active and proposed saltwater disposal wells ("SWD"). The Llano System comprises 110 miles of pipeline with an ultimate projected capacity of 400,000 barrels of water per day, with 6 water recycling and re-use facilities and 11 approved SWDs. The system currently serves 13 dedicated operators with about 640 producing wells connected at 29 different receipt points, which are denoted as green dots on the map. Active production and drilling is located in the vicinity of the receipt points. Pipelines transport the produced water to the disposal field where we have 11 approved SWDs represented by orange triangles. Our pending applications—the Doc Gooden SWD #1 (Case No. 23614), Hernandez SWD #1 (Case No. 23615), Hodges SWD #1 (Case No. 23616), Seaver SWD #1 (Case No. 23617), Andre Dawson SWD #1 Rate Increase (Case No. 23775), and Piazza SWD #1 (de novo Case No. 24123)—and current disposal wells—Andre Dawson SWD #1 (Case No. 24018), Ernie Banks SWD #1 (Case No. 24019), Ryno SWD #1 (Case No. 24020), and Sosa SA 17 SWD #2 (Case No. 24025)—are depicted with blue triangles. We have two approved SWDs that have not yet been drilled—the Verlander SWD #1 and the Rocket SWD #1—which are depicted on the map with yellow triangles.

9. **Goodnight Exhibit B-3** is the same map with the OCD Seismic Response Areas posted relative to our Llano System. As reflected in this exhibit, Goodnight's approach is to move produced water away from areas with the most intense production, where there is high competition for injection permits, reservoir capacity in the Devonian formation is relatively limited, and Delaware Mountain Group disposal has been linked to be interfering with horizontal production from the Avalon. Goodnight identified a depleted saline aquifer reservoir on the Central Basin Platform and has developed a system to move large quantities of produced water out of the overcrowded production zone and into a sustainable, low-pressure reservoir for permanent disposal. By targeting this depleted formation, we avoid adding to the risk of induced seismicity through deep injection into the Devonian and instead target zones, such as the San Andres, where there has been substantial depletion through decades of water production to supply water for secondary recovery operations in nearby waterfloods.

10. Access to the San Andres formation is of critical importance to our customers. These operators rely on Goodnight to provide a sustainable and long-term option to dispose of their produced water. Wells connected to the Llano System produced a combined 48.4 MM barrels of oil, 110.7 BCF of gas, and 100.6 MM barrels of water in 2023. About 46.7 MM barrels of produced water was reclaimed for re-use or handled by other disposal wells and about 53.9 MM barrels of produced water was delivered into the Llano System for disposal. The Llano System has approximately 640 dedicated wells that deliver 100% of their produced water to Goodnight. Goodnight's Llano System and its connected disposal wells are needed for these roughly 640 oil and gas wells to produce. This production, and the related disposal, is of great economic benefit to the stakeholders of New Mexico. Besides serving as a disposal field for substantial oil and gas production, the San Andres itself is also an important source of revenue for the State of New

Mexico and Goodnight Midstream's landowners and royalty owners, including the State Land Office, who receive royalty revenue from Goodnight's disposal of produced water.

Overview of Cases Pending Before the Commission

11. Goodnight has five cases that have been referred to the OCC under Order No. R-23408 that were originally set for hearing at the OCD in October 2023, four pending applications for new disposal permits and one pending application for an authorized rate increase. *See* **Goodnight Exhibit A-2**. The four pending applications for new permits are the Doc Gooden SWD #1 (Case No. 23614), Hernandez SWD #1 (Case No. 23615), Hodges SWD #1 (Case No. 23616), and Seaver SWD #1 (Case No. 23617). These are four new SWDs that are targeting the San Andres aquifer within the EMSU boundary. The application for the rate increase is for the active Andre Dawson SWD #1 (Case No. 23775) where Goodnight is requesting a rate increase from the current authorized injection rate of 25,000 barrels of water per day to 40,000 barrels of water per day. Case Nos. 23614-23617 were scheduled to go to hearing at the OCD in October 2023, but were stayed over Empire's failure to produce responsive documents that came to light after submission of their testimony and exhibits in those cases. After the cases were stayed, all five cases were referred to the Commission in February 2024 under Order No. 23048.

12. Goodnight has also requested a de novo appeal of the Division's order denying the proposed Piazza SWD #1 (Division Case No. 22626, Order R-22869-A), which was the subject of a contested hearing in September 2022. The Piazza SWD #1 is another permit application for a saltwater disposal well targeting the San Andres aquifer within the boundary of the EMSU. During the hearing on that application, Goodnight gave extensive testimony that its San Andres disposal zone at the EMSU has been tested and confirmed to be a non-hydrocarbon bearing aquifer and not a candidate for ROZ development. Additionally, Goodnight showed, based on pressure

observations, that the Grayburg and San Andres disposal zone are isolated by a competent permeability confining layer that is geographically extensive. **There is one pressure system associated with the Grayburg and a different system associated with the San Andres disposal zone, confirming that the permeability barrier is effective in isolating the formations from one another and that they do not function as a single reservoir.**

13. At the hearing in Case No. 22626, Empire provided no evidence that San Andres disposal zone was productive, that San Andres disposal had interfered with any Grayburg production or EMSU operations, or that there is a ROZ in the San Andres. Empire's witness, Eugene Sweeny, claimed the Grayburg and San Andres were one formation by stating that the producing zone at the EMSU is the "Grayburg San Andres Formation," based on the Division-designated pool name, the Eunice Monument; Grayburg-San Andres Pool (Pool Code 23000) **Empire was unable to show through evidence that (1) the San Andres disposal zone had ever produced any oil; (2) the San Andres contains recoverable hydrocarbons; or (3) hydrocarbons, if any exist, can be produced in paying quantities.**

14. Empire alleged that the EMSU #200H and the EMSU #462 produce oil from the San Andres, but Goodnight was able to show through Division well file records that this is not the case. The EMSU #200H was originally a 1930s vintage vertical well that produced from the Grayburg. It was re-entered and converted to a horizontal well in 2011 by XTO, a previous operator of the EMSU. Empire alleged that this well produces from the San Andres but the well records confirm neither the original vertical section of the well nor any part of the horizontal section of the well ever penetrated the San Andres.

15. The EMSU #462 was plugged back from the San Andres and recompleted as a Grayburg producer in 2014. It was originally one of the six water supply wells that supplied make

up water to the field during the initial stages of the EMSU Grayburg waterflood. Empire tried to allege that the San Andres had produced oil in this well because oil production had been associated with it and the well had San Andres perforations at one time. Goodnight showed that this well did not produce oil until after the San Andres had been plugged back and the well was recompleted in the Grayburg. *See* Exhibits and Testimony in Case Nos. 22626 and 23339. Empire has now confirmed this finding by updating the Division well file showing the well was plugged back from the San Andres in February of 2014.

16. In addition, Empire stated one basis for their concern about the proposed Piazza SWD #1 application was its proximity to the EMSU #200H, which is 1.37 miles away. This was an interesting concern as Empire's own disposal well, the EMSU #1, is less than 0.5 miles from the #200H and injects into the same disposal interval that the Piazza SWD #1 targets. Additionally, there is another San Andres disposal well, the EME #33 SWD, which is operated by Permian Line Service that is 0.82 miles from the #200H and has injected more than 40 million barrels of water since the 1960s. Empire was unable to show that their own injection or the injection from the EME #33 had impaired the #200H in any way.

17. Empire was also unable to show that the San Andres at the EMSU is prospective as an ROZ zone. No technical data specific to the EMSU was shown discussing Empire's evaluation of the ROZ zone they are claiming. Empire claimed they were in the appraisal phase of evaluating the EMSU ROZ but were unwilling or unable to speak to the work they had done appraising the San Andres and refused to provide any of their internal documents, studies, analyses or plans. *See* **Goodnight Exhibit B-4**, Case No. 22626, Hrg. Tr. 231:12-238:22.

18. The OCD nevertheless issued Order R-22869-A, denying the Piazza SWD #1 application. The OCD primarily based its decision on two factors. First, the Division expressed

concerns that the proposed injection could cause Class II disposal fluids to encroach towards the northeast and interior of the EMSU where the San Andres was being used as a source of water for the Grayburg waterflood EOR injection wells and may not be compatible with the San Andres formation fluids. *See* Order No. R-22869-A, ¶ 10. Second, the Division determined Empire had provided sufficient evidence for continued assessment of the Unitized Interval for potential recovery of any additional hydrocarbon resources. *Id.* ¶ 11 (stating that "Approval of the Proposed Well would contradict the responsibility of the OCD 'to prevent the drowning by water of any stratum or part thereof <u>capable of producing oil or gas or both oil and gas in paying quantities</u> and to prevent the premature and irregular encroachment of water or any other kind of water encroachment that reduces or tends to <u>reduce the total ultimate recovery of crude petroleum oil or gas or both oil and gas from any pool</u>.'") (quoting NMSA 1978, § 70-2-12(B)(4)) (emphasis added).

19. **Empire presented no evidence that the proposed injection would encroach on its water supply wells or that disposal fluids would impair its EMSU operations or may not be compatible with the San Andres.** In Order No. R-22689-A, OCD referenced a Technical Committee report from 1983 that was presented in the consolidated cases unitizing the EMSU in 1984 as a waterflood unit. This report stated that the San Andres formation waters were compatible for the use as supplemental (make-up) injection for waterflood operations in the Grayburg. *See* Order No. R-22869-A, ¶ 10. The Technical Committee was incorrect in making this statement. In 1996, Chevron employees published a paper discussing formation water chemistries in the San Andres and Grayburg at the EMSU. *See* <u>Goodnight Exhibit B-5</u>. The paper states the following:

> <u>**The San Andres**</u> formation provides the only source of water formation in the geographic area with a sufficient volume of water for the waterflood and unfortunately, <u>**had to be used as the supply**</u>

> **source, knowing that the San Andres water was not compatible with the Penrose and Grayburg formation waters**.

See **Goodnight Exhibit B-5** (emphasis added).

20. **Empire also provided no evidence or technical information showing that the San Andres is capable of producing oil or gas in paying quantities or that Goodnight's proposed disposal would tend to reduce the total ultimate recovery from either the Grayburg or the San Andres.** *See* NMSA 1978, § 70-2-12(B)(4). **Empire also presented no evidence that Goodnight's disposal would impair Empire's opportunity to recover its share of production from either the Grayburg or San Andres formations, or that any purported ROZ in the San Andres even has "recoverable oil or gas."** *See* § 70-2-33(H).

21. With Empire unable to provide any technical evidence showing that an ROZ exists in the San Andres at the EMSU or any basis for disposal fluid compatibility concerns, and the fact that the San Andres was never a compatible water source for the Grayburg waterflood, I believe OCD's decision to deny the Piazza SWD #1 application was not supported.

22. Empire used Order No. R-22869-A as a springboard to file applications to revoke 10 of Goodnight's existing disposal permits: The Andre Dawson SWD #1 (Case No. 24018), Ernie Banks SWD #1 (Case No. 24019), Ryno SWD #1 (Case No. 24020), Rocket SWD #1 (Case. 24021), Pedro SWD #1 (Case No. 24022), Verlander SWD #1 (Case No. 24023), Nolan Ryan SWD #1 (Case No. 24024), Sosa SA SWD #2 (Case No. 24025), Ted 28 SWD #1 (Case No. 24026), and Yaz 28 SWD #1 (Case No. 24027). Only four of the wells are actively injecting and located within the EMSU boundary: Andre Dawson, Ernie Banks, Ryno (Snyder), and Sosa. Four of the wells are active and outside the EMSU boundary: Pedro, Nolan Ryan, Ted, and Yaz. The other two are permitted wells that remain undrilled and are outside the EMSU boundary: Rocket and Verlander.

23. Empire claims that the San Andres in and around the EMSU is a ROZ and that Goodnight's existing and proposed injection in the above wells is causing waste, adversely affecting its correlative rights inside the EMSU. Empire also claims that the wells outside the EMSU are migrating fluids into the EMSU and watering out productive zones. Empire also claims that the produced water Goodnight is injecting is incompatible with San Andres formation water. Additionally, Empire claims that Goodnight is violating its permits by injecting over the authorized daily injection volumes.

24. The OCC has decided to address only the cases that are within the EMSU boundary at this time, which are the applications for the 4 new wells (Case Nos. 23614-23617), the Andre Dawson rate increase (Case No. 23775), the Piazza de novo case (Case No. 24123), and four of Empire's revocation cases (Case Nos. 24018-24020, and 24025). All the other Empire cases to revoke injection have been stayed at this time.

25. **The San Andres at the EMSU has never been prospective for hydrocarbons and has been the defined water management zone for the area, both for disposal and water supply, since as early as the 1960s.** Division records confirm that there has never been production from Goodnight's San Andres disposal zone at the EMSU. At the time the EMSU was unitized, the San Andres was recognized as a non-productive, water management zone, and was included in the EMSU only because it was historically tied to the Division-designated Grayburg pool and because it would serve as the source of water supply. **The San Andres was erroneously unitized at the EMSU and should never have been included in the unitized interval.**

<u>Overview of SADR as a Water Management Zone and Formation of EMSU</u>

26. The San Andres was first used as a disposal zone in the area of the EMSU when Rice Engineering drilled the first SWD in April of 1960 with the EME #33 SWD, more than two

decades before the EMSU was unitized. Rice subsequently drilled another SWD in September of 1966, the EME #21 SWD. The EMSU was unitized in 1984 with millions of barrels having already been disposed into the San Andres by the two Rice wells. The EMSU was unitized with existing, substantial disposal into the San Andres already occurring. In 1987, Chevron, who was operator of the EMSU at the time, converted the EMSU #1 to a San Andres disposal well in the middle of the field. This well is still being utilized as a disposal well by Empire. Since then, many operators have drilled SWDs in and around the EMSU, including Goodnight.

27. In 1984, Gulf Oil Corporation ("Gulf") filed three related applications that were consolidated for hearing before the Commission (Case Nos. 8397-8399). First, Gulf sought approval of the Eunice Monument South Unit ("EMSU") as a statutory waterflood unit. Second, Gulf sought approval for waterflood injection for purposes of secondary recovery in the Grayburg and Lower Penrose formations within the proposed Unit Area. Lastly, Gulf sought to expand the vertical limits of the Eunice Monument Oil Pool upward within the Unit Area to include the top of the Grayburg formation or to a subsea datum of -100 feet, whichever is higher.

28. After public notice and hearing in Case Nos. 8397-8399, the Commission entered Order No. R-7765 approving the EMSU as a statutory waterflood in the Eunice Monument Oil Pool, as amended by Order No. R-7767, and establishing a unitized interval from 100 feet below mean sea level (the gas-oil contact) or at the top of the Grayburg formation, whichever is higher, to a lower limit at the base of the San Andres formation. The unitized interval mirrors the vertical and horizontal extent of the specially created Eunice Monument Oil Pool within the Unit Area, as amended by Order No. R-7767.

29. At the hearing in Case Nos. 8397-8399, Gulf presented evidence and testimony that the proposed waterflood operations within the EMSU target the oil column, which is

limited to the Grayburg and Lower Penrose formations, and expressly excluded the San Andres from its proposed waterflood operations.

30. In Case No. 8399, **Gulf's production geologist, Ray Hoffman, testified that the oil/water contact in the EMSU is at -325 feet subsea and that this depth determines the lower limit of oil production in the area.** *See* Case No. 8399, Hrg. Tr. Vol. 1 46:15-20 (confirming that the western and southern boundaries of the field a dark dashed line in Gulf's exhibit No. 14 represents the oil-water contact at -325 feet subsea depth); *see also* **Goodnight Exhibit B-6** (Gulf Ex. 14, Case No. 8399); Case No. 8399, Hrg. Tr. Vol. 1 46:24-47:2 ("Q. What does the oil/water contact determine for you as a geologist, Mr. Hoffman? A. It determines the lower limit of oil production in the area.").

31. At the time the Commission approved the Unit, Gulf had no intention of conducting waterflood operations within the San Andres formation. *See* Case No. 8399, Hearing Tr. Vol. 2, 224:22-25 ("Q: Now I understand that you will be injecting only into the Grayburg and Penrose and not the San Andres, is that correct? A: That is correct."). The San Andres was determined to be non-prospective. In fact, Gulf made clear in its hearing testimony that the targeted oil column constituting the "unitized formation" includes only the Grayburg and Penrose formations and does not extend into the San Andres. *See id.*, Hrg. Tr. Vol. 1, 52:6-7 ("[T]he oil column in this area thins from the Grayburg up into the lower part of the Penrose."); 53:1-4 ("Q: When you look at the oil column in the unit area, that is included generally in the Grayburg and the lower portion of the Penrose, is that correct? A: That's correct."). **Gulf presented a generalized cross-section of the entire EMSU area showing that the lower limit of oil production at -325 feet subsea is above the depth of the San Andres across the entire unit**. *See* **Goodnight Exhibit B-6.1** (Gulf Ex. 24, p. 11, Case No. 8397).

32. At the hearing in Case Nos. 8397-8399, Gulf presented evidence and testimony that the San Andres formation would be used to provide the massive quantities of water required in the waterflood zone in the Grayburg and Lower Penrose formations for the initial fill-up period and, if needed, for additional makeup water in the future. **The San Andres was included in the unitized interval, not because it is hydrocarbon productive, but because it was to be used as a source of water supply for the planned waterflood.** *See* **Goodnight Exhibit B-7**. The San Andres was known as a saltwater bearing aquifer at the time of the unitization of the EMSU. In fact, at the time the EMSU was formed, the original operator of the Unit, Gulf Oil Corporation, determined that "[t]he bottom of the interval must be the base of the San Andres formations (sic) to include the area's most prolific water production zone[.]" *See id.* (portions of Gulf Hearing Exhibit 21, Case No. 8397) (emphasis added).

33. The majority of the wells in the EMSU were never drilled deep enough to reach the San Andres in order to avoid the prolific water producing zone. The wells that were drilled into the San Andres were always plugged back to shut off the excess water producing zone. Based on a careful review and analysis of all the EMSU well files, it appears little effort was made by EMSU operators to identify an accurate top for the San Andres because it also occurred well below the oil-water contact except in the six water supply wells that were drilled to the San Andres to supply the make-up water for the waterflood in the Grayburg.

34. **The EMSU was formed above the San Andres aquifer, which was already being utilized as a disposal zone for 20 plus years at the time the Unit was formed. Operators of the EMSU continued to use the San Andres aquifer for disposal to support the production of the EMSU.** Empire acquired the EMSU in 2021 with eight active San Andres disposal wells

operating within the EMSU boundary. An additional nine disposal wells were operating within just a few miles of the EMSU. Empire acquired the field knowing that the San Andres aquifer was a disposal zone in, and around, the EMSU.

35. Goodnight has confirmed that San Andres disposal would not interfere with ongoing EMSU operations. The San Andres aquifer has been tested and is not prospective for hydrocarbons and does not meet the definition of an ROZ. This analysis has been corroborated and supported by independent assessments by its technical experts.

36. While a ROZ does not occur in the San Andres aquifer at the EMSU, one potentially exists below the oil-water contact within the Grayburg, but is entirely limited to the Grayburg. **There has never been any evidence that San Andres disposal operations have interfered with the Grayburg producing zone in the 60 plus years since San Andres disposal began at the EMSU.**

37. Empire can target the ROZ that may exist in the Grayburg without impacting underlying San Andres disposal. At the same time, disposal injection can continue into the San Andres disposal zone without impacting existing or future Grayburg operations. **Grayburg oil production and San Andres disposal can continue to operate along with one another as they have for the entire history of the EMSU.**

Goodnight's Existing Injection in the EMSU: Geologic Overview

38. Goodnight Midstream currently operates four San Andres disposal wells inside the EMSU that each inject through perforated completions between the following depths: 4,592 feet to 5,330 feet for the Sosa SWD (API 30-025-47947); 4,380 feet to 5,560 feet for the Ryno (Snyder) SWD (API 30-025-43901); 4,490 feet to 5,420 feet for the Banks SWD (API 30-025-50633); and

4,375 feet to 5,525 feet for the Dawson SWD (API 30-025-50634). The top of the injection intervals for each well do not extend above the top of the San Andres.

Well Name	API	Inj. Top (MD)	Inj. Base (MD)	Inj. Top (SS)	Inj. Base (SS)
Sosa SWD	30-025-47947	4592	5330	-926	-1664
Ryno (Snyder) SWD	30-025-43901	4380	5560	-748	-1928
Banks SWD	30-025-50633	4490	5420	-848	-1778
Dawson SWD	30-025-50634	4375	5525	-720	-1870

39. In **<u>Goodnight Exhibits A-4 through A-7</u>**, which are the C-108 administrative applications for each of Goodnight's proposed SWDs, the geologic descriptions in contains an overview of the geology and lithology of the target formation which are applicable to the existing SWD wells. These wells were properly permitted under the NMOCD UIC program with notice to all affected parties under the Division's regulations, including Empire's predecessor-in-interest.

40. The Sosa SWD penetrates the following geologic tops at the following depths:

Formation	**Top**
Tansil	2,880 feet
Yates	3,106 feet
Seven Rivers	3,297 feet
Queen	3,641 feet
Penrose	3,784 feet
Grayburg	3,944 feet
San Andres	4,368 feet
Glorieta	5.344 feet
Total Depth	5,446 feet

41. The Ryno SWD penetrates the following geologic tops at the following depths:

Formation	**Top**
Tansil	2,802 feet
Yates	3,026 feet
Seven Rivers	3,286 feet
Queen	3,610 feet
Penrose	3,751 feet

Grayburg	3,910 feet
San Andres	4,322 feet
Glorieta	5,625 feet
Paddock	5,946 feet
Blinebry	6,225 feet
Tubb	6,855 feet
Drinkard	7,132 feet
Abo	7,534 feet
Wolfcamp	8,200 feet
Strawn	8,658 feet
Devonian	10,295 feet
Total Depth	11,500 feet

42. The Banks SWD penetrates the following geologic tops at the following depths:

Formation	**Top**
Tansil	2,779 feet
Yates	2,997 feet
Seven Rivers	3,255 feet
Queen	3,529 feet
Penrose	3,668 feet
Grayburg	3,851 feet
San Andres	4,312 feet
Total Depth	5,495 feet

43. The Dawson SWD penetrates the following geologic tops at the following depths:

Formation	**Top**
Tansil	2,841 feet
Yates	3,055 feet
Seven Rivers	3,302 feet
Queen	3,612 feet
Penrose	3,745 feet
Grayburg	3,897 feet
San Andres	4,287 feet
Glorieta	5,590 feet
Total Depth	5,760 feet

44. **Goodnight Exhibit B-8** is an overview locator map depicting the location of the EMSU with a dark green outline and the EMSU "B" Expansion Area to the northwest in a light

green outline. The location of Goodnight's proposed SWDs in this area are indicated with yellow circles while dark blue circles depict the currently active Goodnight SWDs. All of Goodnight's current and proposed locations at issue in these cases are within Sections 3, 4, 10 and 17 in T21S, R36E. Also depicted on the map with an ochre-colored line is the relevant portion of Goodnight Midstream's Llano System serving each of Goodnight Midstream's SWDs. Lines of cross-sections discussed in my testimony are also depicted on the map.

45. Goodnight's active SWDs are indicated with dark blue circles and include the Banks, Ryno, Sosa, Dawson, Nolan Ryan, Piper, Yaz, Ted, and Pedro SWDs. Rice Operating's active SWDs are indicated with a teal blue color and include the EME #33M, the N7 #1, and the State E27 #1 SWDs. The Permian Line Service's active SWDs are the purple circles and include the N11, and the EME #21. OWL SWD Operating has one active SWD, the P15, which is indicated with a light blue circle. Parker Energy has one active SWD, the Parker 5, which is indicated with a brown circle. Empire also operates one active SWD, the EMSU 1, which is located in Section 4, T21S, R36E. The active SWDs on the map include the last five digits of the well's API number and the total volume of produced water injected in millions of barrels.

46. In total, eight active SWDs currently inject produced water into the San Andres within the boundaries of the EMSU, as follows:

WELL	**OPERATOR**	**INJECTED VOLUME**
EMSU 1	Empire	4.4 MM
N11	Permian Line Service	6.7 MM
EME 21	Permian Line Service	43.1 MM
P15	OWL SWD Operating	0.1 MM
Banks	Goodnight Midstream	5.0 MM

Ryno	Goodnight Midstream	16.9 MM
Sosa	Goodnight Midstream	17.5 MM
Dawson	Goodnight Midstream	8.7 MM

47. Seven of the SWDs operating within the EMSU are commercial and, like Goodnight Midstream's proposed SWDs in these cases, are not related to operations of the Unit.

48. Included on the map are the locations of six water supply wells ("WSW") that were used to supply water from the San Andres aquifer for waterflood operations within the EMSU. They are identified with pink squares and are addressed in more detail in my testimony below.

49. Also included on the map are lines of cross section for each of Goodnight Midstream's proposed SWDs in these cases reflecting the location of representative well logs I used to create cross sections for each of Goodnight Midstream's proposed SWDs in the following set of exhibits. A blue line is used for the Doc Gooden SWD #1 (Case No. 23614) well; a green line is used for the Hernandez SWD #1 (Case No. 23615); an orange line is used for the Hodges SWD #1 (Case No. 23616); a red line is used for the Seaver SWD #1 (Case No. 23617); and a light blue line is used for the Piazza SWD #1 (Case No. 24123).

50. **<u>Goodnight Exhibit B-9</u>** is a cross-section I prepared that shows the active Goodnight SWDs within the EMSU in Section 17, along with two of the EMSU water supply wells in Sections 8 and 9 of Township 21 South, Range 36 East. The cross-section line can be seen on the map (Exhibit B-8) in a brown/orange color. The construction of the cross-section exhibit uses color to indicate impermeable, tight rock within each formation that will function as a barrier to vertical transmission of injection fluids. The lithology of these impermeable rocks are anhydrites, and low-porosity dolomites and limestones. The color fill is color coded by formation: Grayburg is green and San Andres is purple-gray. White space represents porous rock that contains either

hydrocarbon or saltwater; saltwater-filled porosity is a saline aquifer. The lithology of these porous intervals are dolomitic siltstones and porous dolomites. The gas/oil contact ("GOC") for the Eumont Field is shown at -100 feet subsea. The GOC is marked by a red-green dashed horizontal line that cuts across all formations indicating a common gas-oil contact. The common oil/water contact for the Eunice EMSU oil pool is shown as a green-blue horizontal line at -325 feet below sea level. The SWD wells were drilled through both the Eumont and the Eunice pools. The cross-section also depicts the perforated intervals for each of the wells, dark blue being used for disposal, light blue are the water supply intervals, and green are oil productive intervals.

51. The EMSU #462 WSW is one of the seven water supply wells that sourced water from the San Andres for the EMSU waterflood and is referenced in the overview locator map, above. This well had an open-hole completion interval between 4,315 feet to 4,998 feet where it has withdrawn about 71.5 MM BW that was utilized in the waterflood before it was recompleted as a Grayburg producer in 2014.

52. The EMSU #460 is another one of the EMSU waterflood source wells. It had an open-hole completion interval between 4,350 feet to 5,000 feet. This well has withdrawn 65.1 MM BW over its lifetime. It was plugged and abandoned in 2002.

53. **With the depletion of the San Andres aquifer from the EMSU #460 and #462 WSWs, along with the other four historical WSWs in the EMSU, Goodnight Midstream's active and proposed disposal wells near the former water supply wells have very low operating pressures, creating an ideal situation for disposal injection operations.** Goodnight discovered the six water supply wells and did research to reconstruct the history of the extracted water volumes. Goodnight used 3D seismic data to locate its wells in a structural low to be as deep below the oil column as possible. We also chose a mostly inactive part of the EMSU to place our

first disposal well, the Ryno (Snyder) SWD.[1] It was drilled through the San Andres to test disposal into the Devonian first. While drilling, the San Andres proved to be porous, highly permeable, and highly pressure depleted. With this proof, Goodnight proceeded with developing its Wrigley disposal field (4 wells), all shown in this cross section.

54. The Goodnight SWDs shown in the cross-section are the Banks, Sosa, Dawson, and Ryno (Snyder). **The current injection zone in each of Goodnight Midstream's SWDs consists of interbedded carbonate rocks, including dolomites and limestones. The upper San Andres is capped by tight dolomite and anhydrite, which serves as the upper geologic seal to prevent migration to the formations above, most importantly the producing Grayburg formation. Within the target injection zone, there are several thick intervals of porous and permeable carbonate rock, with evidence of karsting, capable of accepting large volumes of produced water.** Open-hole logs indicate that the San Andres injection interval has a net thickness of more than 600 feet out of a gross thickness of about 1,300 feet.

55. The lower San Andres lithologic unit consists of approximately 200 feet of limestone with porosity values of 0%-6% and very low permeability, which creates an effective basal seal and barrier against downward fluid migration from the San Andres aquifer into the Glorieta formation below. In addition, below the underlying Paddock interval, the Blinebry interval consists of approximately 580 feet of tight dolomite, which functions as an excellent and exceptionally thick barrier to downward migration.

56. Based on my examination and study of the geology in the area, it is my opinion that these geologic seals above and below the target injection interval effectively contain injected fluids

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[1] The Ryno was originally name the Snyder well when it was drilled to the Devonian. Goodnight renamed the well the Ryno when it was recompleted into the San Andres.

within the injection zone. Additional engineering evidence, addressed below and through Goodnight's technical experts, confirms this assessment.

Goodnight's Proposed SWDs in the EMSU: Geologic Overview

57. The injection disposal interval for Goodnight's proposed SWD wells within the EMSU also will be within the San Andres formation [SWD; San Andres (Pool Code 96121)]. Injection will be through perforated completions in each well between the following approximate depths: 4,125 feet and 5,400 feet for the Piazza SWD #1; 4,200 feet and 4,900 feet for the Doc Gooden SWD #1; 4,200 feet and 5,300 feet for the Hernandez SWD #1; 4,100 feet and 5,200 feet for the Hodges SWD #1; and 4,200 feet and 5,300 feet for the Seaver SWD #1. As with the existing SWDs, the top of the injection intervals for each proposed SWDs will not extend above the top of the San Andres.

58. In **Goodnight Exhibits A-4 through A-7**, which are the C-108 administrative applications for each of Goodnight's proposed SWDs, the geologic description for each application contains an overview of the geology and lithology of the target formation within the area of the proposed SWD wells.

59. The Piazza SWD #1 will penetrate the following geologic tops at the following approximate depths:

Formation	**Top**
Tansil	2,660 feet
Yates	2,810 feet
Seven Rivers	3,012 feet
Queen	3,424 feet
Penrose	3,568 feet
Grayburg	3,733 feet
San Andres	4,125 feet
Glorieta	5,410 feet
Total Depth	5,450 feet

60. The Doc Gooden SWD #1 will penetrate the following geologic tops at the following approximate depths:

Formation	Top
Tansil	2,525 feet
Yates	2,700 feet
Seven Rivers	2,895 feet
Queen	3,330 feet
Penrose	3,480 feet
Grayburg	3,642 feet
San Andres	4,110 feet
Total Depth	5,000 feet

61. The Hernandez SWD #1 will penetrate the following geologic tops at the following approximate depths:

Formation	Top
Tansil	2,590 feet
Yates	2,795 feet
Seven Rivers	2,985 feet
Queen	3,425 feet
Penrose	3,565 feet
Grayburg	3,735 feet
San Andres	4,188 feet
Total Depth	5,300 feet

62. The Hodges SWD #1 will penetrate the following geologic tops at the following approximate depths:

Formation	Top
Tansil	2,505 feet
Yates	2,690 feet
Seven Rivers	2,895 feet
Queen	3,325 feet
Penrose	3,465 feet
Grayburg	3,610 feet
San Andres	4,065 feet
Total Depth	5,200 feet

63. The Seaver SWD #1 will penetrate the following geologic tops at the following approximate depths:

Formation	Top
Tansil	2,570 feet
Yates	2,770 feet
Seven Rivers	2,975 feet
Queen	3,410 feet
Penrose	3,545 feet
Grayburg	3,707 feet
San Andres	4,178 feet
Total Depth	5,300 feet

64. **Goodnight Exhibits B-10.1 through 10.5** are the cross-sections I prepared that show the relative position of each of the proposed Goodnight SWDs along with representative well logs that span a 1.5-to-2-mile distance in the north half of Township 21 South, Range 36 East. The construction of each cross-section exhibit uses color to indicate impermeable, tight rock within each formation that will function as a barrier to vertical transmission of injection fluids. The lithology of these impermeable rocks are anhydrites, and low porosity dolomites and limestones. The color fill is color coded by formation: Grayburg is green and San Andres is purple-gray. White space represents porous rock that contains hydrocarbon in the Yates, Seven Rivers, Queen, Penrose and Grayburg and saltwater (saline aquifer) in the San Andres. The lithology of these porous intervals are dolomitic siltstones and porous dolomites. The gas/oil contact ("GOC") for the Eumont Field (Yates, Seven Rivers, Queen gas production) is shown at -100 feet subsea. The GOC is marked by a red-green dashed horizontal line that cuts across all formations indicating a common gas-oil contact. The oil/water contact for the Eunice EMSU oil pool is shown as a green-blue horizontal line at -325 feet below sea level. At the proposed locations, the proposed SWD wells will be drilled through both the Eumont and the Eunice oil pools.

65. Except for the Doc Gooden cross-section, each of the cross-sections includes a San Andres WSW used to source water for the Grayburg EMSU waterflood, a San Andres SWD that is in, or near, the EMSU boundary, and an offset log to the proposed locations that is representative of the anticipated geology at the proposed permit locations that penetrate the entire San Andres section. Two current SWDs and two WSWs were used in all cross-sections to emphasize that this is already a permitted water management interval and has been for more than 50 years.

66. The EMSU #461 WSW (used in the Hernandez, Seaver, and Piazza cross-sections) is one of the seven water supply wells that sourced water for the EMSU waterflood and is referenced in the overview locator map, above. This well has an open-hole completion interval between 4,200 feet to 5,000 feet where it has withdrawn about 19.3 MM BW that was utilized in the waterflood. It was plugged and abandoned in 2002.

67. The EMSU #458 (used in the Hodges cross-section) is another one of the EMSU waterflood source wells. It has a cased-hole completion interval between 4,056 feet to 4,870 feet. This well has withdrawn 49.5 MM BW over its lifetime. This well has been listed as temporarily abandoned since 2013.

68. The EMSU #278 (used in the Piazza cross-section) is another one of the EMSU waterflood source wells that was converted from a Grayburg producer to a WSW in December 2017. This well currently has a cased-hole completion in the Grayburg between 3,654 feet and 3,845 feet, and a San Andres completion between 4,058 feet and 4,523 feet. This well has withdrawn 1.6 MM BW since it was converted to a San Andres water supply well and is still currently listed as active.

69. With the depletion of the San Andres aquifer from these three WSWs, along with the other four historical WSWs in the EMSU, Goodnight Midstream's proposed disposal wells

near the former water supply wells will have very low operating pressures, as confirmed by its existing disposal operations, creating an ideal situation for disposal injection.

70. The Rice EME SWD #33M (used in the Hodges cross-section) was drilled in 1960 within 175 feet of the EMSU boundary. The well has an open-hole completion and injects in the interval between 4,509 feet to 5,100 feet measured depth ("MD"). This well has injected approximately 59.9 MM BW in its lifetime and currently injects on vacuum. This well has never reported positive tubing pressure since Division injection records began in 1994. This is proof that injection is not putting pressure on the Grayburg waterflood, is not the cause of high pressure in some Grayburg injectors, and even with very large volumes of water injected is still sub-normally pressured.

71. The Permian Line Service N 11 #1 SWD (used in Hernandez, Seaver, and Gooden cross-sections) was drilled in 2020 and is within the EMSU boundary. This well utilizes the San Andres for disposal and has a permitted interval between 4,210 feet to 5,100 feet MD. It has injected 6.7 MM BW and also injects on vacuum due to the large volume of water extracted from the San Andres.

72. As with Goodnight's existing disposal, the proposed injection zone for each of Goodnight Midstream's proposed SWDs consists of interbedded carbonate rocks, including dolomites and limestones. **The upper San Andres is capped by tight dolomite and anhydrite, which serves as the upper geologic seal to prevent migration to the formations above, including the producing Grayburg formation. Within the target injection zone, there are several thick intervals of porous and permeable carbonate rock, with evidence of karsting, capable of accepting large volumes of produced water.** The injection intervals have a net

thickness of more than 600 feet out of a gross thickness of about 1,300 feet based on open-hole logs in the area.

73. The lower San Andres lithologic unit consists of approximately 200 feet of limestone with porosity values of 3%-6% and very low permeability, which creates an effective basal seal and barrier against downward fluid migration from the San Andres aquifer into the Glorieta formation below. In addition, below the underlying Paddock interval, the Blinebry interval consists of approximately 580 feet of tight dolomite, which functions as an excellent and exceptionally thick barrier to downward migration.

74. **Based on my examination and study of the geology in the area, it is my opinion that these geologic seals above and below the target injection interval will effectively contain injected fluids within the injection zone.** Additional engineering evidence, addressed below and through Goodnight's technical experts, confirms this assessment.

Dawson Rate Increase

75. The Andre Dawson SWD can accept high-rate injection at low operating pressures and does not stress the reservoir. Page one of **Goodnight Exhibit B-11** is a graph of the minute-by-minute injection data for the Andre Dawson SWD showing the pressure/rate relationship during injection into the well.[2] The x-axis is the instantaneous flow rate, and the y-axis is the tubing pressure measured at the surface. The data shows the pressure verses rate performance for the well. The red line at 857 PSI is the permitted maximum operating pressure. There is a black dashed line indicating 0 PSI. **The data shows that the well can inject on vacuum (negative surface tubing**

[2] Goodnight inadvertently injected over its permitted injection rate in this well for a period of time in 2023 due to a faulty meter. Upon discovery, the meter was replaced, injection rates were returned to permitted levels, and Goodnight disclosed the issue to the Division in June 2023. *See* discussion below.

pressures) at rates up to about 40,000 BWPD before the well begins to show any positive tubing pressure. This is a robust data set which includes over 50,000 datapoints from the well's first year of operation and confirms that the high-rate injection is sustainable.

76. Additionally, the Andre Dawson SWD shuts-in to negative tubing pressures within seconds of ceasing injection operations. Page 2 of **Goodnight Exhibit B-11** shows a typical injection profile for the Dawson well. The graph on the left shows a continuous injection cycle that lasted about 42 hours. The blue line shows the instantaneous flow rate in barrels of water per day and correlates to the left vertical axis. The red line shows the wellhead tubing pressure and correlates to the vertical axis on the right. These lines are plotted against time on the x-axis in minutes of the injection cycle. The graph on the right is a zoom-in of the final minutes of the injection cycle when the pumps shut down. A black dashed line on both graphs indicate 0 PSI tubing pressure. **The graph on the right shows that at the end of a 42-hour, high-rate injection cycle the well instantaneously goes on vacuum to -15 PSI after being shut in. This data shows that the well was not stressing the reservoir during high-rate injection as there is no material pressure build in the reservoir and the well did not stress the reservoir after nearly 42-hours of high-rate injection.**

77. The Sosa SWD is less than one mile from the Andre Dawson SWD. It was approved under Order No. R-21190. It does not impose a rate limit on injection; only a maximum allowable surface injection pressure of 900 PSI. Page one of **Goodnight Exhibit B-12** is a similar graph to the Dawson injection data of the minute-by-minute injection data for the Sosa SWD. Again, the x-axis is the instantaneous flow rate, and the y-axis is the tubing pressure measured at the surface. The data shows the pressure versus rate performance for the well. The red line at 900 PSI is the permitted maximum operating pressure. There is a black dashed line indicating 0 PSI. **The data**

shows that the well can inject on vacuum (negative surface tubing pressures) at rates up to about 40,000 BWPD before the well begins to show any positive tubing pressure. This is a more robust data set than the discussed with Dawson and includes more than 90,000 datapoints collected over a period of 2.5 years, further confirming that these rates and pressures are sustainable.

78. The Sosa SWD also shuts-in to negative tubing pressure within seconds of ceasing injection operations. Page 2 of **Goodnight Exhibit B-12** shows a typical injection profile for the Dawson well. The graph on the left shows a continuous injection cycle that lasted about 42 hours. The blue line shows the instantaneous flow rate in barrels of water per day and correlates to the left vertical axis. The red line shows the well head tubing pressure and correlates to the vertical axis on the right. These lines are plotted versus time on the x-axis in minutes of the injection cycle. A black dashed line on both graphs indicate 0 PSI tubing pressure. **Like the Dawson well, the Sosa injection data shows that the well instantaneously goes on vacuum after being shut in to -15 PSI following sustained high-rate injection. This is the case for all of Goodnight's injection wells in and around the EMSU. The San Andres aquifer is capable of high-rate injection without stressing the rock as shown by this data.**

79. The data shows that the Andre Dawson can accept rates upwards of 40,000 BWPD at low operating pressures. Because the operating pressures are so low, there is no concern that the San Andres formation would be compromised by high-rate injection causing the formation to fracture or increasing the risk of induced seismicity. **Furthermore, increasing the authorized injection rate will allow Goodnight to utilize and optimize its current infrastructure allowing for fewer SWDs to be drilled. This limits surface disturbances and associated environmental**

risk while being in the interest of conservation and prevention of waste. For all the above reasons, the Andre Dawson rate increase should be approved.

80. It should be noted that Goodnight does not intend to run the Dawson at 40,000 BWPD continuously or indefinitely. Goodnight is requesting the rate increase to support its customers during the initial flow back period of their production wells, which recover high initial rates of completion water for short periods of time, generally only 2-3 weeks. **A historic look back at the Goodnight SWDs shows that the average disposal volumes are less than 15,000 BWPD over the life of Goodnight's wells within the EMSU.**

81. **Goodnight Exhibit B-13** shows the daily injected volume by well for the four wells inside the EMSU from 2023 to date. The average daily volume for this time frame is 14,149 BWPD. Goodnight is requesting this rate only to be able to support peak loads that are short lived and to create redundant capacity in the system if another SWD needs to be temporarily taken offline.

Response to Empire Permit Compliance Allegations

Andre Dawson SWD Over Injection

82. As to Goodnight's SWDs in the EMSU, Empire alleges Goodnight is exceeding its injection authority for the Sosa SWD and the Andre Dawson SWD. As to the Sosa SWD, this order does not provide a maximum authorized injection rate. The order imposes only a maximum surface injection pressure, which the Sosa SWD does not exceed. It does not include a limit on the daily injection rate. The NMOCD did not historically impose maximum daily rate limits on Goodnight wells until July 16, 2021, when the Division issued the Pedro SWD order limiting the daily injection rate to 42,000 BWPD. Subsequently, Goodnight did receive a maximum daily injection

rate on the Andre Dawson SWD and Ernie Banks SWD for 25,000 BWPD in the orders that were granted in 2022.[3]

83. Empire also alleges Goodnight is exceeding its authorized injection limits for the Andre Dawson SWD under Order No. R-22026/SWD-2403. It should be noted at the outset that Goodnight independently determined in 2023 that the Andre Dawson SWD exceeded the permitted maximum daily injection rate during its initial months of operation. After it identified the issued and implemented a corrective action, Goodnight self-reported the issue to the Division in June 2023. Unfortunately, over-injection into Andre Dawson SWD was not identified until May 2023 but has been resolved.

84. As reported to the Division, a turbine meter was installed pending the arrival of a magnetic meter, which is preferred for this application but was not immediately available due to supply chain issues. The turbine meter failed to return a valid daily volume. Control instructions were set to close the valve when daily volumes reached 25,000 barrels of water for each day, which is the authorized injection limit for the well. The turbine meter was repeatedly under-reporting volumes, or completely freezing up. The turbine meter was checked and rebuilt several times. Changes were made to the automation controls to function off the master valve which meters the total volume of water exiting the Wrigley storage facility then subtract the amount of water that goes to the Nolan Ryan and Piper SWDs. The instructions were set to close the Dawson SWD valve when the daily total leaving the Wrigley minus Nolan Ryan plus Piper equals 25,000 barrels.

[3] The Division set a maximum daily injection rate for these SWDs based on Goodnight's request in the C-108 applications for maximum daily injection rates of 25,000 BWPD, not because any evidence showed 25,000 BWPD was the maximum injection rate the target injection formation could receive. 25,000 BWPD was selected as the proposed maximum daily rate because Goodnight's average daily injection does not exceed about 15,000 BWPD.

This temporarily fixed the issues associated with the turbine meter until the magnetic meter was installed at the Andre Dawson SWD on June 6, 2023.

85. Despite this temporary issue, accurate pressure monitoring was maintained during that timeframe. The Andre Dawson SWD's wellhead tubing pressure gauge was operational and did not have any functionality issues. Calibration was checked and verified to be accurate. The maximum pressure recorded during the time was 112 PSI. The average pressure recorded while injecting was 17 PSI, which is significantly below the permitted maximum of 857 PSI. Instantaneous shutdown pressures are on strong vacuum. Surface tubing pressure was -18 PSI two seconds after the pump shut down during that timeframe. This condition of shut-in tubing pressures going on vacuum seconds after shutdown exist to this day. Instantaneous shut down on vacuum indicates that injection was not putting stress on the formation. The formation does not "pressure up" and then bleed off. The wellhead tubing pressures confirm that the temporary and intermittent over-injection into the Andre Dawson SWD had no adverse impact on the San Andres and did not cause the injection interval to be over pressurized.

86. Goodnight self-reported its injection in the Andre Dawson SWD to the Division because it holds itself to a high standard as a responsible and prudent operator and takes responsibility for these oversights. Goodnight implemented additional training, internal management controls, and hired a vice-president level manager to help oversee its operations to avoid any similar operational issues after this incident.

Failure to Submit Monthly Form C-115s

87. Empire also alleges Goodnight has not submitted the required monthly C-115 reports to the Division for its Andre Dawson SWD and Ernie Banks SWD, as required. C-115s include information on the injection volumes and pressures.

88. Goodnight has been unable to submit C-115s through the OCD's e-permitting portal for these wells because the OCD has not yet approved pending completion reports (C-104s/C-105s) that were submitted by Goodnight following completion of these wells. Goodnight has been in regular communication with the Division on this issue for more than a year in an effort to upload its C-115 reports to the Division. Goodnight has, however, submitted its C-115s to the Division by email.

89. Goodnight is not aware of any deficiencies or issues with its completion reports for either the Andre Dawson SWD or the Ernie Banks SWD.

Empire Has Serious Injection Permit Violations at the EMSU

90. While reviewing Empire's operation of the EMSU EOR injection wells, Goodnight became aware that Empire itself has serious injection permit violations that are far more alarming than exceeding an arbitrary injection rate. **It appears that Empire has exceeded the maximum permitted pressure allowed in 37 of their EOR injection wells within the EMSU for a total of 272 instances when the authorized maximum surface injection pressure was exceeded, as shown by their average injection pressures Empire provided on its C-115 reports.**

91. Some of the exceedances are minor, but many are not. **Goodnight Exhibit B-14** shows a table of the API, well name, C-115 reporting month, C-115 reported volume injected, C-115 reported average injection pressure, top perforation, permitted max injection PSI, requested permit PSI increase pressure (where applicable), the applicable order and pressure basis, the calculated PSI over the maximum authorized levels, and the calculated injection gradient (PSI/ft) for each exceedance. This analysis is from 2022 forward during the time Empire was operator of the EMSU. **Sixty-two of the instances are 50 PSI or more over the maximum permitted pressure and reach as high as 133 PSI over the permitted limit.**

92. Empire has claimed concern over Goodnight's permit infractions, stating that SWD injection could impair the Grayburg reservoir due to over-pressurization. Empire's counsel has gone as far to allege to the Commission that Goodnight's injection rates are "almost criminal," during an argument seeking to suspend Goodnight's injection authority. **In fact, Empire's own operations are posing more of a risk of damage to the EMSU as they are putting much more stress on the Grayburg reservoir through their own injection operations. The Grayburg is already an above-normal-pressure reservoir as a result of waterflood operations. Empire—and the Commission—should be more concerned with Empire's violation of its injection pressure limits than Goodnight's injection rates.**

Top of San Andres Aquifer

93. When Goodnight did its original investigation of the EMSU it discovered that the reported tops for the San Andres were very inconsistent and inaccurate. It appeared that the previous operators of the EMSU were not focused on picking an accurate or precise San Andres top in the EMSU. This is likely due to the fact the San Andres aquifer is well below the oil-water contact at the EMSU, was never prospective for hydrocarbons, and not included in the EMSU waterflood operations. It appears that previous operators did not take the time to properly map the San Andres aquifer as it was not the focus for operations and provided little to no value to the companies. The San Andres was so far below the oil producing zone (and the oil-water contact) that operators knew they were not going to be drilling that deep, so picking an accurate and precise San Andres aquifer top did not matter. They just needed to know generally where the top of the San Andres was located to avoid drilling and completing their Grayburg producing wells or the waterflood injection wells into it. The times the San Andres tops did matter was when the EMSU operators drilled the six water supply wells into the San Andres. Not surprisingly, the operator

picks for the top of the San Andres in those WSWs align very closely with Goodnight's picks elsewhere.

94. Goodnight Midstream defines the boundary between the Grayburg and the San Andres as the location of the mappable permeability barrier that prevents flow from occurring between those two formations. This is a functional "Top of San Andres." Everything above performs and behaves together as a single unit and reservoir, and is isolated and distinct from everything below this barrier.

95. It is Goodnight's understanding that Empire plans to continue secondary recovery operations within the Grayburg formation of the EMSU, but is proposing tertiary operations in the Grayburg formation and even a potential Grayburg ROZ below the Grayburg oil-water contact.

96. It appears Empire is seeking to create a conflict with Goodnight's disposal operations by calling a potential Grayburg ROZ (the zone below the Grayburg oil-water contact at -325 feet subsea) the San Andres. It is not San Andres. It is Grayburg because it is in an interval that is geologically and functionally isolated and distinct from the underlying San Andres. That means any residual oil in this zone is Grayburg oil and it is Grayburg oil below the Grayburg oil-water contact. Because it is isolated by the well-defined permeability barrier that separates the San Andres from the Grayburg, the oil in this zone, and any current or proposed operations, will not be affected by San Andres water management operations below.

97. Goodnight Midstream's geologic model does not include this Grayburg interval as part of the San Andres. It is part of the Grayburg because it is in an interval that is geologically and functionally connected to and part of the Grayburg, but isolated and distinct from the San Andres. **Goodnight Midstream has identified the San Andres top, which is our operational**

ceiling for injection, based on data discussed below. Goodnight Midstream has not and does not propose to inject above it.

98. Goodnight's justification for its San Andres top pick comes from multiple data sources. The first data source are the exhibits presented during the Commission hearing that unitized the EMSU in Case Nos. 8396-8399. **Goodnight Exhibit B-15** is a document from the hearing that describes the formations in the unit. First, the Grayburg is described to occur at the approximate depths of 3,500-3,900 feet and has an approximant thickness of 490 feet. Next, the top of the San Andres is described to occur at approximate depths of 4,100-4,500 feet across the EMSU.

99. The second data source are publications from previous operators of the EMSU that describe where the San Andres top was picked. **Goodnight Exhibit B-16** is a 1991 SPE paper on the EMSU that was authored by an employee of Chevron, a previous operator of the field. It discusses drilling the San Andres water supply wells for the field and the top of the San Andres is discussed:

> Instead of drilling 10 5/8-in. production hole and running 8 5/8-in. casing to TD, 10 5/8-in. hole was drilled to the top of the San Andres (roughly 4,200 ft) and cased off. (emphasis added).

100. Figure 6 from this paper is a lithology diagram of the formations that the water supply wells penetrated and shows the depth of the San Andres aquifer at around 4,100 feet. This is consistent with the exhibits that were presented at the unitization hearing discussed above.

101. When Goodnight conducted its initial geologic investigation of the San Andres in and around the EMSU, we keyed off the water supply wells as they pressure-depleted the San Andres aquifer and were some of the only wells that penetrated the San Andres in the area. Utilizing the logs for these wells, Goodnight realized that the reported top of the San Andres was being picked by the operator near non-porous intervals that could be mapped around the field. This

nonporous interval marks the boundary between the Grayburg and San Andres differential pressure systems (discussed later).

102. **Goodnight Exhibit B-17** shows the operator-reported San Andres tops for the six original water supply wells in the EMSU. These tops align closely with the Goodnight picks for the San Andres tops for the same wells. The difference between the Goodnight picks and well file picks are shown in the exhibit in the third column from the right. Negative values in this column indicate that the well file top is deeper than the Goodnight top. Also included is the Grayburg thickness based on the well file and Goodnight picks for the top of the San Andres. Unlike the majority of the EMSU producers and waterflood injection wells, the tops that were reported in the WSWs were consistent with the unitization exhibits and the Chevron SPE publication discussed above, except for the EMSU #461. The top that is reported for #461 is 4,002 feet, making the Grayburg only 255 feet thick. This is inconsistent with the reported thickness for the Grayburg in the unitization case file and with its thickness at the other WSWs. Goodnight picked the San Andres top in this well at 4,195 feet, which is consistent with the Grayburg thickness reported in the unitization case file and with the other water supply wells that picked the top of the San Andres at a mappable confining layer.

103. Goodnight has consistently used this method of picking the San Andres top at the mappable barrier that separates the Grayburg from the San Andres. **This top is confirmed to be the barrier that separates two different pressure systems, one associated with the Grayburg and the other associated with the San Andres aquifer (discussed later in the testimony). Because of the difficulty identifying stratigraphic intervals within the San Andres carbonate ramp system that exists within the EMSU, the best method for accurately picking the top of**

the San Andres—and the strongest evidence it is correct—is not necessarily geologic but engineering based data.

104. Using Goodnight's San Andres top pick that corresponds to the barrier that separates the pressure regimes between the Grayburg and San Andres is the most logical method to confirm and differentiate the water management zone in the San Andres from the oil producing zone in the Grayburg. Goodnight's San Andres top is consistent with the reported thickness of the Grayburg, making it about 490 feet thick using Goodnight's San Andres pick. Goodnight's top also establishes a significant vertical offset between Goodnight's target injection zone to the established productive intervals in the Grayburg. In fact, during discussions with the Division's Underground Injection Control technical team when Goodnight was first permitting its SWDs in the EMSU, the Division's technical examiners requested Goodnight rely on its San Andres top picks, rather than some of the shallower tops picked by EMSU operators, because Goodnight's San Andres pick was deeper and would increase the vertical offset from the Grayburg producing interval

San Andres Injection Does Not Interfere with EMSU Grayburg Operations Due to Isolating Geologic Barriers

105. **The presence of an effective barrier between the San Andres and the overlying Grayburg formation is proven by the presence of a sustained and substantial regional pressure differential.** The early field production behavior of the Grayburg is typical of a solution gas drive reservoir, having a rapid decline in reservoir pressure without a rapid rise in water production. This characteristic is why the operators of the EMSU enacted a waterflood, to re-pressure the reservoir and sweep the remaining oil.

106. **In contrast to the Grayburg, the San Andres water supply wells saw no decline in the ability to produce water for the flooding project despite the Grayburg having been**

depressurized through primary production. The San Andres aquifer was able to supply enough water to fill the EMSU gas cap and re-pressure the depleted Penrose-Grayburg oil column while the pressure dropped in the San Andres below.

107. **The reason the waterflood worked and the Grayburg was successfully re-pressurized by the addition of San Andres water is because the geologic seal between the Grayburg and San Andres is effective. The success of the waterflood and re-pressurization of the Grayburg is the first indication that the Grayburg and San Andres are not in communication and are separated by a geologic barrier.** The Grayburg was pressured up starting in 1987 and held pressure until 2007 when operations switched to drag flood, with continuous recycling of 98% water cuts through the Grayburg. The pressure differential between the Grayburg and San Andres has held for 35 years without equilibration or the exchange of fluids.

108. The high-pressure zone is in the Grayburg, so flow would be into the low-pressure San Andres, if the formations were in communication. If oil was being pushed into the San Andres from high pressures in the Grayburg then the water supply wells, which were the pressure sinks, would have produced some Grayburg oil. They never produced a single barrel.

109. The Grayburg has now been pressured up due to being under continuous waterflood. In contrast, the San Andres is now depleted due to water being extracted in great quantities. The producing Grayburg wells in the EMSU have shown a gradual increase in water cut until they reached more than 98% water. Most of the Grayburg oil producers responded to waterflood injection, showing both fluid increases and pressure increases from the injection of San Andres water.

110. The presence of San Andres water in the Grayburg, therefore, is not diagnostic of unwanted water encroachment, as Empire alleges. San Andres water has been introduced into the

Grayburg at the EMSU starting in 1986. We must look instead to the pressure differential to demonstrate that an effective barrier and seal exists between the two formations.

111. **At the time the EMSU was created, the San Andres was identified as the source of water needed to flood the Grayburg. Water withdrawal began in 1985. Since that time, the San Andres has supplied more than 350 million barrels of water for field operations for the EMSU alone.** **Goodnight Exhibit B-18** is a table that was created using OCD records of production volumes for the initial six San Andres water supply wells within the EMSU, discussed above.

112. The history of these wells is incomplete in the Division's public well data and the New Mexico State Engineer's database. Data from Division hearing case files, and reconstructed volumes from tests and modeled averages were used to supplement the table. A few of the water supply wells are still active today. No oil production was ever reported for any of these wells.

113. **In addition to the WSWs associated with the EMSU, an additional 20 San Andres WSW wells have been identified within one to two townships of the EMSU.** **Goodnight Exhibit B-19** shows these wells on a map as dots that are colored by their current status. These wells have, in the aggregate, withdrawn hundreds of millions of additional volumes from the San Andres in the area. These wells were/are used to source water for other waterfloods outside of the EMSU in the area.

114. As a result of this substantial fluid withdrawal, the San Andres was de-pressured while the Grayburg was re-pressured by waterflood injection. A large pressure differential was established between these two contiguous formations. **We know that an effective geologic barrier and seal exists between the Grayburg and San Andres formations or we would not**

see the effects of the differential persist to the present. The pressure differential has a clear impact on drilling **operations** in the area and on injection into the San Andres.

115. Goodnight drilled its Ryno (Snyder) SWD #1 in the northwest quarter of Section 17 inside the EMSU in June 2018. Goodnight had no difficulty drilling through the normally pressured Grayburg reservoir. **However, once the drill bit passed out of the base of the Upper San Andres anhydrites, which serve as the seal between the Grayburg and San Andres, the well lost circulation in the San Andres. All fluid was lost into the hole in large intervals. This continued for the next 700 vertical feet as we drilled through the upper and middle San Andres zones.** Water was continuously added to the hole to continue drilling until open-hole cement jobs were performed to regain circulation. In contrast, the Grayburg held a column of fluid. This confirms that the Grayburg is pressure isolated from the San Andres.

116. The condition repeated when we drilled each of our subsequent wells. All 11 Goodnight SWD wells have held a column of drilling fluid in the Grayburg but experienced a complete loss of fluid when we pass below the confining layer that separates the San Andres from the Grayburg. The pressure differential between the Grayburg and San Andres is substantial, extends over a large area, and has not equilibrated over time. This strongly establishes that there are effective geologic barriers to flow between the two reservoirs across a substantial area, including the area at issue within the EMSU.

117. **Goodnight Exhibit B-20** shows an example of the pressure differential observed during the drilling of the Grayburg and San Andres aquifer which occurred in all of Goodnight's SWDs during drilling. Three days from the drilling report for the Andre Dawson SWD show that on the sixth day the Grayburg interval was being drilled and did not experience major losses of drilling fluid. Only minor seepage at 4,000 feet occurred that was easily managed. Then the well

passed into the San Andres top which occurs at 4,287 feet. At 4,295 feet the well began to lose 22 barrels of drilling fluid per hour. Then on the seventh day the drillers penetrated the main porosity zone in the San Andres that is targeted for disposal. The well had total loss of drilling fluid circulation at 4,564 feet. All the drilling mud was lost to the formation and the well "dry drilled" using produced water from the Wrigley facility. This continued to occur until the well reached its total depth on the eighth day. This data shows that there is a distinct pressure differential between the Grayburg and the San Andres aquifer.

118. Persistent low pressure in the San Andres is also demonstrated by the fact that Goodnight Midstream's Sosa SWD #1,Ryno (Snyder) SWD #1, Banks SWD #1, and Andre Dawson SWD #1 wells can inject into the San Andres within the EMSU on vacuum by gravity feed. This is also the case for other third-party disposal wells in the EMSU. This would not be possible if there was not an effective seal and barrier to maintain that dis-equilibrium between the two formations. This pressure differential has been maintained for more than 30 years confirming that the geologic barrier and seal between the two formations is effective and prevents water in the Grayburg from migrating into the San Andres, or the inverse. It also prevents water in the San Andres from migrating into the Grayburg.

119. Additional data confirming that the San Andres is pressure depleted is shown by the fact that all the San Andres SWDs operated by Goodnight Midstream in this area go on vacuum (negative wellhead tubing pressure) within seconds of ceasing high-rate injection (as shown in Exhibits B-11 and B-12). This is indicative of each of these wells not being able to support a full tubing column of fluid due to the reservoir being under pressured.

120. **Goodnight Exhibit B-21** is a table showing the shut-in fluid level in each of these wells that was taken on July 20, 2024. The columns included in the table are the shut-in tubing

pressure (SITP), fluid level feet from surface (FL), top perforation, middle point of the perforated interval, base perforation, calculated bottom hole pressure at the middle of the perforated interval, and calculated PSI/ft gradient to the middle of the perforated interval. A 0.465 PSI/ft gradient, which is the hydrostatic pressure of a full column of formation water, was used to calculate bottom hole pressures. On average, fluid is 863 feet from surface. The average reservoir pressure of the San Andres aquifer at the middle of the perforated intervals is 1897 PSI. A normally pressured reservoir is generally considered to be when the reservoir pore pressure is equal to the hydrostatic pressure of a full column of formation water, 0.465 psi/ft. Goodnight's wells are not capable of supporting this full fluid column. **The average perforation depth in the wells and the average pressure calculated from the fluid levels show that the San Andres aquifer is currently at a pressure gradient of approximately 0.381 PSI/ft, which is much lower than a normal pressure gradient of 0.465 psi/ft.**

121. In contrast to the San Andres aquifer being de-pressured, the Grayburg has been re-pressured due to waterflood operations and is maintaining its re-pressurization. This is shown by the reported shut-in pressures for the EMSU waterflood injection wells. **In September 2023, 21 EMSU waterflood injection wells from around the field were shut-in for the month and reported tubing pressures to the OCD. These 21 wells are shown in Goodnight Exhibit B-22 and have an average shut-in tubing pressure of 471 PSI. This is significantly different than the San Andres SWDs in the area which, as discussed above, are unable to support a full column of fluid and shut-in to negative tubing pressures. The average bottom-hole pressure at the middle of the perforated interval for the 21 EMSU wells is calculated from the shut-in tubing pressures and shows that the Grayburg is currently at an average pressure gradient**

of 0.587 psi/ft. This is significantly higher than the San Andres and above even what is considered to be a normally pressured reservoir.

122. On the same topic of the pressure differential, the EMSU #368 is about 600 feet from Goodnight's Banks SWD. The EMSU #368, a Grayburg waterflood injection well, was shut-in on January 8, 2024 and showed an average shut-in pressure of 696 PSI. In contrast, the Banks SWD (San Andres) was shut-in at times during that same day and had a shut-in pressure of-15 PSI. **Goodnight Exhibit B-23** shows a map of these two wells, the distance between them being 594 feet. The data tables show the shut-in pressures from the EMSU #368 that were provided by Empire from periodic times throughout January 8, 2024. The Banks SWD was also shut-in periodically on that day. Note that the final readings in both tables was taken at the same time. This further shows that these two wells are not in pressure communication and there is a substantial difference in the reservoir pressures between San Andres and the Grayburg.

123. Furthermore, **Goodnight Exhibit B-24** is pulled from one of the OCD well files where Chevron, a former operator of the EMSU, requested and was granted an injection pressure increase for 11 of the EMSU waterflood injection wells. If the Grayburg was in pressure communication with the under-pressured San Andres aquifer, these wells could not have pressured up and Chevron would not have needed to request an increase in the maximum surface injection pressure for these wells. The wells subject to Chevron's requested increase are spread across the EMSU field further indicating that this pressure differential between the Grayburg and the San Andres aquifer, and therefore the seal between the two zones, is areally extensive and effective.

124. Dr. Lindsay, in his 2014 PhD dissertation, discusses the reservoir seal between the Grayburg and the San Andres at the EMSU:

> It has been found that the composite sequence boundary at the top of the Upper San Andres Formation acts as a reservoir seal and does

> not allow fluids to communicate with Grayburg Formation fluids. **The ultimate test has come from pressure data that shows one pressure system associated with the Upper San Andres Formation and a different pressure system associated with the Grayburg Formation.** The reason why the composite sequence boundary is not [a] porous pathway from the Upper San Andres Formation up section into the Grayburg Formation is explained by subaerial exposure and karstification associated with the Upper San Andres Formation was cemented to form a tight non-porous interval of strata. Dolomitic sandstones at the base of the Grayburg Formation contain enough dolomitized carbonate matrix that they are also non-porous and non-permeable. Between these two the non-porous karst and non-porous basal sandstone a seal (aquiclude) was formed within the top of the Upper San Andres Formation and the basal Grayburg Formation.

Goodnight Exhibit B-25. (emphasis added). Dr. Lindsay repeats the conclusion stated above an additional five times in his dissertation. *See id.* (OCD 23614-17 01120, 01144, 01366, 01605, 01611).

125. Dr. Linday does go on to state the following:

> There have been places found in EMSU, EMSUB, and AGU where faults/fractures have allowed Upper San Andres Formation fluids to move up section into Grayburg Formation strata, which form vertically-oriented plumes of Upper San Andres Formation water within the Grayburg Formation. These localities tend to be only associated with one well, indicating that faults/fractures are localized in small areas.

In contrast to his statements on the geologic basis for the seal between the Grayburg and San Andres and the pressure differential confirming it is effective, **Dr. Lindsay's statements alleging the presence of localized fracture pathways are not supported by any data and no sources are cited to corroborate this statement. There is no discussion as to which Grayburg well or wells he contends produced San Andres aquifer water or how he was able to diagnose the purported plumes as water from the San Andres. No chemistry data is presented in his study nor has any chemistry data been provided by Empire to confirm these statements.** If water chemistry data is presented to show that San Andres aquifer water was produced from a Grayburg production well, the sample would need to have been collected before waterflood operations commenced in November 1986 when San Andres water was injected into the Grayburg as makeup water.

126. In support of the contention that fracture networks exist between the San Andres and Grayburg, Empire and Dr. Lindsay cited a fracture study conducted on the EMSU 679. They claim this study is evidence showing that the seal between the Grayburg and the San Andres aquifer is compromised. This is not the case. Dr. Lindsay confirms that this fracture study is limited to the Grayburg in the first paragraph of the study (OCD 23614-17: 00281).

> One hundred and twenty feet of oriented core, through the Grayburg Formation in the base of zone 4, all of zone 5, and the upper half of zone 6, was analyzed for fractures orientation in the EMSU well no. 679 (Fig.1). Three hundred and thirteen (313) fractures were measured (Fig. 2). Most fractures are small, discontinuous, en echelon, vertical breaks that have average lengths of only a few inches. A few intervals contain longer, more continuous vertical fractures with lengths of 1 to 3 feet (Fig. 3).

Goodnight Exhibit B-26 (emphasis added).

127. The fracture analysis shows that the deepest rock analyzed for fractures is no deeper than 4,180 feet. The San Andres top for this well is at 4,268 feet, 88 feet deeper than the base of the analysis. This fracture analysis was not conduced in the confining layer that separates the Grayburg from the San Andres aquifer and therefore does not show that the confining layer is compromised. The largest fractures observed in the study were only three feet in length and were located significantly above the confining layer at a depth 4,130 feet. Fractures that extend a maximum of three feet are not nearly long enough to connect the Grayburg to the San Andres, which is nearly 90 feet below the deepest rock analyzed. Additionally, the deepest fractures found in the study, at about 4,180 feet, were found to only extend a few inches. **This study does not show that the upper San Andres confining boundaries are compromised by fractures.**

128. **Goodnight Exhibit B-27** shows the log for the EMSU 679 on the left and a graph of the vertical permeability measurements from the core data on the well. The Goodnight pick for the top of the San Andres is shown at 4,268 feet. The exhibit shows the confining layer that separates the San Andres from the Grayburg by the long interval of non-permeable rock just below the San Andres top that is at or very near 0mD. **This shows that the confining layer is real and effective, especially when married to the fact the zone below this confining layer is under a different pressure regime than the Grayburg above it, as demonstrated above.**

129. Empire shows that the EMSU 239 had produced abnormally high volumes of water as of 1981, before the EMSU waterflood commenced in 1986. Empire claims this is indicative of communication between the Grayburg and the San Andres aquifer. **Goodnight Exhibit B-28** refutes this claim and establishes the reason for the high water production for this well in 1981. The exhibit shows the EMSU 239 in a cross-section with two direct offset wells, the EMSU 230 and EMSU 238 with their mechanical configuration as of 1981 (note that the log for the EMSU 239 did not make it to the TD of the well). These wells were open-hole completed as shown by the green bars in the depth columns. The EMSU 239 well had an open-hole completion from 3,800-3,946 feet. This well was open and producing from below the oil-water contact ("OWC"), which explains the high-water production values in 1981. The near offset wells shown in the cross-section, the EMSU 230 and 238, had similar open-hole completions but were not drilled below the OWC. These wells had much lower water production values in 1981 as a result. **If water was migrating from the San Andres, immediately adjacent offset wells to the EMSU 239 would have similar water production values. The fact that they did not indicates that the EMSU 239's open-hole completion below the OWC caused the high water production for this well, not infiltration from the San Andres.**

130. **Additionally, if the previous operators of the EMSU had confirmed that there was San Andres aquifer communication with the Grayburg in this area they would not have converted the EMSU #1, a direct offset well to the EMSU 239 about 1,320 feet away, into a San Andres disposal well. That would make no operational sense. Empire continues to use the EMSU #1 as a disposal well to this day.** Empire's continued injection into the San Andres would be directly contributing to this problem. If Empire truly had concerns about communication between the San Andres and Grayburg it would discontinue its own offsetting injection.

131. The EMSU has a long history of San Andres disposal that has never interfered with Grayburg production. As discussed above, San Andres disposal in and around the EMSU has been ongoing since 1960—decades before the EMSU was formed. As of September 2018, a total of about 131.5 MM Bbls of water have been injected into the San Andres aquifer in and around the EMSU by third-party commercial disposal operators when Goodnight commenced injection into its first San Andres disposal well in the area. **There were never claims, by any of the previous EMSU operators, that San Andres disposal interfered with Grayburg production or EMSU operations. Empire, to date, has not shown any evidence that San Andres disposal has interfered with Grayburg production or EMSU operations.**

132. The San Andres aquifer is segregated from the Grayburg as shown by multiple datasets. Goodnight disposal operations in the San Andres will not interfere with Empire's ongoing operations in the Grayburg. Core data presented above shows a thick impermeable barrier at the base of the Grayburg that isolates disposal operations from shallower oil operations. **The ultimate test that this permeability barrier is real and effective is the fact that the Grayburg and San Andres have different pressure systems associated with each formation demonstrated by the data discussed above, which is echoed by Empire's experts. No data has been presented to**

show that this confining layer is compromised in any way. There is also no indication or evidence that disposal water has encroached on any Empire producing well in the Grayburg.

133. The San Andres in and around the EMSU is a world class disposal reservoir that is ideal to support New Mexico's oil producers. It is a textbook example of ideal characteristics one hopes for in a disposal reservoir and the state of New Mexico should be incentivized to protect it as such.

Injection Will Not Affect Underground Sources of Drinking Water or Freshwater

134. The deepest underground source of groundwater is the Rustler formation at a depth of approximately 1,345 feet. Water well depths in the area range from approximately 195 feet to 213 feet below ground surface. There are no underground sources of drinking water below the San Andres injection interval.

135. Based on this review and analysis of freshwater, the geologic seals above and below the injection interval, and the significant vertical offset between the injection zone and shallow zones containing freshwater, it is my opinion that the proposed injection will not threaten drinking water sources or zones containing freshwater.

136. Empire claims that San Andres injection will migrate about 4 miles to the west and into the Goat Seep aquifer. These claims are not backed by facts. The Goat Seep aquifer is stratigraphically equivalent to the Queen and Grayburg formations, as shown in **Goodnight Exhibit B-29**. **The San Andres is stratigraphically equivalent to the Lower Brushy Canyon and Bone Spring Lime, not the Goat Seep aquifer. As discussed above, the top of the San Andres has an effective confining layer that not only isolates the San Andres from the Grayburg but also isolates it from the Goat Seep due to the fact the Grayburg and Goat Seep are stratigraphically equivalent.** A bold line on the exhibit highlights the boundary between the

Grayburg and San Andres showing that the San Andres is not contiguous to the Goat Seep at any point across the Basin.

137. Not only does Empire's claim make no sense geologically because the San Andres and Goat Seep formations are not contiguous, but Empire also has presented no evidence that San Andres volumes are reaching, or have ever reached, the Goat Seep aquifer or have ever been documented to be in communication with it. This allegation is pure conjecture and not feasible where the San Andres is substantially under-pressurized.

138. Even if the San Andres and Goat Seep aquifer were somehow in communication, there is no mechanism to drive communication between the two geologically separate zones. Arguably, water that Empire injects into the Grayburg, which is stratigraphically connected to the Goat Seep and is over-pressured, has a higher likelihood of communicating with and contaminating the Goat Seep aquifer than Goodnight's San Andres injection. Empire has presented no feasible explanation for how disposal into the San Andres is a greater risk to the Goat Seep than Empire's own waterflood operations are in the Grayburg.

139. **Moreover, Empire's own experts agree that the Goat Seep is isolated from the San Andres.** The following is an excerpt from a 2012 RPSEA report authored by Dr. Trentham, Mr. Melzer, and Mr. Vance that states the following:

> [Dr. Lindsay] also documented that the San Andres has a sulfate rich "bottom water drive" which is sourced from the Sacramento Mountains and a sulfate poor "edge water drive" in the Grayburg, sourced from the Guadalupe Mountains. <u>This supports the concept that the concept that the San Andres is hydrologically separated from the Goat Seep Reef (Grayburg) and therefore separated from the Capitan Reef.</u>

<u>Goodnight Exhibit B-30</u> (emphasis added).Empire's claim that the Goat Seep is at risk is contradicted by their own experts.

140. **Goodnight Exhibit B-31** are the geology and engineering statements that I prepared for Case Nos. 23614-23617 and 24123. They confirm I have reviewed the available geologic and engineering data and have found no evidence of a hydrological connection between the proposed injection intervals and any underground sources of drinking water. In addition, the casing strings have been designed to ensure that there will be no hydrologic connection between the injection interval and overlying underground sources of drinking water.

The San Andres Aquifer is Not a ROZ Target in the EMSU and not Prospective for Hydrocarbons

141. A residual oil zone, or ROZ, has been defined in literature as being analogous to conventional oil zones that are in the late stages of waterflood operations when oil production nears zero. Main pay intervals at the late stage of waterflood operations typically bring oil saturations down to 20-40%. ROZs have been waterflooded by "mother nature's" waterflood where oil saturations, like a conventional waterflood, have brought oil saturations down to about 20-40%. This assumes that the area swept by mother nature's waterflood had oil saturations to begin with. Therefore, ROZ are defined as long intervals (200-400 feet) of oil saturations in the 20-40% range.

142. Core data from wells drilled in the EMSU confirm that a potential ROZ interval in the EMSU is limited to the Grayburg. Empire's witness, Mr. Melzer, has authored two papers of particular note on this topic, *Residual Oil Zone Exploration: Rethinking Commercial Reservoir Models* and the *Residual Oil Zone "Cookbook"*. Both papers conclude that "many ROZs are oil wet and contain, by definition, between 20-40% oil saturation".

143. **Goodnight Exhibit B-32** shows a comparison of two graphs showing oil saturations. The graph on the first page is from the referenced publications and shows core oil saturations from the Goldsmith-Landreth San Andres Unit, a known and producing ROZ field. The

20% oil saturations cutoff is shown by the horizontal red line. The gas cap interval is shaded in red, the main oil pay zone in green, and the ROZ interval in blue. Oil saturations from the ROZ zone range from 20%-60% matching the published definitions for ROZ oil saturations. The base of the ROZ is shown by the drop in oil saturations to below the 20% cutoff. This well in the Goldsmith-Landreth Unit is the gold standard for defining the base of an ROZ.

144. The graph on page two shows a well from the EMSU, the EMSU 679. This is a similar display of core oil saturations from the core report which covers the lower Graybrug and the uppermost section of the San Andres. **The deepest that consecutive oil saturation measurements that are above 20% occurs at -652 feet subsea. The San Andres top occurs at -672 feet subsea in the EMSU 679. This oil saturation data shows that a potential ROZ zone (by Melzer's definition) is confined to the Grayburg interval.**

145. The graph on the third page shows multiple well core oil saturations from EMSU: The EMSU 679 (green dots), EMSU 649 (yellow dots), and the RR Bell #4 (purple dots) to show the full oil producing zone in the EMSU. Dr. Lindsay and Mr. Melzer have stated that the analog to ROZ zones are production-mature, main pay zones that have undergone secondary waterflood operations. Waterflooded main pay intervals generally still have oil saturations that range from about 20-40%. **ROZ zones that have been swept by "mother nature's waterflood" are expected to** also **have 20-40% oil saturations, according to Mr. Melzer and Dr. Trentham. Dr. Lindsay and Mr. Melzer have discussed in their testimony and publications that there is little** difference **between a main pay zone that has been waterflooded and a ROZ. This graph shows that the potential ROZ is limited to the Grayburg at the EMSU and matches the description given by Dr. Lindsay and Mr. Melzer.** The main pay zone has an average oil saturation of 18.64% after decades of waterflood operations and the ROZ interval in the lower

Grayburg has a similar oil saturation of 18.28%. The cored interval below the base of the ROZ starting at -652 feet subsea has an average oil saturation of only 7.11%. This data further confirms that the ROZ interval in the EMSU is limited to the Grayburg.

146. Further proof that the San Andres is not prospective can be found in the EMSU's water supply wells, which have thoroughly tested the San Andres. The EMSU #457, #458, #460, #461, and #462 water supply wells are all within the EMSU boundary and proximal to Goodnight's proposed and active SWD wells. As shown in **Goodnight Exhibit B-18, the EMSU water supply wells have produced a combined total of approximately 350 million barrels of water from the San Andres over more than 30 years with no show of oil. Three hundred fifty-million barrels over three decades with no oil production is a sufficient test to confirm that the San Andres is devoid of hydrocarbons here.**

147. In addition to the water supply wells testing the San Andres, **the EMSU #746 is a well that was drilled by XTO in September 2005 to test the San Andres for oil production from the top to the base of the formation. The well tested seven zones throughout the San Andres from 4,100 feet to 5,138 feet and produced 100% water on multiple swab runs and pumping tests.**

148. On September 19, 2005, the first four zones were perforated in the lower San Andres from 4,990 feet to 5,138 feet. The well was then flowed and swabbed 110 barrels of water over two days with no oil recovered. A cast iron bridge plug was then set at 4,755 feet to abandon the lower San Andres perforations. On September 23, 2005, three zones in the upper San Andres were perforated from 4,100 feet to 4,340 feet and swabbed 300 barrels of water over two days with no oil recovered. These upper San Andres perforations were tested again October 18, 2005, when the well pumped 1,287 barrels of water and no oil during a 24-hour pump test. On December 15,

2005, a cast iron bridge plug was set at 4,210 feet, abandoning more of the San Andres perforations and zones in the lower Grayburg were added. The last remaining San Andres perforations that had not been abandoned (4,100-4,110 feet) were isolated and tested again 100% water. On December 31, 2005, a 24-hour pump test was run on the last remaining San Andres perforations along with the open lower Grayburg perforations and made 1,600 barrels of water and no oil. The well was then shut-in for evaluation. On June 16, 2005, a cast iron bridge plug was set at 3,950 feet permanently abandoning the San Andres.

149. The EMSU #746 tested multiple zones throughout the San Andres interval multiple times but no oil was ever recovered. There could be oil with saturations less than 20% in some of these zones but ROZ experts, including Empire's own expert witnesses, state that less than 20% oil saturation does not meet the definition of a ROZ.

150. **Goodnight Exhibit B-33** shows the Nutech interpreted log of the EMSU #746 along with the swab and pumping tests from the well file that were discussed above. The top of the San Andres is shown in red at 4,195 MD. Blue shaded intervals on the log are the perforated intervals that tested 100% water, green shaded intervals are perforated intervals that tested oil (all in the Grayburg), and gray shaded intervals are perforated intervals that tested 100% water and were squeezed. Left of the log are the average of the Nutech calculated oil saturations (S_o) from the water/oil saturation track annotated in the log header for each of the perforated intervals tested for hydrocarbons. The water/oil saturation track has the porosity curve that is filled proportionally with the fluid saturations calculated by Nutech to occupy that pore space. Black is oil saturation, light blue is free water saturation, and cyan is irreducible water saturation.

151. **The point of the exhibit is that the Nutech calculated oil saturations do not match the production tests. Nutech calculates oil saturations in the San Andres that would**

have produced oil if its interpretation was correct. Note that the interval from 4,100-4,110 feet is shown to have an oil saturation of 73% and is calculated to be at an irreducible water saturation shown by the lack of light blue color fill that denotes free water in the water/oil saturation track on the log. If an interval is at irreducible water saturation, it should produce oil free of water. This zone tested 100% water multiple times. This shows that Nutech's calculation of oil and water saturations are invalid. The Nutech analysis over states oil. The fact that this interval tested 100% water invalidates the calculated oil saturations (73%) and proves the analysis is not, and does not, calibrate to real world tests.

152. The EMSU 746 is not Nutech's only invalid log interpretation. **Similar log interpretation problems are apparent in the EMSU 658 and EMSU 660, which are the only other wells that have logs and tested the San Andres, confirming that Nutech's analysis is invalid and unreliable.**

153. The EMSU 658 was drilled to a depth of 4,375 feet in November of 2005 and was completed in February of 2006. The San Andres top in this well at 4,145 feet. The well first tested six sets of perforations from 3,995-4,186 feet. Two sets of perforations were in the San Andres at 4,144-4,153 feet and 4,174-4,186 feet. The well history from the OCD well file shows the swab tests from the interval between 3,995-4,186 feet that occurred from February 8, 2006, to February 11, 2006. A total of 117 swab runs were made over three days on these perforations and showed 100% water with no oil. The well was then completed in the main pay zone of the Grayburg.

154. **Goodnight Exhibit B-34** shows the Nutech interpreted log for the EMSU #658 along with the swab and pumping tests from the well file that were discussed above. The San Andres top is shown in red at 4,145 MD. Blue shaded intervals on the log are the perforated intervals that tested 100% water, green shaded intervals are perforated intervals that tested oil (all

in the Grayburg). Left of the log are the average of the Nutech calculated oil saturations (S_o 57-70%) from the water/oil saturation track annotated in the log header for each of the perforated intervals that were tested for hydrocarbons.

155. **The exhibit shows that the Nutech calculated oil saturations do not match the production tests. Nutech again calculates oil saturations that would have produced oil if it existed at the saturations Nutech claims.** The zones tested are calculated to have mobile oil and are very close to irreducible water saturation shown by the lack of light blue color fill that denotes free water in the water/oil saturation track on the log. If an interval is at irreducible water saturation, it should produce oil free of water. **These zones tested 100% water multiple times. This shows that Nutech's calculation of oil and water saturations are invalid and not reliable estimations of future economic value.**

156. The EMSU 660 was drilled in October 2005 to a depth of 4,448 feet MD and was completed in December 2005. *See* **Goodnight Exhibit B-35**. The top of the San Andres in this well at 4,121 feet. Six sets of perforations tested the upper San Andres from 4,126 to 4,239. These perforations were swabbed multiple times from December 10, 2005, to December 14, 2005, and tested 100% water. On December 28, 2005, a 24-hour pumping test was conducted on the well where the well produced 1,100 barrels of water and no oil. On December 31, 2005, another 24-hour pumping test was conducted where the well produced 4 barrels of oil and 1,200 barrels of water. A final 24-hour pump test was conducted on January 10-11, 2006, where the well produced 3 barrels of oil and 1,057 barrels of water. In total the well was tested over multiple days and produced 7 barrels of oil and 4,056 barrels of water. The operator then abandoned the San Andres interval and set a plug at 4,000 feet before perforating the main pay interval in the Grayburg.

157. This test does not show any ROZ viability within Goodnight's San Andres disposal zone. The electronic well files demonstrate that this zone is not in communication with Goodnight's San Andres disposal zone that is utilized by multiple operators within the EMSU. **Goodnight Exhibit B-35** shows that the shut-in tubing pressure for the tested interval discussed above was 300 PSI on December 13, 2005, and 250 PSI on December 14, 2005. If this zone were in pressure communication with the under-pressured disposal interval in the San Andres aquifer, the well would have shut-in on vacuum and not been able to hold a column of fluid.

158. **Goodnight Exhibit B-35** shows the Nutech interpreted log of the EMSU #660 along with the swab and pumping tests from the well file that were discussed above and reflected in Exhibit B-35. The San Andres top is shown in red at 4,126 MD. Blue shaded intervals on the log are the perforated intervals that tested 99% water, green shaded intervals are perforated intervals that tested oil (all in the Grayburg). Left of the log are the average of the Nutech calculated oil saturations (So 64-73%), from the water/oil saturation track annotated in the log header, for each of the perforated intervals that were tested for hydrocarbons.

159. **This exhibit shows that the Nutech calculated oil saturations do not match the production tests. As with the previous interpreted logs, Nutech again calculates oil saturations here that would produce oil.** The zones that were tested are calculated to have mobile oil and are very close to irreducible water saturation shown by the lack of light blue color fill that denotes free water in the water/oil saturation track on the log. If an interval is at irreducible water saturation, it should produce oil free of water. **These zones tested 100% water multiple times. This shows that Nutech's calculation of oil and water saturations are invalid and not a reliable indicator of future economic value.**

160. Nutech's oil saturation calculations are concerning because they show oil saturations in the San Andres so high that they would be defined as conventional oil zones, not ROZ. **Nutech calculates hundreds of feet in the San Andres with oil saturations above 60%. If this were true, the San Andres would have produced some oil from among the approximately 350 million barrels of water produced from the EMSU water supply wells and it would have been developed as a conventional oil field long ago.** How can Empire see these calculations and not be concerned with the validity of the analysis? Empire claims ROZ and not conventional oil zones. Empire put forth these petrophysical analyses as proof of a ROZ when instead they should be skeptical of them as they do not match their own claims, nor do they even approximate the history of the wells analyzed.

Goodnight's Injection is Well Below the Potential ROZ Interval

161. **Goodnight's San Andres disposal zone is below any prospective ROZ interval in the EMSU.** **Goodnight Exhibit B-36** is a cross-section that shows all SWDs in the EMSU and one that is 176 feet from the EMSU boundary (Rice EME #33) with the date of first injection and cumulative disposal volumes for each well. The location of the wells and the line of the cross-section is shown by the inset map.

162. The cross-section shows the correlated formations tops for the Queen, Penrose, Grayburg, San Andres, and Glorieta by the black lines that go from well to well. The EMSU gas/oil contact is shown by the red/green dashed line at -100 feet subsea, and the EMSU oil/water contact is shown by the green/blue dashed line at -325 feet subsea. The orange dashed line shows the base of a potential ROZ interval at -652 feet based on the core data from the EMSU 679 shown in **Goodnight Exhibit B-32** and discussed above. The brown dashed line is the deepest indication of sparce residual oil saturations that exist anywhere in the EMSU, based on calculated data from a

single well log which XTO cites to in their sales brochure discussing the upside potential. Light blue intervals shown on the logs are the perforated intervals that are being utilized for disposal. The injection intervals for the Rice EME #21 and EME #33 are open-hole intervals. The Rice N11 does not have the perforated intervals in the OCD well file so the dark blue interval shows the permitted disposal interval. **The intervals that Goodnight uses for disposal operations are all below the base of the deepest potential ROZ interval that is supported by data.** None of the Goodnight perforations are above the orange dashed line at -652 feet subsea or the brown dashed line at -700 feet.

163. **The only interval that meets the definition of a potential ROZ, as defined by Mr. Melzer and Dr. Trentham with an oil saturation greater than 20%, is limited to the Grayburg. The San Andres aquifer in this area was never saturated with conventional oil saturations and was only a migratory pathway due to the lack of a trapping mechanism.** Therefore, it does not fit the ROZ model that conventional oil saturations were swept to ROZ saturations. This model is limited to the Grayburg. Goodnight's operations will have no impact on that interval because there is a competent confining layer that separates the San Andres water management zone from the Grayburg oil producing zone, as confirmed above. It should also be noted that the Empire saltwater disposal well (EMSU #1), which is shown on the cross-section, utilizes the same disposal intervals in the San Andres and Empire continues to operate this well.

164. There has been a long history of disposal operations in the San Andres within the EMSU. Goodnight's disposal operations had been ongoing in the EMSU years before Empire acquired the field. Empire was aware, or should have been aware, of the water management aspects of the San Andres when they acquired the EMSU.

165. The San Andres aquifer is not a ROZ target in the EMSU. Core data from the San Andres aquifer confirm that the San Andres does not contain oil saturations that meet the definition of a ROZ as they are significantly below the 20% cutoff. The San Andres has been tested for oil production in multiple wells over many decades. Six wells pulled more than 350 million barrels of water from the San Andres over 30 years and never recovered a barrel of oil. The Nutech petrophysical models for oil and water saturation are confirmed to be unreliable and invalid based on production tests on the wells that were evaluated. Goodnight's petrophysics and geology experts identify additional disqualifying problems with Nutech's assumptions, analysis, and conclusions. All zones in the San Andres were calculated by Nutech to have significant saturations of mobile oil, yet all of them tested at more than 99% water.

166. Goodnight is disposing into intervals significantly below the base of the of any potential ROZ within the EMSU that is supported by data or a reasonable petrophysical interpretation. The only viable ROZ interval that could be potentially developed is limited to the Grayburg. Disposal operations in the San Andres aquifer will have no effect on that development and have no impact on current or future Grayburg operations.

167. San Andres Reservoir Disposal Suitability

168. The San Andres aquifer, in and around the EMSU, is a world class disposal reservoir that needs to be used to the benefit of the State of New Mexico to support the oil and gas industry and mitigate water disposal challenges the state is facing.

169. **The San Andres has proven capable of accepting large volumes of water at high rates with only a small increase in reservoir pressure.** **Goodnight Exhibit B-37** is a table showing how San Andres aquifer pressure has increased over time from injection in the Goodnight SWDs. The data included in the table under the blue columns are empirical measurements. From

left to right, the table shows the well name, the date the fluid level was taken, the cumulative injected volume on that date, the shut-in time before the fluid level was taken, the shut-in tubing pressure (SITP), the fluid level feet from surface, top perforation depth (MD), the middle point of the perforated interval (MD), the base perforation depth (MD). The data shown in orange are calculations starting with the calculated bottom-hole pressure at the middle of the perforated interval, and the pressure gradient calculated at the middle of the perforated interval (PSI/ft).

170. **This data shows that, the San Andres aquifer pressure increases minimally for millions of barrels of water injected and that the San Andres aquifer is still significantly under pressured. This is an ideal situation for a disposal reservoir and shows that the San Andres can sustain high-volume injection for a long period of time before even reaching a normal reservoir pressure.** All other SWDs generally start their operational life at a normal reservoir pressure and increase from there. The Goodnight SWDs will be able to inject tens of millions of additional barrels before they even reach the starting reservoir pressure of a 0.465 gradient and start a normal SWD well life.

171. Additionally, this data shows an interesting fact. **The Piper 26 #2 SWD is the oldest of the Goodnight disposal wells in the area. This SWD was shut-in for two months at a time when injection volumes on Goodnight's Llano System were low due to high volumes of water re-use in the field. The fluid level in the Piper SWD dropped 362 feet during that time, indicating the reservoir pressure at that well has dropped 165 PSI even with a cumulative disposal volume of more than 26MM BW. This is an indication that the San Andres can distribute pressure over a large area in a short amount of time.**

172. All this data, the aquifer pressure minimally changing after millions of barrels have been injected, as well as the drop in reservoir pressure seen at the Piper SWD, is a strong indication

that the San Andres reservoir is very large and has exceptional storage capacity. In total, about 313MM BW have been injected in and around the EMSU since 1960. Empire estimates that 576MM BW have been injected in the grater Eunice area spanning from the North Monument Unit down to the Arrowhead Grayburg Unit just from Rice/Permian Line and Goodnight SWDs. There are other operators that Empire has not accounted for in this area, so Empire's injection estimate is conservative. Even with this large volume of water injected in the San Andres the reservoir is still well below a normal pressure gradient and still consistently returns to vacuum on shut-in. **This is a world class disposal reservoir that New Mexico should be glad to have in its state to support the water disposal needs of the oil and gas industry.**

CONCLUSION

173. In conclusion, Goodnight Midstream Permian LLC has demonstrated a robust and sustainable approach to managing produced water through its comprehensive Llano System pipeline and SWD infrastructure. By effectively transporting and disposing large volumes of produced water, the company mitigates environmental risks while supporting substantial oil and gas production in the state. Strategically targeting the under-pressured San Andres formation for disposal highlights Goodnight Midstream's commitment to sustainable and long-term solutions. Goodnight's operations not only support the industry's water management needs but also contribute significant revenue to the state of New Mexico and its stakeholders.

174. The geological review of the current injection wells and proposed injection reveals a meticulous approach to ensuring safe and effective disposal. The detailed analysis of the geological formations penetrated by Goodnight SWDs underscores the suitability of the San Andres aquifer as a disposal zone. The selected injection zone within the San Andres aquifer is characterized by its ability to sustainably accept large volumes of produced water at very low

operating pressures. The presence of impermeable layers above and below the injection interval effectively contains injected fluids, thereby preventing upward or downward migration. This geological integrity, combined with Goodnight Midstream's operational expertise, ensures that disposal operations do not compromise overlying production from the Grayburg at the EMSU or freshwater sources.

175. The extensive data on pressure differentials between the Grayburg and San Andres aquifer confirm the presence of an effective geologic barrier between the two formations. This data provides conclusive evidence that disposal operations in the San Andres will not interfere with current or future EMSU operations in the Grayburg main pay zone or any potential ROZ interval. It also establishes that the Grayburg reservoir and San Andres aquifer are distinct geologic zones that are functionally severed and do not act as a single reservoir.

176. The analysis of core data and historical production tests confirms that the San Andres does not meet the criteria for a ROZ. San Andres oil saturations are well below the defined 20% cutoff as defined by Empire's own ROZ experts. Goodnight Midstream's disposal operations are confined to intervals below the prospective ROZ, ensuring that its activities do not interfere with potential hydrocarbon production in the Grayburg formation anywhere within the EMSU.

177. For these reasons, Empire's motions to revoke Goodnight's injection authority should be denied and Goodnight's permit applications for new disposal wells, as well as its request to increase the authorized injection rate for its Andre Dawson SWD, should be granted.

178. I affirm under penalty of perjury under the laws of the State of New Mexico that the foregoing statements are true and correct. I understand that this self-affirmed statement will be used as written testimony in this case. This statement is made on the date next to my signature below.

Preston McGuire | 8-20-24
Date

Preston McGuire

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Fort Worth, TX 76114
Pmcg1992@yahoo.com / (575) 937-5351
linkedin.com/in/preston-mcguire-382771129/

Summary of Skills:

As a geologist currently specializing in saltwater disposal wells and underground storage reservoirs. I have a proven track record of using my skills in geology, reservoir engineering, and operational management to contribute to the successful development of permanent, large-volume disposal reservoirs. These skills are also applicable to CO2 sequestration and gas storage. My work involves analyzing geological data to identify and evaluate suitable reservoirs for disposal and managing the drilling and completion of disposal wells. I am skilled in monitoring and managing reservoir performance, including pressure and flow rate, and using this information to optimize disposal operations (i.e. pipeline balancing/optimization). In addition, I have experience developing plans for induced seismicity mitigation to ensure safe disposal operations.

Work Experience:

Goodnight Midstream, Geology and Reservoir Engineering Manager, September 2023-Present
Responsible for various aspects of the company's operations, involving the evaluation and troubleshooting of existing produced water injection wells and the selection of new disposal sites/zones to meet specific reservoir capacity and economic development criteria. Worked in close collaboration with the Business Development/Finance, Land, Regulatory, and Engineering groups to achieve common business goals. Served as regulatory lead in New Mexico, Texas, and North Dakota for all SWD regulatory filings.
Duties: Managed the Geology and Reservoir Engineering personnel. Provide geologic and reservoir analysis to support project decision making. Analyze SWD performance metrics, including flow rate vs. pressure, Fall-off tests, and step-rate tests to assess reservoir performance and well life. Perform analysis to understand and mitigate induced seismicity risk for injection wells. Provide mechanical and operation enhancement recommendations for existing assets. Serve as technical representative for company in meetings and conferences.

-Senior Geologist, May 2021-September 2023
Worked as a subsurface team lead for Texas assets with a team of geologists and engineers conducting geological assessments for saltwater disposal sites, resulting in optimized injection well placements and increased disposal capacity. Assisted finance team in evaluating oil & gas production of current and potential clients to underwrite gathering contracts.
Duties: Prepare comprehensive technical reports and presentations summarizing geological findings, reservoir analyses, and disposal system performance for management and stakeholders. Identify and address operational challenges, proposing and implementing innovative solutions to enhance injection efficiency and reduce costs. Monitored injection data to analyze well health and current injection capacity and optimize pipeline balancing. Performed oil and gas production analysis of potential customer leaseholds to forecast and underwrite cashflows. Served as company representative on multiple industry groups that advises regulators in developing regulations that are needed and operationally feasible.

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-1
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775,
24018 – 24020, 24025, 24123

-Geologist, May 2017- May 2021
Worked as a geologist on a multidisciplinary team to locate, drill, complete, and monitor saltwater disposal wells in Texas, New Mexico, and North Dakota.
Duties: Perform detailed geological mapping and interpretation using industry-standard software to identify optimal locations for saltwater disposal wells (structure contour, isopachs, net pay, pore volume). Analyze well logs and interpret subsurface data to evaluate reservoir characteristics and optimize reservoir utilization. Developed structural analyses and stratigraphic framework of multiple geologic horizons and conducted petrophysical analyses to identify reservoirs with suitable characteristics to support SWD viability and longevity. Involved in SWD permitting process in New Mexico and Texas working with regulators to achieve approved injection permits.

Antero Resources, Geologic Intern summers of 2015 & 2016
Skills learned: Working within a multidisciplinary team for an E&P company to achieve a common goal and becoming familiar with the E&P process from prospect to market.
Duties: Mapping project of Upper Devonian shales in eastern Kentucky and western West Virginia. Project included structure contour maps and pay zone isopach maps produced in Petra.

Paragon Geophysical Services, Geotechnical Intern summer of 2014
Skills learned: Designing spreads of seismic shoots as well as working with the seismic data files.
Duties: Assisted in designing the spread and layout of extensive seismic surveys in the U.S. and Canada using Mesa and DeLorme XMap 8. Gathered and uploaded raw seismic data from crews for the client's geoscientist.

Western State Colorado University, Research Assistant to Dr. Allen Stork, 2013-2015
Skills learned: GIS experience and lab techniques.
Duties: Digitized geologic quadrangles for use in GIS and completed general petrographic work.

Education:

Texas Christian University
M.S. in Geology
Thesis: U-Pb detrital zircon signature of the Ouachita Orogenic Belt, Advisor: Xangyang Xie
May 2017. GPA: 3.8/4.0

Western State Colorado University
B.S. in Geology with an emphasis in Petroleum Geology, minors in Mathematics and Psychology
December 2014. GPA: 3.3/4.0; Geology 3.6/4.0

Accomplishments & Memberships:

NMOGA Company Representative 2019-Present
- Served on NMOGA Delaware Mountain Group Capacity Technical Team
- Served on NMOGA Deep Disposal & Seismicity Technical Team

TXRRC SRA Company Representative
TXOGA Company Representative 2019-Present
Imperial Barrel Award team member, TCU 2016
Fort Worth Geological Scholarship, Fort Worth Geological Society 2016-2017
Petroleum Geology Award/Scholarship, Roswell Geologic Society, 2011-2017
AAPG Student Chapter Member 2012-2017, Treasurer 2013-2014
Mountaineer Award/Scholarship, Western State Colorado University, 2010-2014

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-2
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775, 24018-24020, 24025, 24123


Goodnight Midstream
Active SWD
Approved Permit
Proposed SWD
Receipt Points
Active Pipelines
Seismic Activity
2.5 - 3.0 mag
3.1 - 3.5 mag
3.6 - 4.0 mag
SRA
3 miles
6 miles
10 miles
Unit Outline
EMSU
GOODNIGHT MIDSTREAM
Hodges
Doc
Gooden
VERLANDER SWD 1
ERNIE BANKS
Piazza
Seaver
Hernandez
NOLAN RYAN SWD 1
ANDRE DAWSON
SOSA SA 17-2
RYNO 17-1 SWD
PIPER #1 SWD
ROCKET SWD
YAZ SWD 1
TED 28 SWD 1
PEDRO SWD
SCULLY SWD
ROBINSON SWD
Dagger State
Blueberry RP
Cheddar RP
COP Yeah Yeah
3Bear RP
Ojo Chiso
Jalapeno RP
Squints
Northridge
South Ridge
Tanks RP
Avogato
Florence CTB
Red Bull 30
Serrano RP
Red Bull
Irvin Wall
Stateline Delivery Point
New Mexico
Texas
Andrews
Eddy
Lea
Winkler
20S 32E
20S 33E
20S 34E
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Idaho
Montana
Wyoming
South Dakota
Nebraska
Iowa
Nevada
Utah
Colorado
Kansas
Arizona
New Mexico
Oklahoma
Texas
0 2.75 5.5 11
Miles
N
BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-3
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775, 24018 – 24020, 24025, 24123
Document Name: Llano Updates 2024_0717 PT
Printed Date: August 6, 2024

A Yes.

Q Okay. Now, Mr. Goetze points out that to his knowledge -- and I haven't gone through the entire well file -- there's no documentation to confirm whether this work was ever done and I was asking you if we ask -- make a request for a production of documents that Empire has in its records for this well that -- assuming your counselor agrees, that we would be able to get a copy of whatever you have in your possession relating to this well.

A Yes.

Q Okay. Now, I want to talk more specifically now about the 200H well, the well that you've identified in your testimony as a high priority well; okay? You told us in your testimony that the well provides valuable information regarding the exploitation of the San Andres; agree?

A That's right.

Q Okay. Now, the only information we got from you when we asked for it -- okay? In the subpoena was the Enverus -- let me find it -- an Enverus document; okay? This is the only information that has any well file information or production data or anything that you've given us; okay? And you agree with me that this well was producing and testing, according to this

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-4
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775, 24018 – 24020, 24025, 24123

document, from the Grayburg?
A That's right.
Q Do you have any additional information regarding the ability of this well to produce from the San Andres?
A So again, this -- this well is -- provides valuable information regarding the exploitation of the San Andres. There's a lot of reasons why it does that, partly because it was a re-entry for a horizontal well in the field and the production history that it had associated with that. And as we appraise our options going forward, that's certainly one of the ones -- one of -- one of the exploitation plans that we would consider.
I don't -- you know, as far as the information that we want to -- that -- that is available to share with you, there's -- you know, if I have a correspondence internally with some of our subsurface people on what we're seeing or what we -- what we like or don't like about the production from that well, I'm not sure that I would even want to share that and I -- that I would have to. That's not part of the public record and I could value -- I could view a lot of that as trade secret or proprietary. So I'm not really sure what -- what you're asking me to

deliver to you.

Q Well, I guess, Mr. Sweeney, we asked for all information that is in your possession; okay? Including confidential proprietary information that would reflect the ability of Empire to produce --

A So I have to -- I'd -- I'd have to talk to my counsel about whether or not I have to provide proprietary or confidential information to Goodnight because Goodnight is proposing that they want to inject 25 to 40,000 barrels a day into the middle of our unitized formation. Does that -- does that mean I have to go and provide everything that I have on -- you know, regarding this -- you know, our production capability?

Q Mr. Sweeney --

A I -- I didn't have that full conversation with him, but I -- I don't -- I don't think I'd agree with that.

Q Mr. Sweeney, are you alleging that the San Andres is productive?

A I am.

Q Okay. And you're telling me --

A I -- I am alleging that -- I am alleging that the -- the Grayburg San Andres interval in our formation, the formation that we bought last year, is -- has hydrocarbon potential across the whole formation that we -- that we are in the middle of appraising and we're going to move to a select and define once we make our appraisal on it and I am fully confident that it's going to be productive across the whole formation.

Q All right. I'm not -- I don't want to get into an argument with you here, but I understand that you're alleging that the San Andres is productive, and I want you to understand --

A I'm -- I'm alleging that the -- that the San Andres has -- had production and is -- and -- and has hydrocarbon production potential.

Q So if that's the case, Mr. Sweeney --

A So that's it. And I -- and we -- and we -- and -- and my company has invested millions of dollars to that effect, too. So yes, that's what I'm -- that's what I'm -- that's my answer to that question.

Q Okay. Well, I think it's important, Mr. Sweeney, that we understand and that the Division understand the potential for the San Andres to be productive. We have asked you to produce us documents -- let me finish --

A Well, we -- we made a multi-million dollar bet that the San Andres is productive.

Q Okay. Well, I guess, Mr. Sweeney, if I can't get my question out, then I may just have to take it up separately with your counsel.

But I want to make clear that we have asked for the documents that reflect your position that the San Andres is productive and you're telling me that you may have it, it may be confidential or proprietary and you're not willing to give it to me; okay? Because for various reasons. Now, I just want to make clear on the record that you are refusing to provide these documents because, in your view, they're proprietary and confidential; is that the case?

A That -- that is not the case. I did not say that.

Q Okay --

A I said -- I said that if I have a conversation with my subsurface team and we're reviewing production or -- or information that's coming from that, we have -- that we -- we do not have to document it and send it to you.

Q All right. I'm asking about existing data, existing files, records, studies, analyses, reports that you have in process, underway. And I understand you're in the appraisal stage right now and so I'm asking for documents that relate to that, communications, emails with your subsurface team that would reflect the ability of the San Andres to produce hydrocarbons.

And now, I'm just saying that if you believe and you're confident in the ability of the San Andres to produce, and I'm talking about the interval that we are injecting into here -- proposing to inject into here, I'm asking you to please let us know if you've got documents.

And if you don't, that's fine, but if you're withholding any documents based on a confidentiality, proprietary, I would like to know that as well; okay? Because we -- there's no basis, as I understand, for that to be withheld from a subpoena request. So with that, I'll move on from that line of questioning.

A Understood. Understood. Thank you.

Q Okay. Now, I want to just query you a little further about what work Empire is doing; okay? So I understand. I understand from your testimony -- okay? That you are in the appraisal stage of your operations of the unit; correct?

A That's -- that's correct.

Q Has Empire prepared a written plan or some sort of a go-forward analysis that outlines the company's analytical plan for tracking the performance of its wells and capability of producing in the San Andres?

A That's -- so our plan as far as going forward, we're -- we're in the appraise stage. Again, we're in the appraise phase of what we -- what -- what our possibilities are and our options are for producing the hydrocarbons which we are confident are present across the interval and we have not moved to a select -- what you're talking about, it sounds to me like you're looking for more like you would like our selections and -- and albeit confidential selection documents and -- and selection phase that we're in -- that we're into and -- and we are not in that stage yet.

Q Okay. I guess what I'm trying to find out is do you have a written -- any written plan or document that outlines what your proposal is going forward? How are you going to actually do this appraisal?

A How we are going to do the appraising? We -- we are appraising the -- we are appraising the project. We're in the appraise phase of the project, sir. Mr. Rankin, that's all I can tell you.

Q Okay.

A Do -- do -- if -- if you want -- you know, what -- what -- again, what it seems like you're asking for is -- is what -- what are we selecting to do on -- on it and we're not there yet. And I -- I wish I could move at a different pace that was more comfortable with Goodnight, but we're -- but we're not and we've already made -- we're -- we are -- we are proceeding with it and we've made a multi-million dollar bet on this deal. So you better be sure that we're going to -- we're going to be systematic and in control the way we exploit this -- you know, our field.

Q Mr. Sweeney, I'm asking you because you're going to be systematic and in control, do you have a written plan about how you're going to evaluate this field, including the San Andres?

A Yes.

Q Okay. Mr. Sweeney, I'm asking you to produce that plan because it's responsive to our requests for documents; okay? That's what I just want to make clear. And any emails or correspondence relating to that plan should be reproduced.

A Well --

Q That's -- that's what I'm trying to get across. All right. Now, are you also tracking --

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-4
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775, 24018 – 24020, 24025, 24123

Utilization of Geological Mapping Techniques to Track Scaling Tendencies in the Eunice Monument South Unit Waterflood, Lea County, New Mexico

Conference Paper · March 1996

3 authors, including:

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BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-5
Submitted by: Goodnight Midstream Permian, LLC
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UTILIZATION OF GEOLOGICAL MAPPING TECHNIQUES TO TRACK SCALING TENDENCIES IN THE EUNICE MONUMENT SOUTH UNIT WATERFLOOD, LEA COUNTY, NEW MEXICO

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ABSTRACT

The Eunice Monument South Unit (EMSU) has historically experienced barium sulfate scale deposits in many producing oil wells prior to field unitization and initiation of the present waterflood. This problem was exacerbated with the waterflood due to incompatibility of the supply water and the water in the reservoir. Scale inhibitor treatments are used to control the barium sulfate scale deposition where water analyses indicate treatments are needed. Geological mapping techniques are used to show the wells with barium sulfate scaling tendencies. Maps are updated on an annual basis using current water analysis data from each well in the waterflood unit.

KEYWORDS: scale, barite, scale inhibitor, geological mapping, waterflood, incompatibility, scale prediction index, barium sulfate, scale squeeze treating, San Andres, Permian Basin, Penrose, and Grayburg

INTRODUCTION

The Eunice Monument South Unit (EMSU) is located in Lea County in southeastern New Mexico as shown in **Figure 1**. Waterflood operations began after the properties were unitized in 1985 covering approximately 25 percent of the Eunice Monument field, a total of 14,300 acres (37.23 km^2). The remainder of the wells in the field are in the two other waterflood units (Arrowhead Grayburg and Eunice Monument-B).

The first producing oil wells were drilled in the 1930's. Many of the wells were completed as openhole completions using nitroglycerin as a means of perforating the productive intervals. Wells drilled more recently are completed as cased hole completion using conventional perforation techniques. There are currently 156 active producing wells of the 210 total producing wells in the EMSU. A map of the EMSU is shown in **Figure 2**. The water injection wells total 138. Production was 2,620 barrels per day (416 m^3/d) ; 50,500 barrels of water per day (8,029 m^3/d), and 2.0 million cubic feet of gas per day (56,637 m^3/d). Water injection is approximately 100,000 - 110,000 barrels per day (15,898 - 17,488 m^3/d) of which approximately 60,000 barrels per day (9,539 m^3/d) is supply water and 50,500 barrels per day (8,029 m^3/d) is produced water. The CO_2 content of the gas is 0.56 mole percent. Bottomhole temperature is less than 100^0 F (38^0 C) and the flowing tubing pressure at the surface is less than 100 psi (686 kPa).

Geology of EMSU is complex and not homogeneous. The chemistry of the produced waters vary widely across the field from northeast to southwest. The northern part of the field total dissolved solids (TDS) is about 90,000 mg/L Cl^- while the southern part is approximately 5,000 mg/L Cl^-. Production is from the Penrose and five Grayburg formations. There are five sands in the Grayburg formations which are productive. Supply water is from the San Andres formation which is the next zone below the Grayburg. A geological sketch of the producing zones is shown in **Figure 3**. There are six supply wells in the San Andres formation. The San Andres is below the Grayburg producing intervals. A high permeability area exists in the center of the field in a northwest to southeast orientation. Permeability declines significantly in each direction from the center of the field.

Water from the production wells contain barium ions ranging from less than one mg/L to 118 mg/L. The supply water from the San Andres formation is relatively consistent in chemistry. Sulfate ion concentration is approximately 2,800 mg/L. A typical barium, sulfate, and chloride ion concentrantion in the produced waters can be seen in **Table 1** in addition to the barium sulfate saturation indices. **Table 2** shows typical water chemistry across the waterflood unit. If these waters are mixed one would expect to precipitate barium sulfate scale. The San Andres formation provides the only source of water formation in the geographic area with a sufficient volume of water for the waterflood and unfortunately, had to be used as the supply source, knowing that the San Andres water was not compatible with the Penrose and Grayburg formation waters.

During the time of primary production prior to unitization and initiating the waterflood in the Eunice Monument field, barium sulfate scale deposition was experienced in a number of producing wells. Although the drilling was confined to the Penrose and Grayburg formations, apparently some San Andres water was finding its way into the wellbore of these wells and resulted in a barium sulfate scale,barite, deposition problem. A possible explanation is shown in the sketch in **Figure 4**. Production experience strongly suggests that mixing of the water occurs in the producing wellbores rather than in the formation. This problem was and continues to manifest itself in downhole pump problems. Inflow of fluids into the wells is not affected, thus leading to the conclusion that sulfate rich water found its way into some producing wells before the waterflood was initiated.

Barium sulfate scale has also been detected in the surface vessels that are used to process the produced fluids.

SCALE INHIBITION

Producing wells are treated with commercially available scale inhibitors to prevent the formation of barium sulfate scale that either resulted in the inlet of the downhole pump being blinded with scale or in the formation of sand like barium sulfate crystals which caused the pump barrel to become scored. The typical scale treatment consists of a formation squeeze treatment consisting of 110 - 440 gallons of scale inhibitor (416 -1,665 L) per treatment. The actual volume of inhibitor and total volume of overflush varied, based on the total production volume of the well. Success of the squeeze treatments has been very erratic and unpredictable due to a combination of open hole completions and the resulting inability to prevent the inhibitor squeeze volume from going into the high permeability zones. Consequently, squeeze treatments do not usually flow back slowly nor uniformly over the desired 12 - 18 months long period after a treatment. The inhibitor frequently returns from the high permeability zone muce to quickly to be effective in the long term in most wells. Wells with severe barium sulfate scale problems are continuously treated with scale inhibitor with a continuous overflush down the casing-tubing annulus when squeeze treatments were not effective and production is sufficient to do so. A major problem in trying to use continuous inject is that many wells do not poduce sufficien volume to allow for a continuous treatment in addition to the difficulties generated in trying maintaim the large number of chemical injection pumps required to continuously inject scale inhibitor. However, the advantage to the continuous treatment where aplicable is that the chemical treatment can be tailored to the specific inhibitor requirement of that well. Failure to inhibit the barium sulfate scale results in lost production, associated cost to repair the well and replacement of the equipment affected by the scale.

A number of methods are utilized to monitor the scale inhibition programs. The produced water is analyzed for the amount of residual scale inhibitor present. Pump failures are analyzed to determine whether scale played a part in the failure. Solids taken from the pump are examined by x-ray diffraction for identification of the crystal structure of the deposit. Downhole equipment is inspected each time it is pulled out of the well for evidence of scale deposition.

Water samples are obtained and analyzed annually on each producing well in EMSU. Of particular interest is the barium, sulfate, and chloride ion concentrations. These data are used to estimate the amount of scale precipitation[1] for each water sample. The index is calculated by the following formula:

$$\text{Estimated Precipitation Index} = \frac{mgBa}{L} \times \frac{1.70\ mgBaSO_4}{mgBa}$$

The barium sulfate saturation index (SI) is calculated using the following formula:

$$SI = \log([Ba^{2+}][SO_4^{2-}] \div Ksp\ Ba\ SO_4)$$

These indices are plotted annually on a field map using geological mapping techniques to indicate the presence of barium sulfate scale in each well sampled.

RESULTS

These maps reveal where the waterflood front is in the reservoir using the predicted presence of barium sulfate scale from the water analyses as result of the incompatibility of the San Andres supply water and the connate water. Interestingly, the water analyses indicate that as the flood front passes the wellbore, the barium sulfate saturation index shows that barium sulfate scale is no longer a problem in most wells. This results from the removal or sweeping of barium ions from the reservoir around the wellbore, replacing it with sulfate ion rich water which by itself does not present a barium sulfate scale problem. Those wells experiencing barium sulfate problems prior to the waterflood continue to experience barium sulfate scale problems. Geological maps with this information plotted annually provide a visual image of the changing conditions in the reservoir and allows personnel to focus their efforts where barium sulfate remains a problem. **Table 1** shows the changes in the barium, sulfate, and chloride ion concentrations as the waterflood progressed from 1989-1993. **Figures 5-8** show plots of the scaling predictions in chronological order based on the water analyses performed annually.

CONCLUSIONS

The use of geological mapping is a valuable tool that allows the Corrosion Engineer or Geochemist to visualize where barium scale is being deposited in the reservoir due to water incompatibility. High permeability streaks in the reservoir can be readily identified based on the water chemistry. It also provides information to the Reservoir Engineer regarding the injection characteristics of the reservoir and assists in managing the waterflood to assure that the sweep efficiency is maximized. Mapping readily identifies areas of potential concern regarding barium sulfate scale deposits and the possible contamination of equipment. Scale inhibitor treatments can be terminate in wells by simply looking at the maps to see where scale deposition is no longer a problem or continued where the map indicates scale deposit continues to be a problem.

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REFERENCE

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TABLE 1
Analyses of Produced Waters for Barium, Sulfate, and Chloride Ions
From 1989 - 1992

Well	Date	Ba, mg/L	Cl,mg/L	SO4,mg/L	SI(BaSO4)
100	11/1/91	0.6	21977	2170	1.03
103	11/1/90	0.5	19900	2050	0.98
103	11/1/91	26.1	3710	83	2.10
104	11/1/90	0.5	19526	368	0.24
107	10/1/89	0.7	18238	1350	0.99
113	10/1/89	0.5	17300	1325	0.86
113	11/1/90	0.5	12271	1632	1.14
114	11/1/91	<0.1	18900	1413	-1.38
117	11/1/90	27.8	7790	1	-0.11
117	11/1/91	0.5	15878	1640	1.00
119	11/1/90	0.3	32300	1525	0.37
119	11/1/91	61.6	14600	1	-0.08
121	11/1/90	2	19866	103	0.28
125	11/1/90	11.6	10159	14	0.53
125	11/1/91	0.5	12202	867	0.87
127	10/1/91	0.8	27200	1100	0.74
129	10/1/89	1.7	16800	650	1.10
129	11/1/90	0.9	13937	1440	1.27
133	11/1/91	0.3	16943	1740	0.77
135	11/1/91	1.2	17100	1450	1.29
139	11/1/90	0.3	9273	370	0.41
139	10/1/91	0.4	8521	873	0.95
139	11/1/91	0.3	7100	305	0.45
141	10/1/91	0.2	6670	588	0.59
143	11/1/91	76.9	3990	1	0.62
145	11/1/90	0.3	10849	326	0.28
145	11/1/91	0	15117	966	neg
147	11/1/90	1.3	13900	875	1.22
147	11/1/91	0.4	3141	189	0.70
151	11/1/90	5.7	4553	64	1.24
155	10/1/89	0.5	6482	237	0.61
155	11/1/90	16.5	4880	185	2.14
159	10/1/89	1.5	17867	591	0.97
159	11/1/90	0.2	8097	1600	0.94
159	11/1/91	2.7	8890	1500	1.99
161	11/1/90	0.4	9313	1710	1.20
163	6/1/90	0.5	4094	198	0.72
163	11/1/90	0.6	3863	201	0.83
165	11/1/90	0.2	7285	538	0.51
165	11/1/91	0.9	7380	625	1.22
165	10/21/92	1	4870	11	-0.30
166	10/1/89	0.5	10467	827	0.92
166	11/1/90	0.8	9220	963	1.26
166	11/1/91	0.3	16588	746	0.42

Well	Date	Ba, mg/L	Cl,mg/L	SO4,mg/L	SI(BaSO4)
166	10/21/92	0.6	13722	879	0.89
167	11/1/90	0.6	11700	788	0.92
167	11/1/91	0.9	9513	399	0.91
167	10/21/92	0.2	8665	737	0.57
173	10/1/89	2.2	3730	139	1.24
173	11/1/90	0.3	19960	1359	0.58
177	11/1/91	0.2	11683	1060	0.58
179	11/1/91	0.2	13144	1060	0.52
179	10/22/92	0.6	7670	978	1.23
180	10/1/89	0.1	7985	1009	0.44
182	11/1/90	0.2	8378	1585	0.92
182	11/1/91	0.5	8910	1475	1.25
183	10/1/91	0.2	4578	270	0.41
184	11/1/90	0.6	7020	963	1.26
184	11/1/91	0.2	7332	1598	0.98
186	11/1/91	0.1	7962	1600	0.64
190	11/1/90	13.6	4109	39	1.45
190	11/1/91	15.8	3836	160	2.15
190	10/21/92	1.77	4324	441	1.59
191	11/1/90	16	3910	9	0.90
191	11/1/91	131	1996	0	neg
192	11/1/90	111.6	2038	0	neg
194	11/1/90	119	2126	53	2.74
194	11/1/91	122.56	2105	6	1.81
196	10/1/91	0.3	16960	693	0.37
198	11/1/90	0.3	12535	731	0.56
198	11/1/91	0.56	11341	595	0.79
202	10/1/89	0.6	8970	1350	1.29
208	11/1/90	0.8	9120	1100	1.32
208	11/1/91	0.5	4033	408	1.04
210	10/1/89	1.2	4422		
210	10/1/91	0.3	7929	501	0.62
212	11/1/90	0.6	12900	1275	1.08
212	10/1/91	7.1	6133	86	1.34
212	11/1/91	1.84	6522	5	-0.51
212	10/22/92	16.3	6020	1	-0.22
214	11/1/90	0.6	22836	459	0.33
214	11/1/91	0.2	6762	447	0.47
216	11/1/90	0.2	8173	1120	0.78
216	11/1/91	0.9	7620	1075	1.45
216	10/21/92	0.3	5681	513	0.78
218	11/1/91	21.3	4603	426	2.64
218	10/21/92	0.3	4010	590	0.98
219	10/1/89	0.5	4390	500	1.09
220	10/1/89	0.5	5194	778	1.22
222	11/1/90	0.8	4750	394	1.16
222	11/1/91	1.1	6780	450	1.21
224	11/1/91	3.8	2796	42	1.06

Well	Date	Ba, mg/L	Cl,mg/L	SO4,mg/L	SI(BaSO4)
226	10/1/91	2.8	3075	170	1.50
228	10/1/89	7.22	2972	45	1.35
228	11/1/90	2.3	3530	163	1.35
228	10/1/91	0.4	21522	550	0.27
230	10/1/89	0.4	20666	786	0.44
230	10/1/91	1.6	20800	538	0.88
232	11/1/91	1.6	32008	785	0.81
236	11/1/90	0.2	8834	780	0.58
238	11/1/90	0.2	5472	666	0.73
238	11/1/91	0.2	10173	767	0.51
240	11/1/90	<0.1	6480	763	-1.11
240	10/1/91	0.2	6082	1082	0.90
242	10/1/89	0.2	7076	1570	0.99
242	11/1/90	0.4	13266	312	0.28
242	10/1/91	0.4	8211	1105	1.07
242	11/1/91	0.2	8023	1490	0.91
244	11/1/90	0.2	8840	1450	0.85
246	11/1/90	5.4	4000	118	1.54
246	11/1/91	0.3	6903	444	0.63
246	10/21/92	5	5677	642	2.10
248	11/1/90	8.9	3483	230	2.09
248	11/1/91	1.1	3328	447	1.49
249	10/1/89	0.25	4256	421	0.73
249	11/1/91	0.5	8350	1413	1.27
249	10/21/92	1.2	8072	615	1.30
250	11/1/90	0.2	8383	1160	0.78
250	11/1/91	0.6	9770	1475	1.29
252	11/1/90	0.1	5578	618	0.39
252	11/1/91	0.2	5775	1160	0.95
254	11/1/90	0.12	6323	929	0.59
254	11/1/91	1.3	6500	963	1.63
254	10/21/92	25.5	4185	187	2.39
256	10/1/89	31.52	3789	30	1.73
256	10/1/91	4.4	55453	1260	1.23
258	10/1/91	53.3	2439	16	1.83
260	10/1/89	2.6	4478	116	1.17
260	11/1/90	0.4	5530	308	0.69
260	11/1/91	2.5	4430	163	1.30
267	11/1/91	14.3	5124	120	1.87
274	10/1/89	5.3	6790	450	1.89
274	11/1/90	0.2	9242	1930	0.95
276	11/1/90	2.2	2707	53	0.94
278	11/1/90	4.1	3666	204	1.69
278	11/1/91	1.1	3214	176	1.10
280	11/1/90	0.3	6023	994	1.04
280	11/1/91	0.2	8367	1860	0.99
282	11/1/91	1	7577	1500	1.64
284	10/1/89	0.7	7850	1412	1.44

Well	Date	Ba, mg/L	Cl,mg/L	SO4,mg/L	SI(BaSO4)
284	11/1/90	0.1	5646	479	0.27
284	10/1/91	0.1	9201	1090	0.41
286	11/1/91	0.2	6953	1390	0.95
289	11/1/91	0.1	7320	1300	0.59
290	10/1/89	7.3	2543	9	0.71
290	11/1/91	0.5	4932	797	1.25
292	11/1/90	0.7	3349	73	0.51
294	10/1/89	16.8	2867	35	1.62
294	11/1/90	0.5	3378	146	0.66
294	11/1/91	1.1	3810	257	1.20
294	10/21/92	1.3	6057	426	1.31
298	11/1/91	0.1	7440	763	0.35
300	11/1/91	0.1	7947	1196	0.52
302	11/1/90	0.2	8294	1410	0.87
302	11/1/91	0.24	8555	1476	0.95
304	11/1/90	0.3	8260	1225	0.99
306	6/1/90	0.6	5044	272	0.85
306	11/1/91	0.2	5621	1350	1.03
311	11/1/90	1	11196	272	0.71
315	11/1/90	1.5	10602	470	1.15
315	11/1/91	0.62	8579	441	0.84
317	11/1/91	5.4	8590	450	1.79
319	10/1/89	0.7	4183	209	0.88
321	11/1/90	0.4	4501	546	1.03
323	10/22/92	20	2881	45	1.80
325	11/1/90	0.7	3421	388	1.22
325	11/1/91	1.4	3700	228	1.26
325	10/21/92	0.1	8288	1616	0.63
327	11/1/91	9	8325	1750	2.62
329	11/1/91	0.11	8613	1473	0.61
329	10/21/92	<0.1	8360	1475	-0.94
333	10/1/89	0.3	8314	1540	1.08
333	11/1/91	0	8136	2000	neg
333	10/21/92	0.4	8700	1525	1.18
335	11/1/90	0.1	6098	1500	0.74
335	11/1/91	3.3	8170	1500	2.12
337	11/1/91	0.4	4629	852	1.21
341	11/1/91	0.2	5489	998	0.91
343	10/1/89	0.2	5838	1200	0.96
343	11/1/90	0.2	6110	1163	0.93
343	11/1/91	0.6	6040	813	1.25
345	11/1/90	5.1	4930	145	1.52
345	11/1/91	0.5	3566	855	1.41
347	11/1/90	0.5	3670	650	1.28
353	11/1/90	0.7	4696	658	1.33
355	11/1/90	0.4	5814	828	1.10
355	11/1/91	0.2	6640	1163	0.89
357	11/1/91	0.1	6876	1365	0.64

Well	Date	Ba, mg/L	Cl,mg/L	SO4,mg/L	SI(BaSO4)
359	11/1/90	0.2	4052	231	0.39
359	11/1/91	0.2	4150	545	0.76
363	11/1/90	0.9	4850	738	1.48
365	11/1/90	0.4	3698	110	0.40
365	11/1/91	1.2	2460	93	0.95
369	11/1/90	0.8	3290	284	1.16
369	11/1/91	0.1	5776	945	0.56
371	10/1/89	0.8	7040	1250	1.50
371	11/1/90	0.1	9050	1340	0.51
375	11/1/91	0.1	8698	1609	0.60
375	10/21/92	0.1	8944	1700	0.61
377	11/1/90	0.4	5965	332	0.69
377	11/1/91	1.8	5930	281	1.28
379	10/1/91	0.4	4035	341	0.86
383	11/1/90	1.3	4620	400	1.39
385	11/1/91	0.2	3518	220	0.42
389	10/1/89	0.2	4427	570	0.75
389	11/1/90	0.4	4780	625	1.06
389	11/1/91	0.1	7102	1525	0.68
391	11/1/91	0.2	8973	1510	0.86
395	11/1/90	0.1	8707	1510	0.58
397	10/1/91	0.2	8226	1540	0.91
397	11/1/91	0.17	8715	1875	0.90
399	11/1/90	0.1	8610	1500	0.58
403	11/1/91	0.8	6580	1163	1.50
405	11/1/90	0.3	4832	962	1.12
405	11/1/91	0.4	5430	1025	1.22
407	10/1/89	0.4	7684	1520	1.24
407	11/1/91	0.5	7890	1450	1.30
409	11/1/91	0.3	4536	739	1.03
409	10/21/92	0.2	5783	1280	0.99
413	11/1/90	0.1	6900	1388	0.65
416	11/1/91	0.1	4580	608	0.46
416	10/21/92	1.5	4830	788	1.73
417	11/1/90	2.4	4240	195	1.38
418	11/1/91	0.2	5111	802	0.84
419	11/1/90	0.3	5720	813	0.98
420	11/1/90	0.3	874	93	0.61
420	11/1/91	28.2	3549	10	1.23
421	11/1/91	6.1	3680	68	1.38
423	6/1/90	0.2	7840	1625	0.96
423	11/1/90	0.2	3609	216	0.41
425	10/1/89	0.1	5369	1280	0.72
425	11/1/91	0.6	6150	1250	1.43
427	11/1/90	0.1	5170	1130	0.68
429	11/1/91	0.7	6220	1275	1.50
435	11/1/91	71.6	2063	35	2.35
440	11/1/90	1.8	8000	2500	2.09

Well	Date	Ba, mg/L	Cl,mg/L	SO4,mg/L	SI(BaSO4)
440	11/1/91	0	5618	867	neg
441	10/1/91	0.9	6720	1300	1.59
441	11/1/91	0.11	6490	1503	0.75
443	11/1/91	0.6	7230	1300	1.38
447	10/1/89	0.3	6347	972	1.01
449	11/1/91	0.2	6691	1100	0.86
451	11/1/90	0.17	7937	1745	0.91
452	11/1/91	3.7	5146	134	1.33
453	11/1/90	0.1	4391	583	0.46
454	11/1/91	0.09	4616	688	0.47
455	11/1/91	8.5	6130	10	0.49
456	10/1/89	134	2029	6	1.86
456	11/1/91	104	2081	50	2.67
457	10/1/89	94.61	2000	5	1.64
457	10/1/89	0.3	5136	622	0.90
457	11/1/90	0.5	5701	903	1.24
457	11/1/91	0.5	6370	1100	1.28
457	10/22/92	0.4	8280	1140	1.08
458	11/1/90	0.1	5190	1090	0.67
458	10/1/91	0.5	3935	678	1.27
459	10/1/89	0	6494	1516	neg
459	11/1/90	0.3	6718	1770	1.24
459	10/22/92	0.1	7740	2000	0.75
460	11/1/90	0.2	7033	1842	1.06
460	10/1/91	118	7414	1990	3.84
460	11/1/91	0.1	7730	2050	0.77
460	10/22/92	12.1	3794	28	1.28
461	10/1/89	3.4	6720	1138	2.10
461	11/1/90	0.2	8614	1820	0.96
461	11/1/91	0.3	8290	1850	1.16
461	10/22/92	0.1	8451	2151	0.74
462	11/1/90	0.1	5670	1230	0.68
462	11/1/91	0.4	8390	1450	1.18
462	10/22/92	0.1	8479	1950	0.70
620	10/1/89	0.6	6400	1188	1.39
620	11/1/91	0.1	6339	1283	0.65
625	10/21/92	0.2	7026	1460	0.96
625	10/22/92	0.8	9650	1388	1.39
642	11/1/91	0.3	7350	1413	1.10
643	10/1/89	0.1	8093	1524	0.61
643	11/1/91	0.5	8093	1525	1.31
679	11/1/90	0.3	8377	1530	1.08
679	11/1/91	0.2	4298	261	0.42
679	10/21/92	0.2	4903	489	0.64
Clear Well	10/22/92	3.8	5300	563	1.95
Filter In	10/22/92	89	2472	149	3.02
Filter Out	10/22/92	0.1	4171	149	-0.11
ORCUT F-2	6/1/90	0.3	3224	279	0.73

Well	Date	Ba, mg/L	Cl,mg/L	SO4,mg/L	SI(BaSO4)
West Tank	10/22/92	0.29	2987	238	0.68
WHITE 1-B	6/1/90	0.8	3350	313	1.20
WHITE 3-B	6/1/90	0.5	7351	203	0.48

TABLE 2
Representative Analyses of EMSU Produced Water

Well #	357	325	151	117	449	165	220	416	333	461
Date	11/1/91	11/1/91	11/1/90	11/1/91	11/1/91	11/1/91	10/1/89	10/21/92	10/1/89	11/1/91
K	164	145	355	348	237	186	82	68	58	156
Na	4927	3890	10510	9442	3131	2278	1490	1571	1180	6040
Ca	909	750	1052	999	370	506	332	427	410	1216
Mg	293	304	1139	904	218	261	214	188	183	355
Sr	18.5	16.4	17.4	16.6	10.2	16.9	19	18.64	21.9	23.5
Ba	0.1	0.2	0.3	0.3	1.7	15.8	53	81	134	0.2
Alk	1331	1251	1234	999	2826	2278	1940	2019	2280	561
SO4	1950	1100	1359	1740	64	160	16	6	6	3140
Cl	8479	6691	19960	16943	4634	3836	2439	2635	2029	10148
Br	12.9	17.7	24.7	72.1	18.1	9.7	10.8	34.7	6.7	18
B	2.8	2.6		10.1	5.1	2.9	6.4	4.2	3.7	2.1
H2S	250	300	250	300	250	300	400	400	250	200
Li	1.3	1	2.5	2.3	1.7	1.2	0.1	0.5	0.1	0.4
P	0.6	0.5	1.4	1	0.4	0.7	0.7	2.1	0.4	0.7
pH			7.23					6.75		
TDS	17425	13545	35030	31014	10103	8407	5649	6060	5171	21385
Charge_Balance	-2.2	0.7	0.1	1.2	0.2	0.8	0.6	0.3	-2.2	-0.5
Density	1.011	1.012	1.028	1.025	1.007	1.006	1.004	1.011	1.005	1.018
Rw	0.504	0.452	0.191	0.206	0.634	0.723		1.546		0.311

181/13

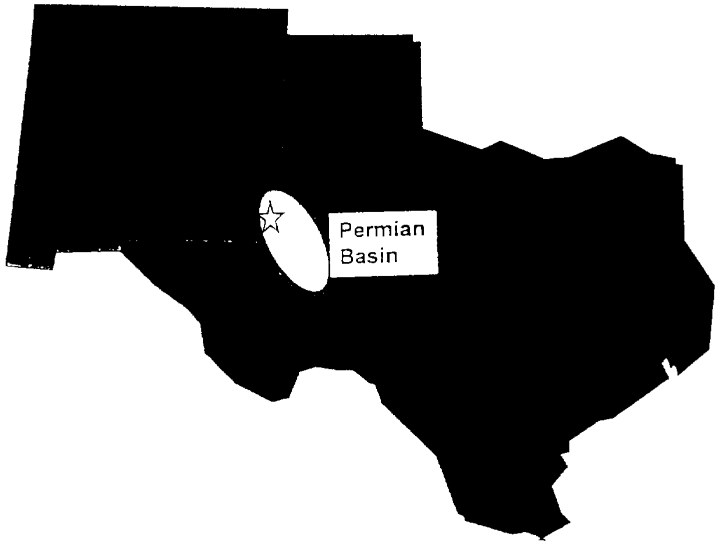


Figure 1 - Shows the general location of EMSU in the Permian Basin

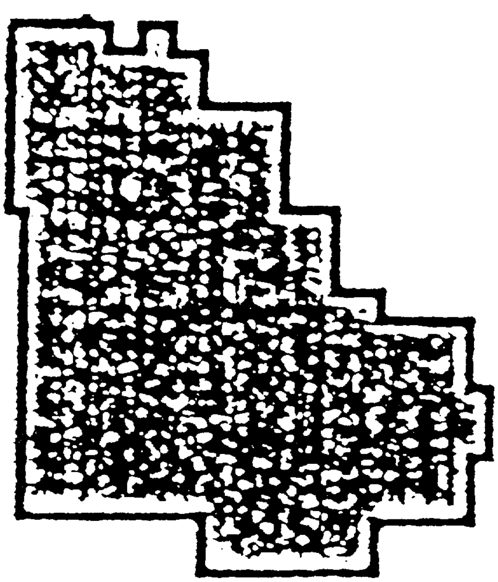


Figure 2 - Is a map of the EMSU waterflood

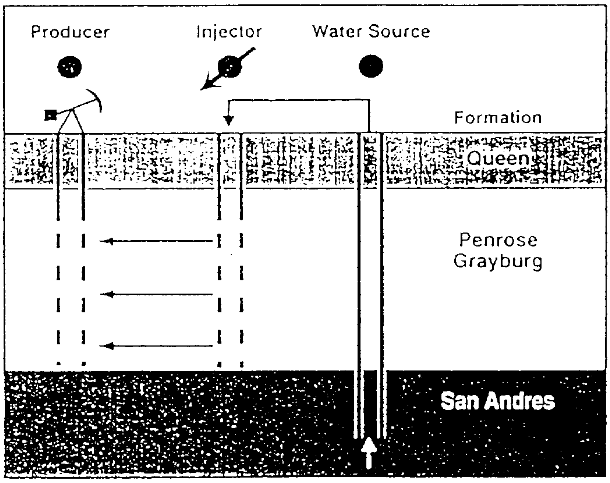


Figure 3 - shows the relative vertical location of the the hydrocarbon producing zones (Penrose and Grayburg) and supply water (San Andres)

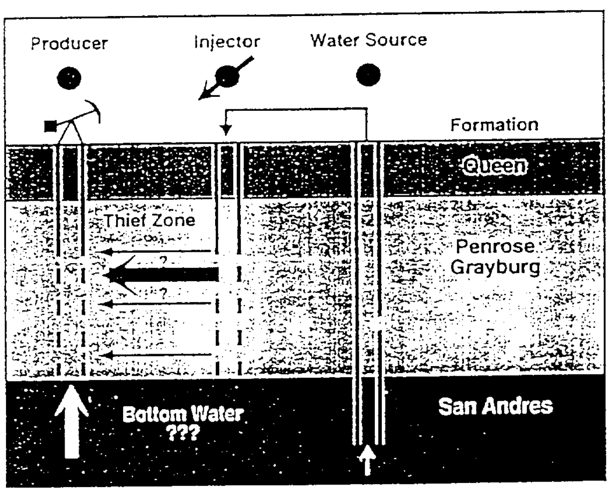


Figure 4 - Sketch of how San Andres water resulted in the formation of barium sulfate scale before the waterflood was initiated.

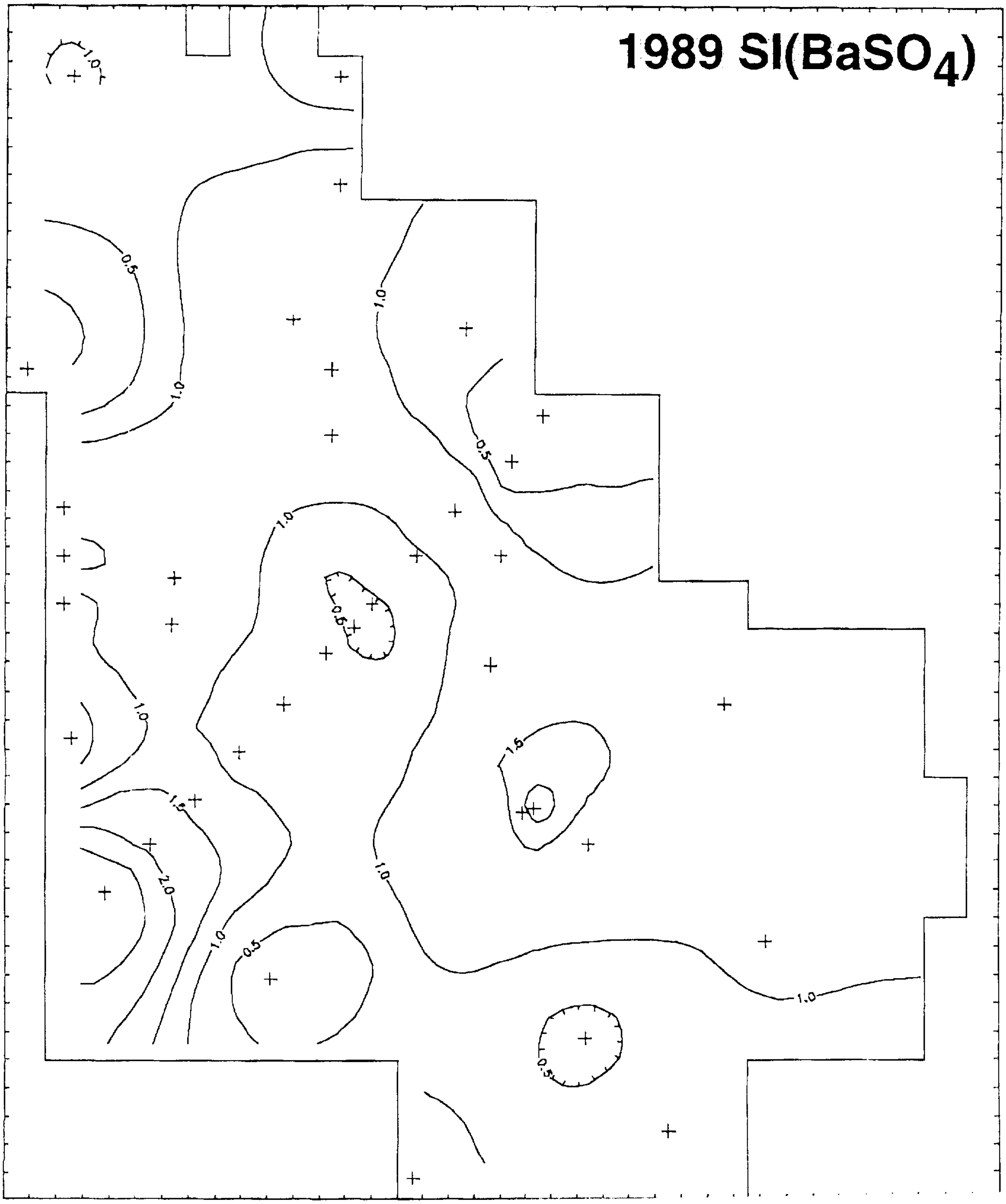


Figure 5 - Barium sulfate precipitation index for each producing well in EMSU in 1989

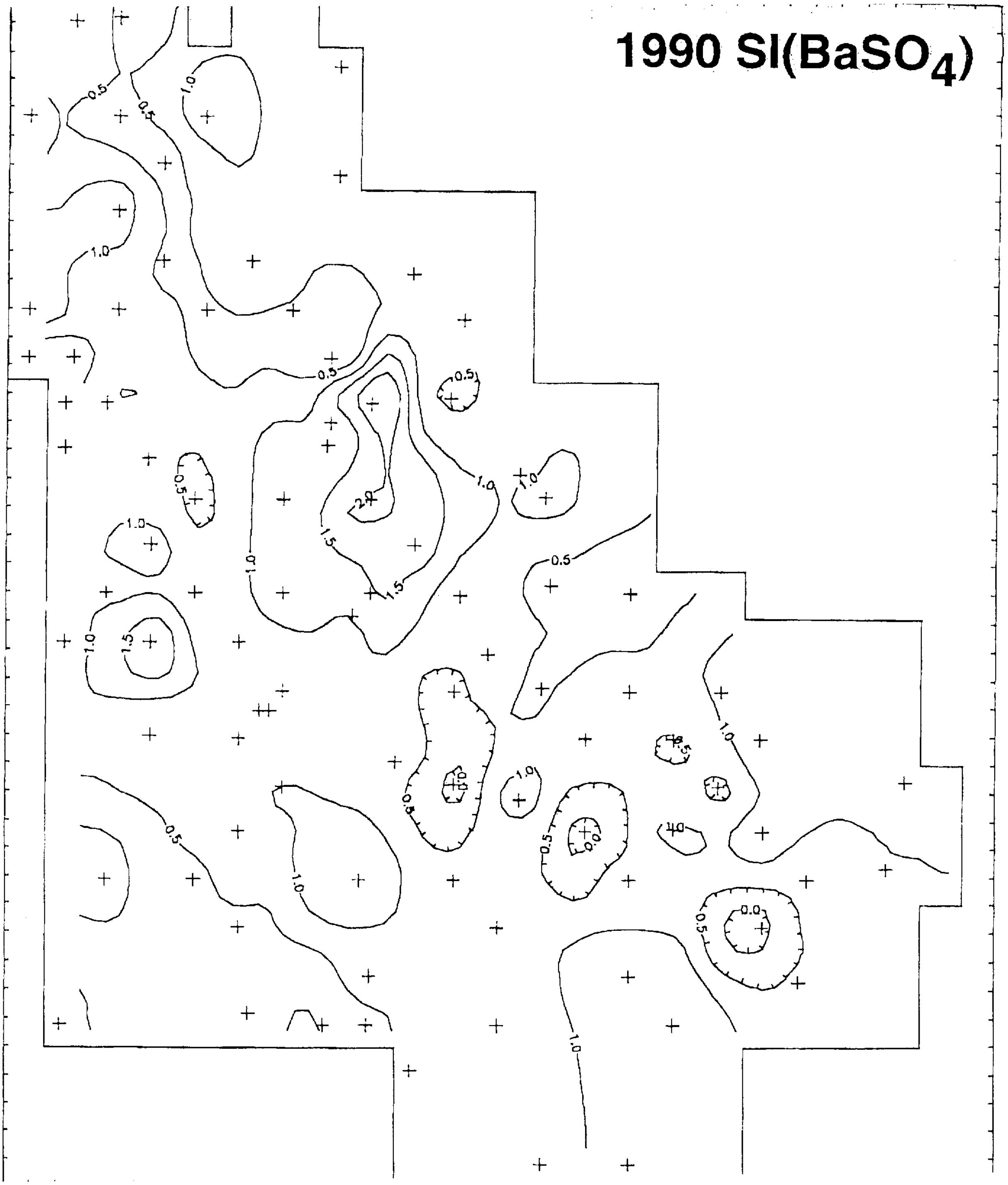


Figure 6 - Barium sulfate precipitation index for each producing well in EMSU in 1990

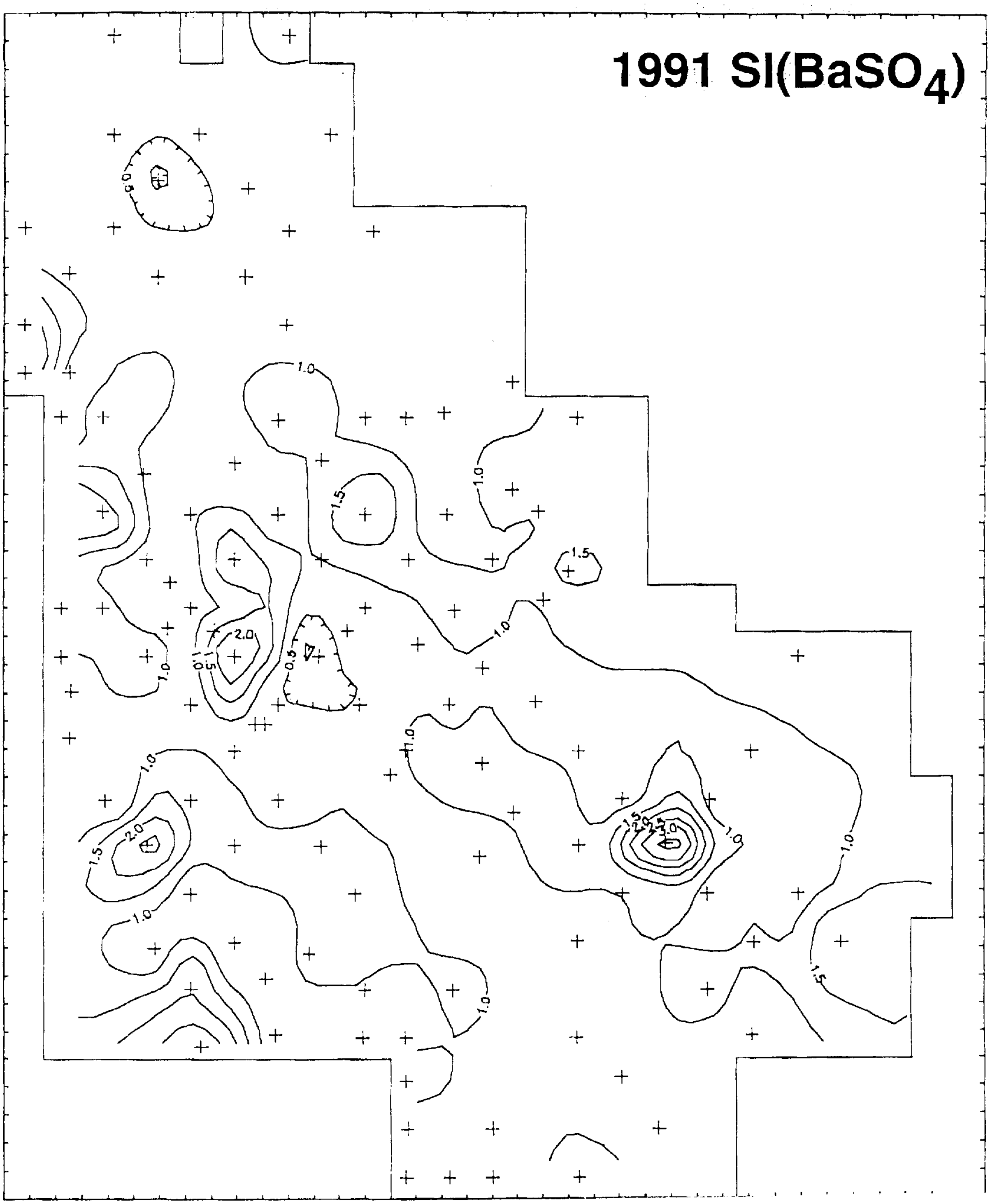


Figure 7 - Barium sulfate precipitation index for each producing well in EMSU in 1991

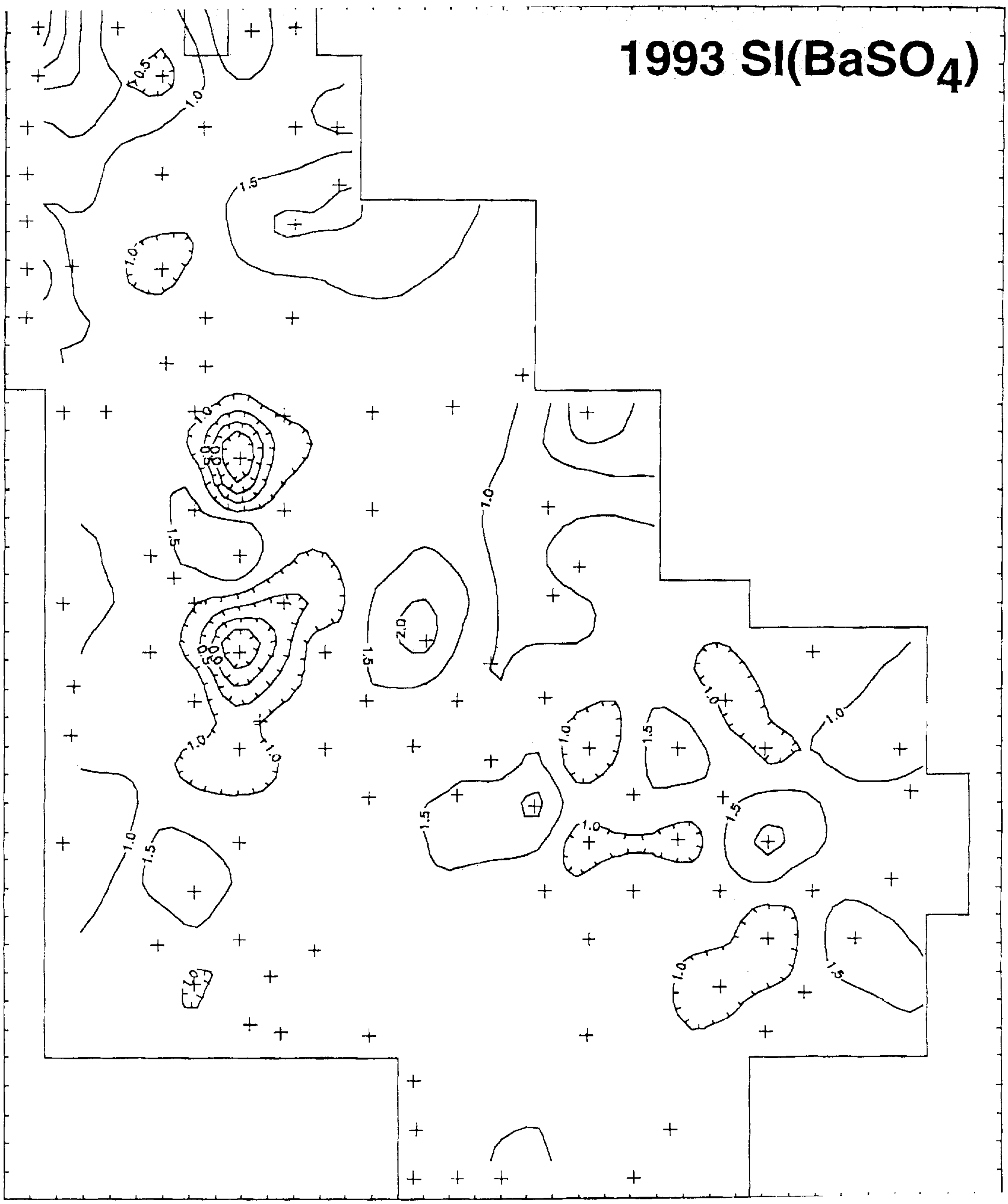
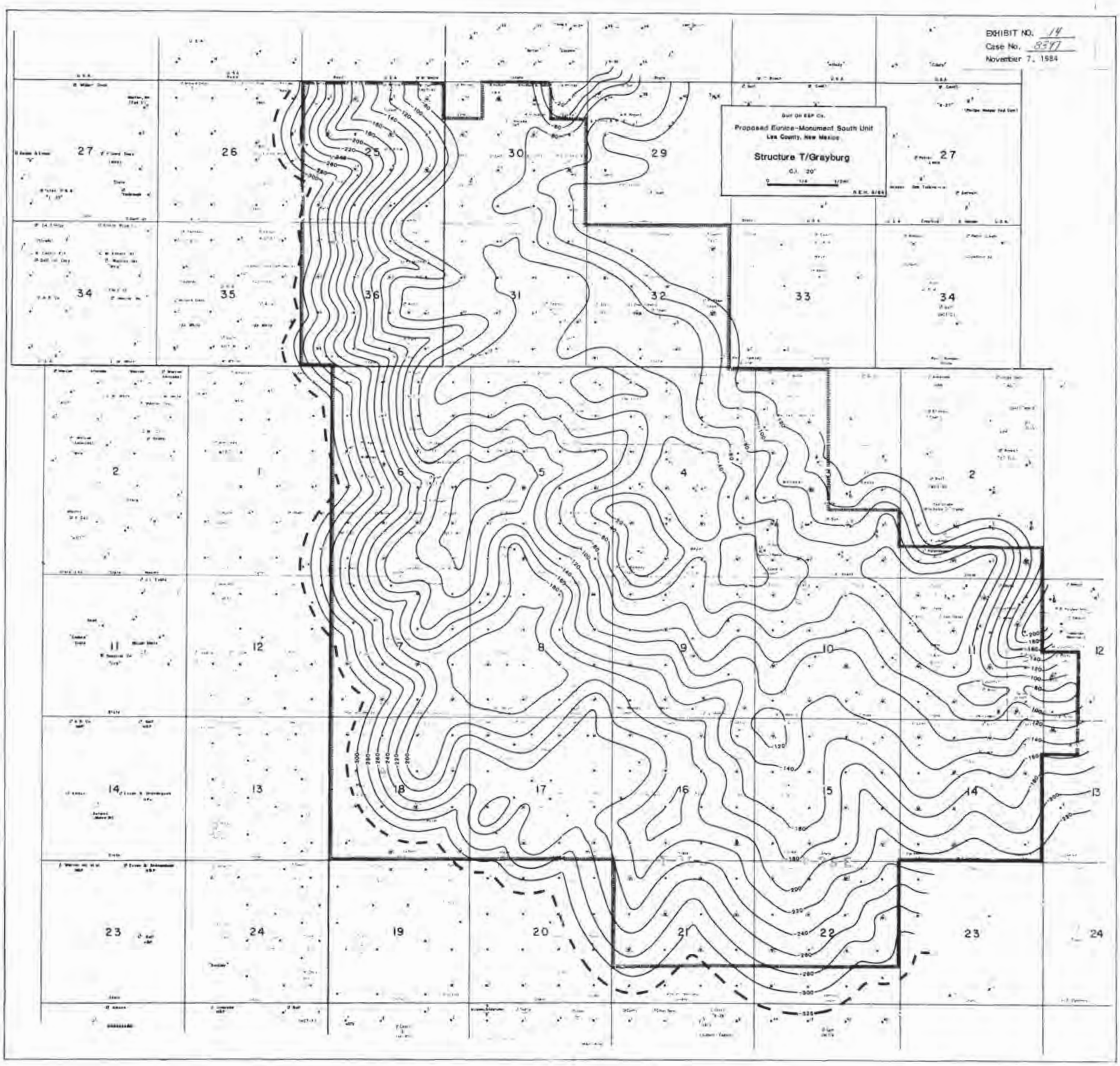


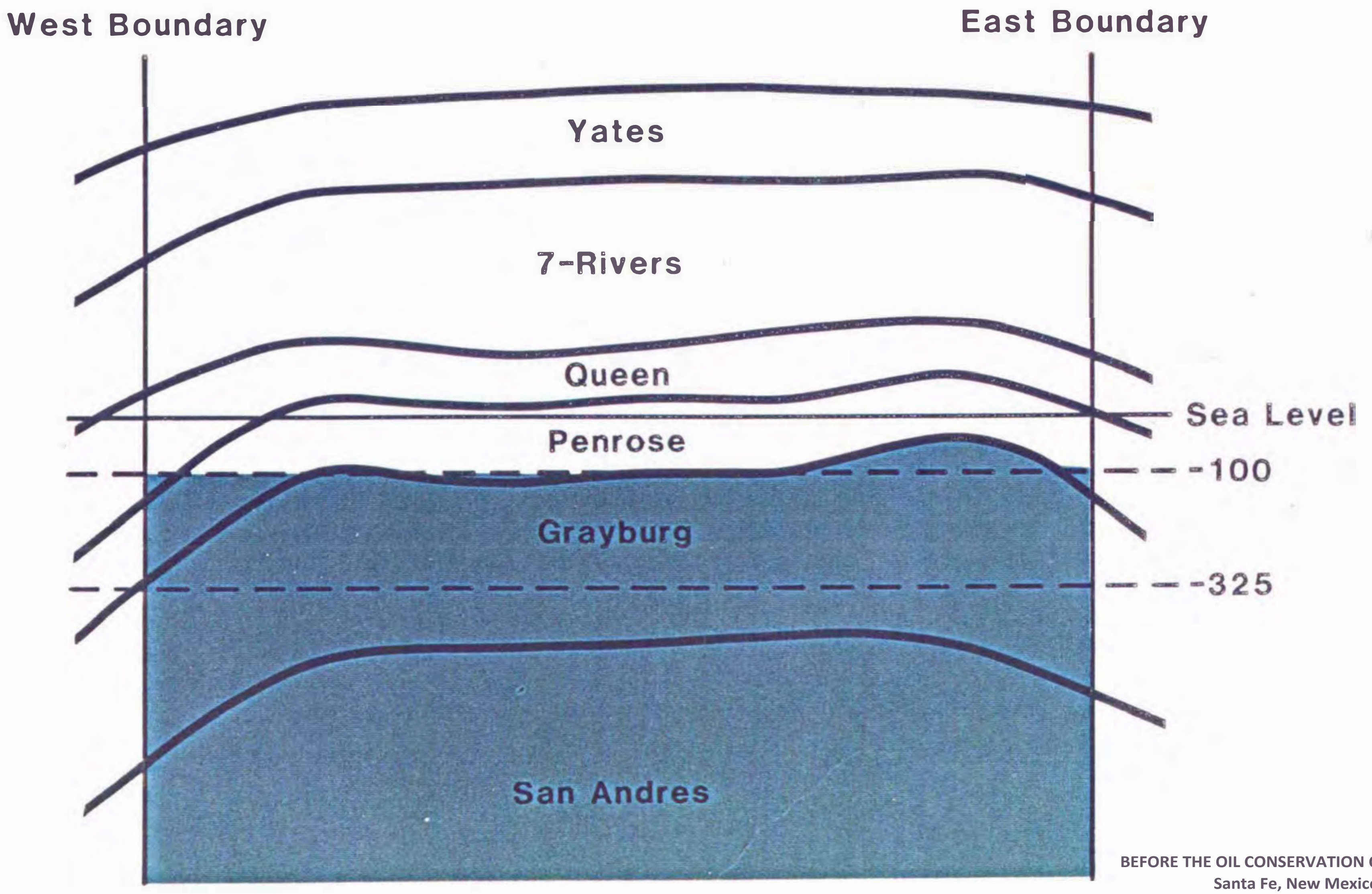
Figure 8. Barium sulfate precipitation index for each producing well sampled in 1993



BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-6
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775,
24018 – 24020, 24025, 24123

EUNICE MONUMENT SOUTH UNIT
GENERALIZED CROSS SECTION

No Scale



11

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-6.1
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024 Case Nos.
23614-23617, 23775, 24018 – 24020, 24025, 24123

Minutes of Technical Committee Meeting

Proposed Eunice Monument South Unit

May 4, 1982

The Technical Committee meeting began at 9:00 a.m., May 4, 1982, at the Midland Center, Midland, Texas. Representatives of 15 operators having working interests within the proposed Unit were present. The attendees represented 93% of the Unit acreage.

Mr. D. T. Berlin, chairman of the Technical Committee, opened the meeting by introducing Gulf personnel. Mr. Berlin announced the agenda items and briefly reviewed the Technical Committee voting procedure. He then turned the meeting over to Mr. Tom Wheeler to proceed with the Committee discussion.

Mr. Wheeler began by reviewing the status of the data which has been requested from Unit Operators. Approximately two thirds of the Unit Operators have not complied with all data requests, and some have not answered any Unit correspondence. Mr. Wheeler asked that the Information Request summary, Attachment 1, be reviewed by all Operators. A complete parameter table cannot be constructed until all Operators have provided correct information regarding the tract legal descriptions and Working Interest divisions.

Mr. Wheeler introduced the three agenda items for the day as follows:

1. Definition of the vertical limits of the unitized interval
2. Finalization of the Unit boundary
3. Committee consensus of the Tract production decline curves

He reminded the participants that the goal of the Committee was to provide recommendations to the Working Interest Owners on these three topics.

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-7
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775,
24018 – 24020, 24025, 24123

During the discussion of the vertical interval to be unitized, Mr. Wheeler described the five alternatives which have been investigated by Gulf. The bottom of the interval must be the base of the San Andres formations to include the area's most prolific water production zone, however, the five alternatives for the top of the interval are as follows:

1. Top of the Grayburg Formation
2. Top of the Penrose Formation
3. An intermediate marker between the upper Penrose sand and lower Penrose carbonate section
4. A subsea datum
5. A combination of 1 and 4 (above)

Each alternative has advantages and disadvantages, however, after an extensive analysis of the cross sections from the Unit, Gulf engineers and geologists had concluded that the following vertical limit definition should be proposed to the Working Interest Owners: "The Unitized Interval shall include the formations from a lower limit defined by the base of the San Andres formation, to an upper limit defined by the top of the Grayburg formation or a -100 foot subsea datum, whichever is higher."

The significant advantages of this definition include the following:

1. Includes all known Eumont Oil and Eunice Monument Oil production in the Unit area
2. Excludes most gas well completions in the area
3. Minimizes the number of workovers required to prevent waterflooding non-unitized formations
4. Exposes the total oil productive interval in the Unit area to Waterflood operations

When no other alternatives were presented by Committee members for consideration, the Committee unanimously accepted the above definition of the Unit vertical limits.

The second discussion topic, final boundary selection, involved review of all properties adjacent to the current boundary to determine whether additional acreage should be included in the Unit. After discussion the Committee voted to include three tracts which have current or past Eunice Monument oil production. The three tracts are outlined on Attachment 2, and are identified below.

1. Tract 114 - 80 acres of Amoco "State 'C' Tract 11" Lease located in S/2 SE/4 Section 2, Township 21 South, Range 36 East, Lea County, New Mexico.
2. Tract 115 - Amoco "McQuatters" lease covering N/2 NE/4 Section 11, Township 21 South, Range 36 East, Lea County, New Mexico.
3. Tract 116 - 40 acres of Conoco "Lockhart B" Lease located in NW/4 NW/4 Section 13, Township 21 South, Range 36 East, Lea County, New Mexico.

Mr. Huan Pham presented ARCO's recommendation that the Committee consider adding three tracts as listed below:

1. Arco "Ida White" Lease - 80 acres in N/2 SE/4 Section 35, Township 20 South, Range 36 East.
2. Arco "Endure State" Lease - 160 acres in SE/4 Section 12 Township 21 South, Range 35 East.
3. Arco "State 176" Lease - 280 acres composed of N/2 NW/4, SE/4 NW/4 and W/2 E/2 Section 19, Township 21 South, Range 36 East.

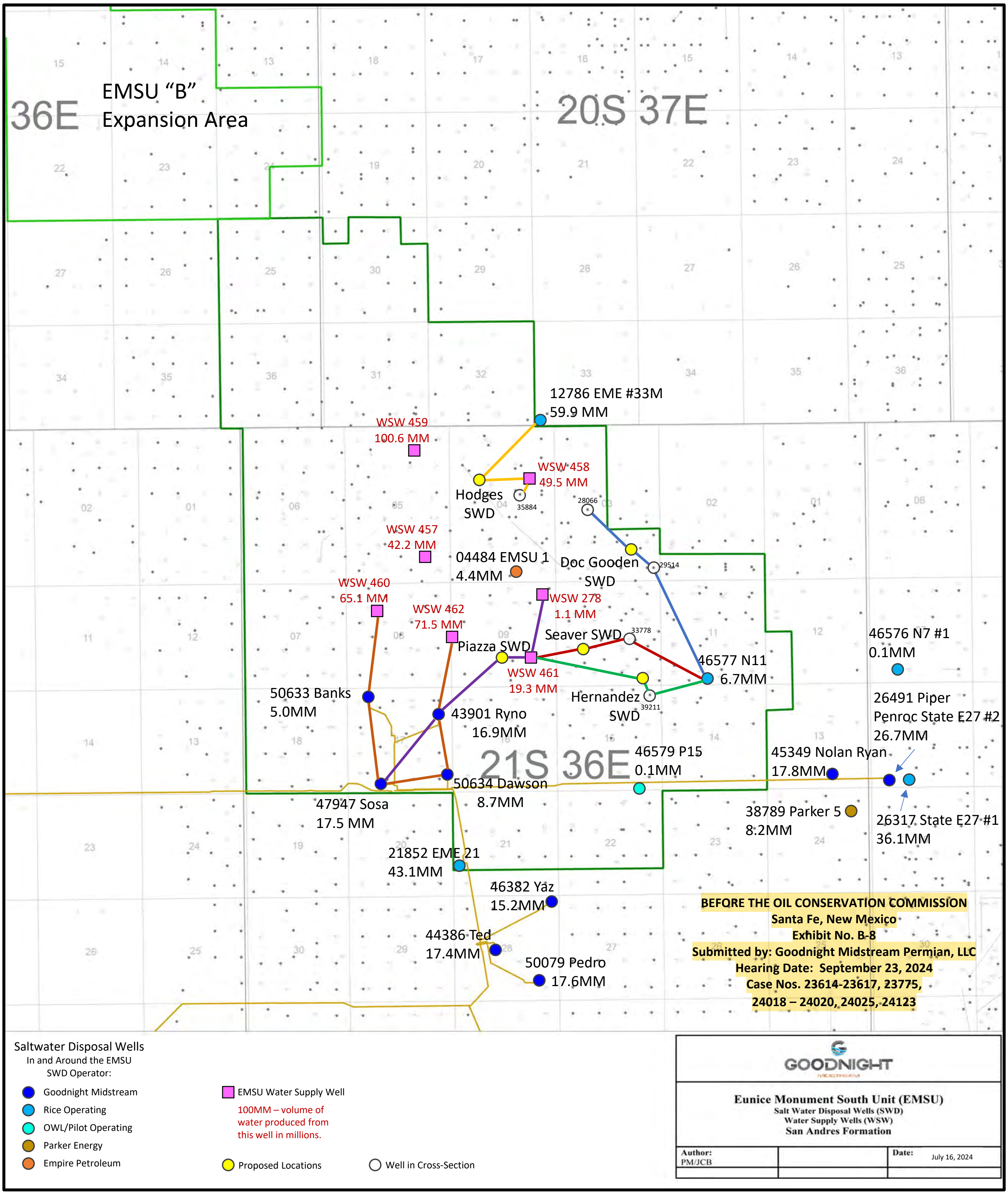
The Technical Committee voted against the addition of the Arco tracts.

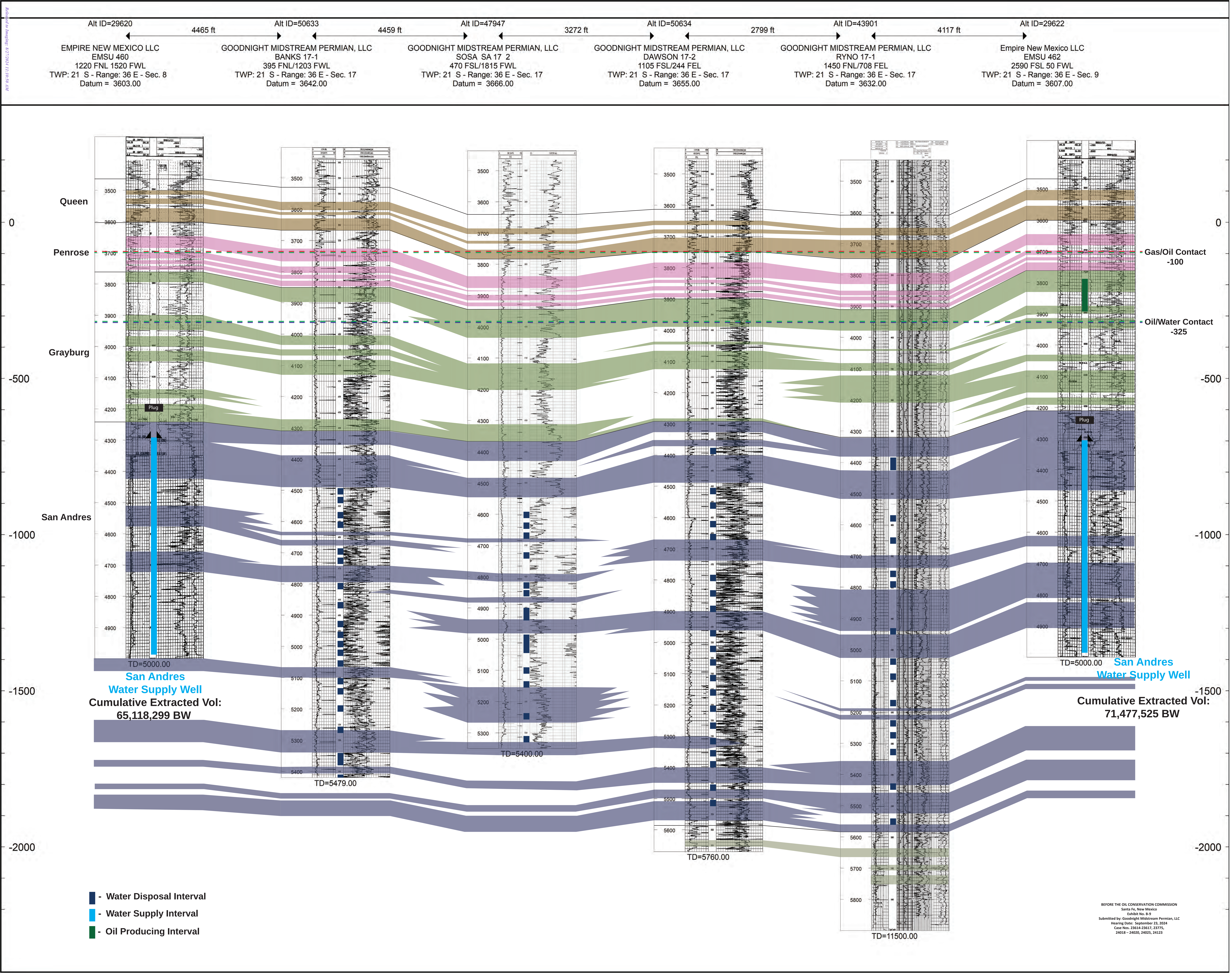
The Committee heard a request from Ms. Pam Morphew, representing the interests of Doyle Hartman and James Rasmussen, to delete tracts 70 and 113 from the Unit. These adjacent 40 acre tracts are located in the eastern portion of the Unit. Tract 70 is the Hartman operated Rasmussen State lease which has a high GOR Eunice Monument oil well, the #1 Rasmussen State, and an abandoned Eunice Monument well, the #1 Rasmussen State 'G'. Tract 113 has the abandoned #2 Rasmussen State 'G' Eunice Monument oil well. After discussion the Committee voted to recommend to the Working Interest Owners that the tracts not be excluded from the Unit at this time.

The last agenda item was the finalization of production decline curves. All curves were individually reviewed, declined and approved by group consensus. Reserve calculations will be based on these decline curves.

The meeting was adjourned following completion of the decline curve review.

Water injected into and withdrawn from the San Andres Formation and cross-section lines





Alt ID=29620
4465 ft
Alt ID=50633
4459 ft
Alt ID=47947
3272 ft
Alt ID=50634
2799 ft
Alt ID=43901
4117 ft
Alt ID=29622
EMPIRE NEW MEXICO LLC
EMSU 460
1220 FNL 1520 FWL
TWP: 21 S - Range: 36 E - Sec. 8
Datum = 3603.00
GOODNIGHT MIDSTREAM PERMIAN, LLC
BANKS 17-1
395 FNL/1203 FWL
TWP: 21 S - Range: 36 E - Sec. 17
Datum = 3642.00
GOODNIGHT MIDSTREAM PERMIAN, LLC
SOSA SA 17 2
470 FSL/1815 FWL
TWP: 21 S - Range: 36 E - Sec. 17
Datum = 3666.00
GOODNIGHT MIDSTREAM PERMIAN, LLC
DAWSON 17-2
1105 FSL/244 FEL
TWP: 21 S - Range: 36 E - Sec. 17
Datum = 3655.00
GOODNIGHT MIDSTREAM PERMIAN, LLC
RYNO 17-1
1450 FNL/708 FEL
TWP: 21 S - Range: 36 E - Sec. 17
Datum = 3632.00
Empire New Mexico LLC
EMSU 462
2590 FSL 50 FWL
TWP: 21 S - Range: 36 E - Sec. 9
Datum = 3607.00
Queen
Penrose
Grayburg
San Andres
0
-500
-1000
-1500
-2000
Gas/Oil Contact
-100
Oil/Water Contact
-325
Plug
TD=5000.00
TD=5479.00
TD=5400.00
TD=5760.00
TD=11500.00
TD=5000.00
San Andres
Water Supply Well
Cumulative Extracted Vol:
65,118,299 BW
San Andres
Water Supply Well
Cumulative Extracted Vol:
71,477,525 BW
- Water Disposal Interval
- Water Supply Interval
- Oil Producing Interval
BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-9
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775,
24018 – 24020, 24025, 24123

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-10.1
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775, 24018 – 24020, 24025, 24123

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-10.2
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775,
24018 – 24020, 24025, 24123

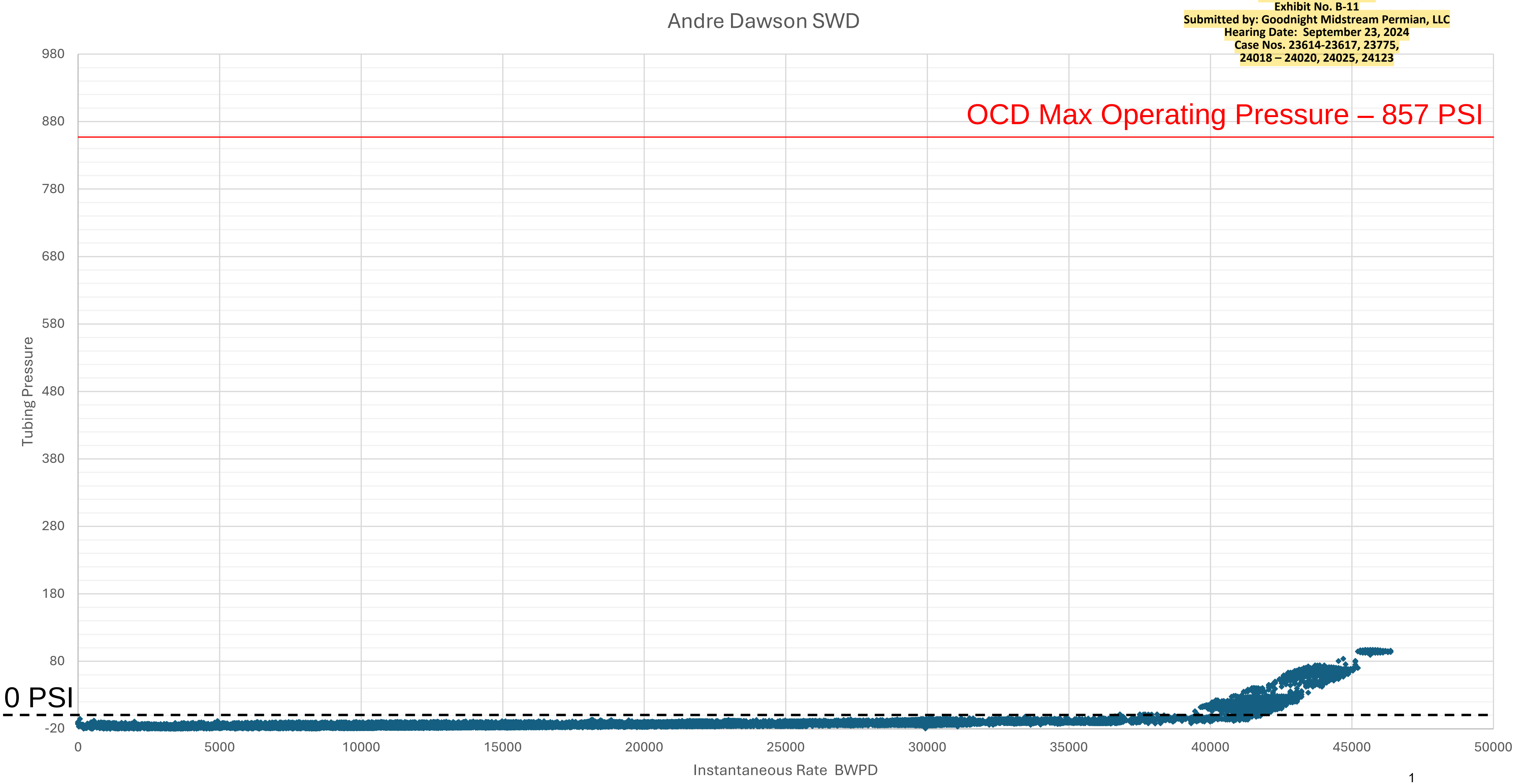
BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-10.3
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775,
24018 – 24020, 24025, 24123

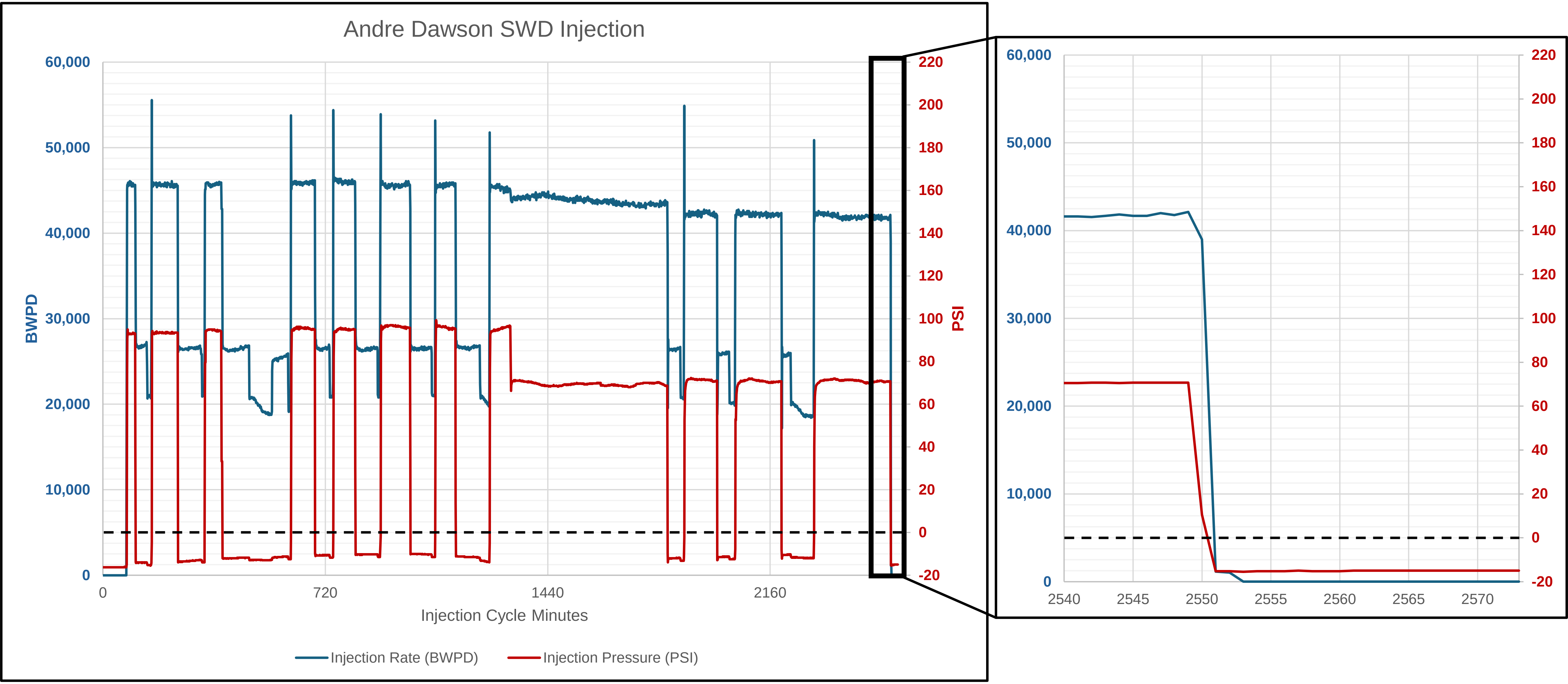
BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-10.4
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775, 24018 – 24020, 24025, 24123

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-10.5
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775,
24018 – 24020, 24025, 24123

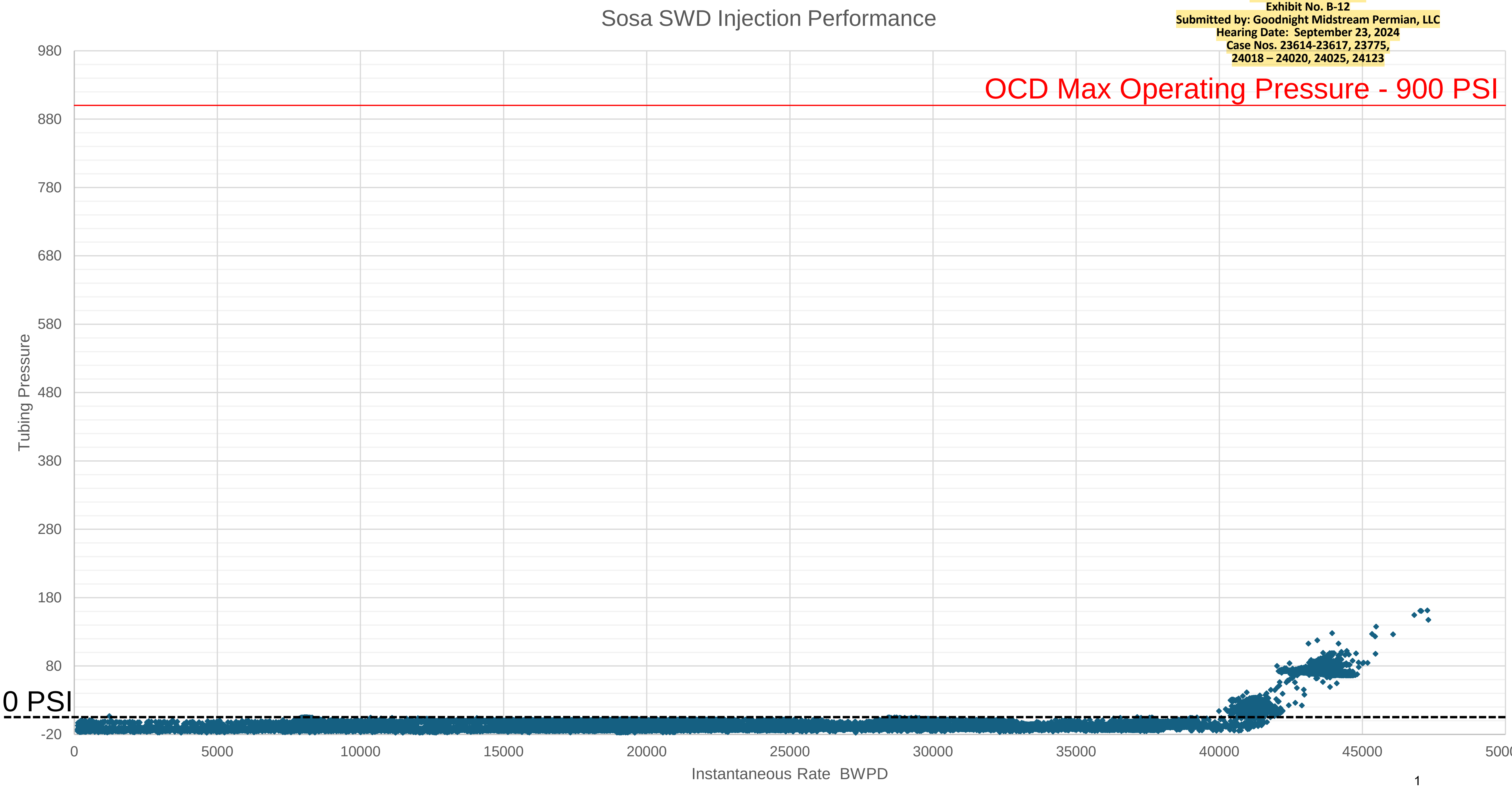
BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-10.5
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775,
24018 – 24020, 24025, 24123

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-11
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775,
24018 – 24020, 24025, 24123




Andre Dawson SWD Injection
60,000
50,000
40,000
30,000
20,000
10,000
0
BWPD
220
200
180
160
140
120
100
80
60
40
20
0
-20
PSI
0
720
1440
2160
Injection Cycle Minutes
Injection Rate (BWPD)
Injection Pressure (PSI)
2540
2545
2550
2555
2560
2565
2570

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-12
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775,
24018 – 24020, 24025, 24123



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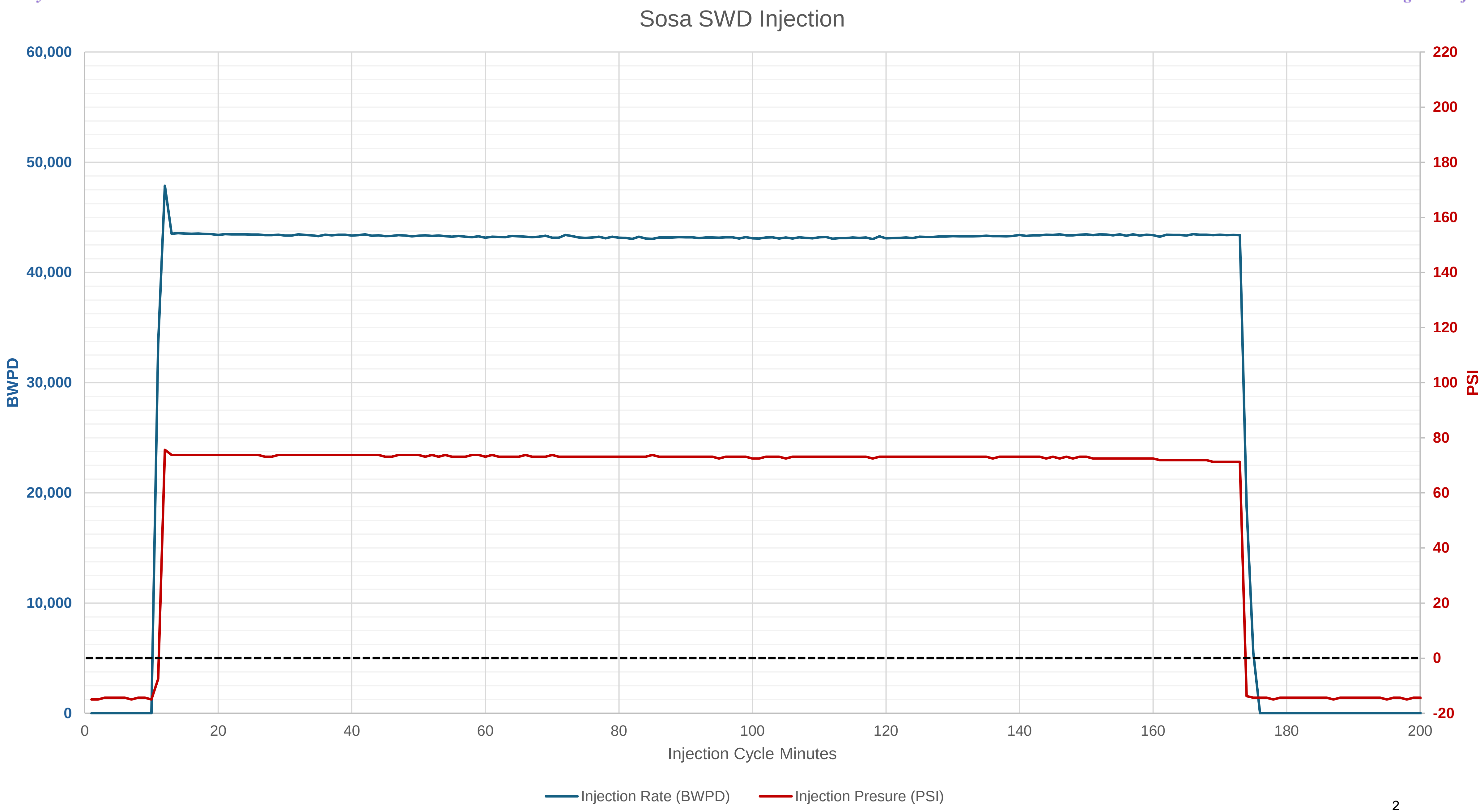
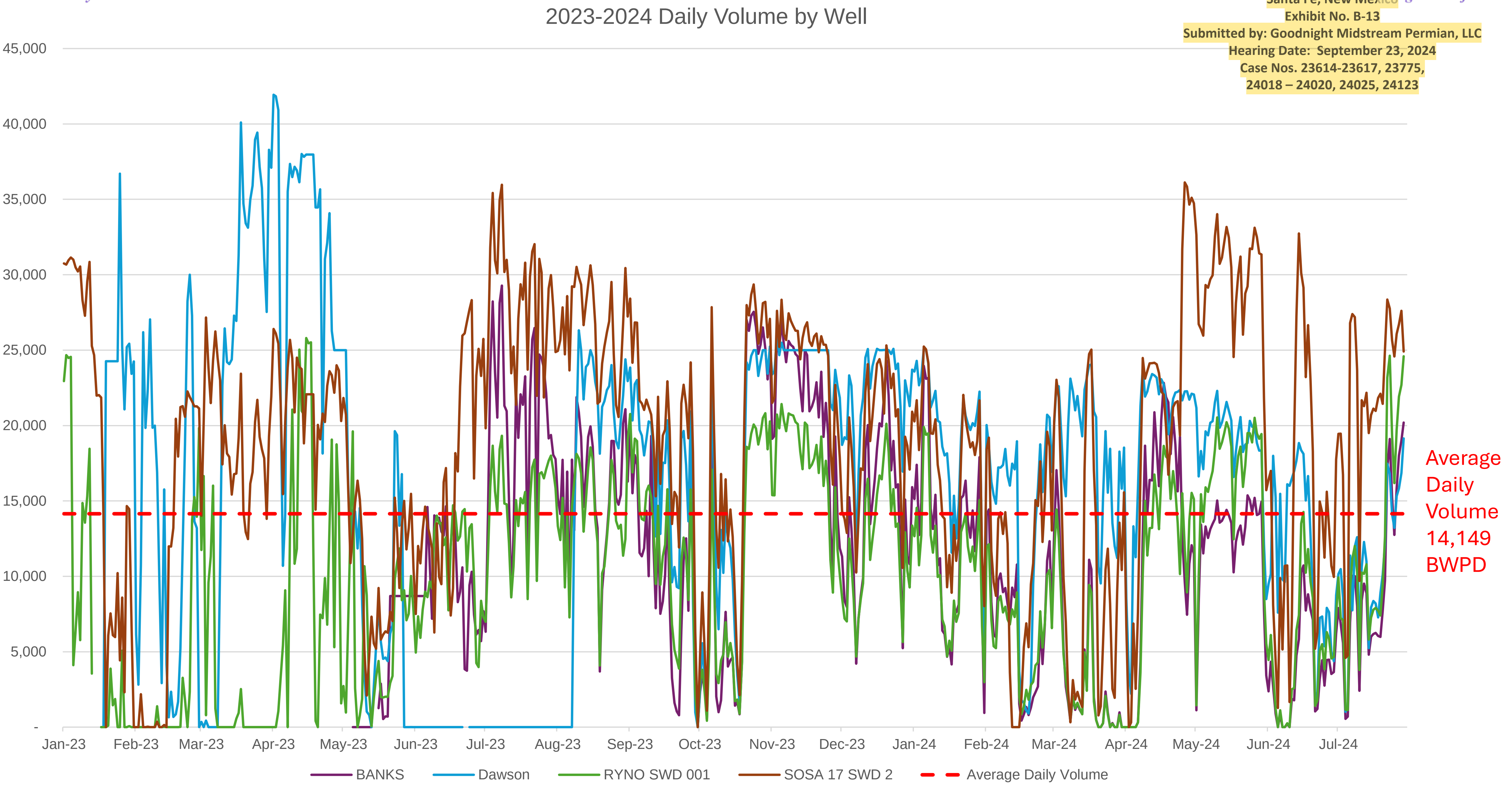

Sosa SWD Injection
60,000
50,000
40,000
30,000
20,000
10,000
0
BWPD
220
200
180
160
140
120
100
80
60
40
20
0
-20
PSI
0
20
40
60
80
100
120
140
160
180
200
Injection Cycle Minutes
Injection Rate (BWPD)
Injection Presure (PSI)

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-13
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775, 24018 – 24020, 24025, 24123



API	Well Name	C-115 Report Month	C-115 Monthly Injected Volume	C-115 Reported Average Inj. Pressure	Top Perf	Permit Max	Requested Increase	Confirm Permit/ Increased pressure Max	PSI over Permit Max	Injection Pressure Gradient
30-025-04330	EUNICE MONUMENT SOUTH UNIT #108	4/1/22	2701	787	3730	746		R-7766 0.2 PSI/foot	**41**	0.676
30-025-04330	EUNICE MONUMENT SOUTH UNIT #108	4/1/23	2701	787	3730	746		R-7766 0.2 PSI/foot	**41**	0.676
30-025-04330	EUNICE MONUMENT SOUTH UNIT #108	5/1/22	2772	784	3730	746		R-7766 0.2 PSI/foot	**38**	0.675
30-025-04330	EUNICE MONUMENT SOUTH UNIT #108	3/1/22	2849	752	3730	746		R-7766 0.2 PSI/foot	**6**	0.667
30-025-04330	EUNICE MONUMENT SOUTH UNIT #108	3/1/23	2849	752	3730	746		R-7766 0.2 PSI/foot	**6**	0.667
30-025-06283	EUNICE MONUMENT SOUTH UNIT #111	4/1/24	8028	755	3727	745		WFX-893 / R-7766 0.2 PSI/foot	**10**	0.668
30-025-06290	EUNICE MONUMENT SOUTH UNIT #116	8/1/22	33502	809	3712	742		R-7766 0.2 PSI/foot	**67**	0.683
30-025-06290	EUNICE MONUMENT SOUTH UNIT #116	7/1/22	35598	799	3712	742		R-7766 0.2 PSI/foot	**57**	0.680
30-025-06290	EUNICE MONUMENT SOUTH UNIT #116	6/1/22	28939	795	3712	742		R-7766 0.2 PSI/foot	**53**	0.679
30-025-06290	EUNICE MONUMENT SOUTH UNIT #116	5/1/22	36607	792	3712	742		R-7766 0.2 PSI/foot	**50**	0.678
30-025-06290	EUNICE MONUMENT SOUTH UNIT #116	4/1/22	35286	791	3712	742		R-7766 0.2 PSI/foot	**49**	0.678
30-025-06290	EUNICE MONUMENT SOUTH UNIT #116	4/1/23	35286	791	3712	742		R-7766 0.2 PSI/foot	**49**	0.678
30-025-06290	EUNICE MONUMENT SOUTH UNIT #116	10/1/22	35413	787	3712	742		R-7766 0.2 PSI/foot	**45**	0.677
30-025-06290	EUNICE MONUMENT SOUTH UNIT #116	3/1/22	35846	785	3712	742		R-7766 0.2 PSI/foot	**43**	0.676
30-025-06290	EUNICE MONUMENT SOUTH UNIT #116	3/1/23	35846	785	3712	742		R-7766 0.2 PSI/foot	**43**	0.676
30-025-29598	EUNICE MONUMENT SOUTH UNIT #118	12/1/22	4990	888	3834	767		R-7766 0.2 PSI/foot	**121**	0.697
30-025-29598	EUNICE MONUMENT SOUTH UNIT #118	11/1/22	5071	878	3834	767		R-7766 0.2 PSI/foot	**111**	0.694
30-025-29598	EUNICE MONUMENT SOUTH UNIT #118	8/1/22	1982	854	3834	767		R-7766 0.2 PSI/foot	**87**	0.688
30-025-29598	EUNICE MONUMENT SOUTH UNIT #118	7/1/22	5195	853	3834	767		R-7766 0.2 PSI/foot	**86**	0.687
30-025-29598	EUNICE MONUMENT SOUTH UNIT #118	4/1/22	4938	846	3834	767		R-7766 0.2 PSI/foot	**79**	0.686
30-025-29598	EUNICE MONUMENT SOUTH UNIT #118	4/1/23	4938	846	3834	767		R-7766 0.2 PSI/foot	**79**	0.686
30-025-29598	EUNICE MONUMENT SOUTH UNIT #118	5/1/22	5257	843	3834	767		R-7766 0.2 PSI/foot	**76**	0.685
30-025-29598	EUNICE MONUMENT SOUTH UNIT #118	6/1/22	5065	840	3834	767		R-7766 0.2 PSI/foot	**73**	0.684
30-025-29598	EUNICE MONUMENT SOUTH UNIT #118	10/1/22	1093	809	3834	767		R-7766 0.2 PSI/foot	**42**	0.676
30-025-29598	EUNICE MONUMENT SOUTH UNIT #118	2/1/24	4978	780	3834	767		R-7766 0.2 PSI/foot	**13**	0.668
30-025-29598	EUNICE MONUMENT SOUTH UNIT #118	1/1/24	5315	775	3834	767		R-7766 0.2 PSI/foot	**8**	0.667
30-025-06306	EUNICE MONUMENT SOUTH UNIT #134	1/1/22	3171	856	3732	746		R-7766 0.2 PSI/foot	**110**	0.694
30-025-06306	EUNICE MONUMENT SOUTH UNIT #134	1/1/23	3171	856	3732	746		R-7766 0.2 PSI/foot	**110**	0.694
30-025-06306	EUNICE MONUMENT SOUTH UNIT #134	12/1/22	3294	786	3732	746		R-7766 0.2 PSI/foot	**40**	0.676
30-025-06306	EUNICE MONUMENT SOUTH UNIT #134	11/1/22	3028	781	3732	746		R-7766 0.2 PSI/foot	**35**	0.674
30-025-06306	EUNICE MONUMENT SOUTH UNIT #134	10/1/22	3085	778	3732	746		R-7766 0.2 PSI/foot	**32**	0.673
30-025-06306	EUNICE MONUMENT SOUTH UNIT #134	8/1/22	3136	777	3732	746		R-7766 0.2 PSI/foot	**31**	0.673
30-025-06306	EUNICE MONUMENT SOUTH UNIT #134	4/1/22	3064	775	3732	746		R-7766 0.2 PSI/foot	**29**	0.673
30-025-06306	EUNICE MONUMENT SOUTH UNIT #134	4/1/23	3064	775	3732	746		R-7766 0.2 PSI/foot	**29**	0.673
30-025-06306	EUNICE MONUMENT SOUTH UNIT #134	5/1/22	3588	770	3732	746		R-7766 0.2 PSI/foot	**24**	0.671
30-025-06306	EUNICE MONUMENT SOUTH UNIT #134	3/1/22	3008	770	3732	746		R-7766 0.2 PSI/foot	**24**	0.671
30-025-06306	EUNICE MONUMENT SOUTH UNIT #134	3/1/23	3008	770	3732	746		R-7766 0.2 PSI/foot	**24**	0.671
30-025-06306	EUNICE MONUMENT SOUTH UNIT #134	2/1/22	3197	767	3732	746		R-7766 0.2 PSI/foot	**21**	0.671
30-025-06306	EUNICE MONUMENT SOUTH UNIT #134	2/1/23	3197	767	3732	746		R-7766 0.2 PSI/foot	**21**	0.671
30-025-06306	EUNICE MONUMENT SOUTH UNIT #134	6/1/22	2581	756	3732	746		R-7766 0.2 PSI/foot	**10**	0.668
30-025-04425	EUNICE MONUMENT SOUTH UNIT #140	2/1/24	6105	749	3703	741		R-7766 0.2 PSI/foot	**8**	0.667
30-025-04425	EUNICE MONUMENT SOUTH UNIT #140	12/1/23	6716	745	3703	741		R-7766 0.2 PSI/foot	**4**	0.666
30-025-04425	EUNICE MONUMENT SOUTH UNIT #140	11/1/23	6654	742	3703	741		R-7766 0.2 PSI/foot	**1**	0.665
30-025-12543	EUNICE MONUMENT SOUTH UNIT #144	1/1/22	17238	758	3700	740		R-7766 0.2 PSI/foot	**18**	0.670
30-025-12543	EUNICE MONUMENT SOUTH UNIT #144	1/1/23	17238	758	3700	740		R-7766 0.2 PSI/foot	**18**	0.670
30-025-06304	EUNICE MONUMENT SOUTH UNIT #146	11/1/23	32325	750	3734	747		R-7766 0.2 PSI/foot	**3**	0.666
30-025-04419	EUNICE MONUMENT SOUTH UNIT #162	10/1/22	4114	761	3725	745		R-7766 0.2 PSI/foot	**16**	0.669
30-025-04532	EUNICE MONUMENT SOUTH UNIT #195	4/1/24	12449	762	3753	751		R-7766 0.2 PSI/foot	**11**	0.668
30-025-04532	EUNICE MONUMENT SOUTH UNIT #195	12/1/22	13273	761	3753	751		R-7766 0.2 PSI/foot	**10**	0.668
30-025-04532	EUNICE MONUMENT SOUTH UNIT #195	2/1/24	12017	755	3753	751		R-7766 0.2 PSI/foot	**4**	0.666
30-025-04532	EUNICE MONUMENT SOUTH UNIT #195	11/1/22	13455	753	3753	751		R-7766 0.2 PSI/foot	**2**	0.666
30-025-04532	EUNICE MONUMENT SOUTH UNIT #195	3/1/24	12904	753	3753	751		R-7766 0.2 PSI/foot	**2**	0.666
30-025-04472	EUNICE MONUMENT SOUTH UNIT #201	1/1/22	3909	811	3746	749		R-7766 0.2 PSI/foot	**62**	0.681
30-025-04472	EUNICE MONUMENT SOUTH UNIT #201	1/1/23	3909	811	3746	749		R-7766 0.2 PSI/foot	**62**	0.681
30-025-04472	EUNICE MONUMENT SOUTH UNIT #201	4/1/22	10379	806	3746	749		R-7766 0.2 PSI/foot	**57**	0.680
30-025-04472	EUNICE MONUMENT SOUTH UNIT #201	4/1/23	10379	806	3746	749		R-7766 0.2 PSI/foot	**57**	0.680
30-025-04472	EUNICE MONUMENT SOUTH UNIT #201	3/1/22	5621	778	3746	749		R-7766 0.2 PSI/foot	**29**	0.673
30-025-04472	EUNICE MONUMENT SOUTH UNIT #201	3/1/23	5621	778	3746	749		R-7766 0.2 PSI/foot	**29**	0.673
30-025-04469	EUNICE MONUMENT SOUTH UNIT #210	6/1/22	9112	779	3749	750	736	R-7766-B 0.2/PSI/foot / Authority Revoked through order R-7766-C / Regranted through WFX-848 (736 PSIG)	**43**	0.673
30-025-04469	EUNICE MONUMENT SOUTH UNIT #210	5/1/22	10239	770	3749	750	736	R-7766-B 0.2/PSI/foot / Authority Revoked through order R-7766-C / Regranted through WFX-848 (736 PSIG)	**34**	0.670
30-025-04469	EUNICE MONUMENT SOUTH UNIT #210	2/1/24	5367	768	3749	750	736	R-7766-B 0.2/PSI/foot / Authority Revoked through order R-7766-C / Regranted through WFX-848 (736 PSIG)	**32**	0.670

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-14
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775,
24018 – 24020, 24025, 24123

30-025-04469	EUNICE MONUMENT SOUTH UNIT #210	1/1/24	5883	755	3749	750	736	R-7766-B 0.2/PSI/foot / Authority Revoked through order R-7766-C / Regranted through WFX-848 (736 PSIG)	**19**	0.666
30-025-04469	EUNICE MONUMENT SOUTH UNIT #210	4/1/22	10589	753	3749	750	736	R-7766-B 0.2/PSI/foot / Authority Revoked through order R-7766-C / Regranted through WFX-848 (736 PSIG)	**17**	0.666
30-025-04469	EUNICE MONUMENT SOUTH UNIT #210	4/1/23	10589	753	3749	750	736	R-7766-B 0.2/PSI/foot / Authority Revoked through order R-7766-C / Regranted through WFX-848 (736 PSIG)	**17**	0.666
30-025-04469	EUNICE MONUMENT SOUTH UNIT #210	11/1/23	5919	753	3749	750	736	R-7766-B 0.2/PSI/foot / Authority Revoked through order R-7766-C / Regranted through WFX-848 (736 PSIG)	**17**	0.666
30-025-29615	EUNICE MONUMENT SOUTH UNIT #211	1/1/22	9511	784	3698	740		R-7766 0.2 PSI/foot	**44**	0.677
30-025-29615	EUNICE MONUMENT SOUTH UNIT #211	1/1/23	9511	784	3698	740		R-7766 0.2 PSI/foot	**44**	0.677
30-025-29615	EUNICE MONUMENT SOUTH UNIT #211	4/1/24	16214	751	3698	740		R-7766 0.2 PSI/foot	**11**	0.668
30-025-29615	EUNICE MONUMENT SOUTH UNIT #211	10/1/22	20694	750	3698	740		R-7766 0.2 PSI/foot	**10**	0.668
30-025-29615	EUNICE MONUMENT SOUTH UNIT #211	11/1/22	19956	750	3698	740		R-7766 0.2 PSI/foot	**10**	0.668
30-025-29615	EUNICE MONUMENT SOUTH UNIT #211	12/1/22	19544	750	3698	740		R-7766 0.2 PSI/foot	**10**	0.668
30-025-29615	EUNICE MONUMENT SOUTH UNIT #211	10/1/23	18321	750	3698	740		R-7766 0.2 PSI/foot	**10**	0.668
30-025-29615	EUNICE MONUMENT SOUTH UNIT #211	11/1/23	17103	750	3698	740		R-7766 0.2 PSI/foot	**10**	0.668
30-025-29615	EUNICE MONUMENT SOUTH UNIT #211	1/1/24	17254	750	3698	740		R-7766 0.2 PSI/foot	**10**	0.668
30-025-29615	EUNICE MONUMENT SOUTH UNIT #211	2/1/24	16011	750	3698	740		R-7766 0.2 PSI/foot	**10**	0.668
30-025-29615	EUNICE MONUMENT SOUTH UNIT #211	8/1/22	22246	749	3698	740		R-7766 0.2 PSI/foot	**9**	0.668
30-025-29615	EUNICE MONUMENT SOUTH UNIT #211	12/1/23	17492	749	3698	740		R-7766 0.2 PSI/foot	**9**	0.668
30-025-29615	EUNICE MONUMENT SOUTH UNIT #211	3/1/24	16935	748	3698	740		R-7766 0.2 PSI/foot	**8**	0.667
30-025-29615	EUNICE MONUMENT SOUTH UNIT #211	5/1/24	16466	748	3698	740		R-7766 0.2 PSI/foot	**8**	0.667
30-025-29615	EUNICE MONUMENT SOUTH UNIT #211	5/1/22	23428	746	3698	740		R-7766 0.2 PSI/foot	**6**	0.667
30-025-29615	EUNICE MONUMENT SOUTH UNIT #211	7/1/23	18286	746	3698	740		R-7766 0.2 PSI/foot	**6**	0.667
30-025-29615	EUNICE MONUMENT SOUTH UNIT #211	6/1/22	22221	744	3698	740		R-7766 0.2 PSI/foot	**4**	0.666
30-025-29615	EUNICE MONUMENT SOUTH UNIT #211	7/1/22	22993	742	3698	740		R-7766 0.2 PSI/foot	**2**	0.666
30-025-29615	EUNICE MONUMENT SOUTH UNIT #211	8/1/23	17821	742	3698	740		R-7766 0.2 PSI/foot	**2**	0.666
30-025-04503	EUNICE MONUMENT SOUTH UNIT #213	1/1/22	21888	844	3796	759		R-7766 0.2 PSI/foot	**85**	0.687
30-025-04503	EUNICE MONUMENT SOUTH UNIT #213	1/1/23	21888	844	3796	759		R-7766 0.2 PSI/foot	**85**	0.687
30-025-04503	EUNICE MONUMENT SOUTH UNIT #213	4/1/22	21002	843	3796	759		R-7766 0.2 PSI/foot	**84**	0.687
30-025-04503	EUNICE MONUMENT SOUTH UNIT #213	4/1/23	21002	843	3796	759		R-7766 0.2 PSI/foot	**84**	0.687
30-025-04503	EUNICE MONUMENT SOUTH UNIT #213	5/1/22	21748	840	3796	759		R-7766 0.2 PSI/foot	**81**	0.686
30-025-04503	EUNICE MONUMENT SOUTH UNIT #213	7/1/22	20765	838	3796	759		R-7766 0.2 PSI/foot	**79**	0.686
30-025-04503	EUNICE MONUMENT SOUTH UNIT #213	6/1/22	20534	835	3796	759		R-7766 0.2 PSI/foot	**76**	0.685
30-025-04503	EUNICE MONUMENT SOUTH UNIT #213	3/1/22	21035	818	3796	759		R-7766 0.2 PSI/foot	**59**	0.680
30-025-04503	EUNICE MONUMENT SOUTH UNIT #213	3/1/23	21035	818	3796	759		R-7766 0.2 PSI/foot	**59**	0.680
30-025-04464	EUNICE MONUMENT SOUTH UNIT #231	4/1/24	5361	762	3768	754		R-7766 0.2 PSI/foot	**8**	0.667
30-025-04464	EUNICE MONUMENT SOUTH UNIT #231	2/1/24	5161	758	3768	754		R-7766 0.2 PSI/foot	**4**	0.666
30-025-04464	EUNICE MONUMENT SOUTH UNIT #231	1/1/24	5520	756	3768	754		R-7766 0.2 PSI/foot	**2**	0.666
30-025-04464	EUNICE MONUMENT SOUTH UNIT #231	3/1/24	5375	756	3768	754		R-7766 0.2 PSI/foot	**2**	0.666
30-025-29867	EUNICE MONUMENT SOUTH UNIT #240	1/1/22	7595	786	3682	736		WFX-618 736 PSIG	**50**	0.678
30-025-29867	EUNICE MONUMENT SOUTH UNIT #240	1/1/23	7595	786	3682	736		WFX-618 736 PSIG	**50**	0.678
30-025-29867	EUNICE MONUMENT SOUTH UNIT #240	4/1/22	7516	774	3682	736		WFX-618 736 PSIG	**38**	0.675
30-025-29867	EUNICE MONUMENT SOUTH UNIT #240	4/1/23	7516	774	3682	736		WFX-618 736 PSIG	**38**	0.675
30-025-29867	EUNICE MONUMENT SOUTH UNIT #240	3/1/22	7464	752	3682	736		WFX-618 736 PSIG	**16**	0.669
30-025-29867	EUNICE MONUMENT SOUTH UNIT #240	3/1/23	7464	752	3682	736		WFX-618 736 PSIG	**16**	0.669
30-025-04518	EUNICE MONUMENT SOUTH UNIT #243	12/1/22	232	876	3713	743		R-7766 0.2 PSI/foot	**133**	0.701
30-025-04518	EUNICE MONUMENT SOUTH UNIT #243	8/1/22	5151	751	3713	743		R-7766 0.2 PSI/foot	**8**	0.667
30-025-04518	EUNICE MONUMENT SOUTH UNIT #243	11/1/22	3897	751	3713	743		R-7766 0.2 PSI/foot	**8**	0.667
30-025-04518	EUNICE MONUMENT SOUTH UNIT #243	4/1/24	4566	751	3713	743		R-7766 0.2 PSI/foot	**8**	0.667
30-025-04518	EUNICE MONUMENT SOUTH UNIT #243	1/1/22	4367	750	3713	743		R-7766 0.2 PSI/foot	**7**	0.667
30-025-04518	EUNICE MONUMENT SOUTH UNIT #243	10/1/22	5089	750	3713	743		R-7766 0.2 PSI/foot	**7**	0.667
30-025-04518	EUNICE MONUMENT SOUTH UNIT #243	1/1/23	4367	750	3713	743		R-7766 0.2 PSI/foot	**7**	0.667
30-025-04518	EUNICE MONUMENT SOUTH UNIT #243	2/1/24	4390	750	3713	743		R-7766 0.2 PSI/foot	**7**	0.667
30-025-04518	EUNICE MONUMENT SOUTH UNIT #243	5/1/24	4997	748	3713	743		R-7766 0.2 PSI/foot	**5**	0.666
30-025-04518	EUNICE MONUMENT SOUTH UNIT #243	3/1/24	4703	748	3713	743		R-7766 0.2 PSI/foot	**5**	0.666
30-025-04518	EUNICE MONUMENT SOUTH UNIT #243	4/1/22	4297	748	3713	743		R-7766 0.2 PSI/foot	**5**	0.666
30-025-04518	EUNICE MONUMENT SOUTH UNIT #243	4/1/23	4297	748	3713	743		R-7766 0.2 PSI/foot	**5**	0.666
30-025-04518	EUNICE MONUMENT SOUTH UNIT #243	1/1/24	4616	748	3713	743		R-7766 0.2 PSI/foot	**5**	0.666
30-025-04518	EUNICE MONUMENT SOUTH UNIT #243	5/1/22	4669	745	3713	743		R-7766 0.2 PSI/foot	**2**	0.666
30-025-04518	EUNICE MONUMENT SOUTH UNIT #243	6/1/22	4599	744	3713	743		R-7766 0.2 PSI/foot	**1**	0.665
30-025-29575	EUNICE MONUMENT SOUTH UNIT #247	12/1/22	15884	833	3700	740		R-7766 0.2 PSI/foot	**93**	0.690
30-025-29575	EUNICE MONUMENT SOUTH UNIT #247	11/1/22	15555	830	3700	740		R-7766 0.2 PSI/foot	**90**	0.689
30-025-29575	EUNICE MONUMENT SOUTH UNIT #247	10/1/22	16016	815	3700	740		R-7766 0.2 PSI/foot	**75**	0.685
30-025-29575	EUNICE MONUMENT SOUTH UNIT #247	4/1/24	9258	812	3700	740		R-7766 0.2 PSI/foot	**72**	0.684
30-025-29575	EUNICE MONUMENT SOUTH UNIT #247	8/1/22	16520	791	3700	740		R-7766 0.2 PSI/foot	**51**	0.679

30-025-29575	EUNICE MONUMENT SOUTH UNIT #247	7/1/22	16615	783	3700	740		R-7766 0.2 PSI/foot	**43**	0.677
30-025-29575	EUNICE MONUMENT SOUTH UNIT #247	1/1/22	14970	780	3700	740		R-7766 0.2 PSI/foot	**40**	0.676
30-025-29575	EUNICE MONUMENT SOUTH UNIT #247	1/1/23	14970	780	3700	740		R-7766 0.2 PSI/foot	**40**	0.676
30-025-29575	EUNICE MONUMENT SOUTH UNIT #247	5/1/22	16783	776	3700	740		R-7766 0.2 PSI/foot	**36**	0.675
30-025-29575	EUNICE MONUMENT SOUTH UNIT #247	6/1/22	16311	772	3700	740		R-7766 0.2 PSI/foot	**32**	0.674
30-025-29575	EUNICE MONUMENT SOUTH UNIT #247	4/1/22	9732	763	3700	740		R-7766 0.2 PSI/foot	**23**	0.671
30-025-29575	EUNICE MONUMENT SOUTH UNIT #247	4/1/23	9732	763	3700	740		R-7766 0.2 PSI/foot	**23**	0.671
30-025-29575	EUNICE MONUMENT SOUTH UNIT #247	3/1/22	13904	747	3700	740		R-7766 0.2 PSI/foot	**7**	0.667
30-025-29575	EUNICE MONUMENT SOUTH UNIT #247	3/1/23	13904	747	3700	740		R-7766 0.2 PSI/foot	**7**	0.667
30-025-29575	EUNICE MONUMENT SOUTH UNIT #247	1/1/24	14521	745	3700	740		R-7766 0.2 PSI/foot	**5**	0.666
30-025-29575	EUNICE MONUMENT SOUTH UNIT #247	2/1/24	13829	745	3700	740		R-7766 0.2 PSI/foot	**5**	0.666
30-025-29575	EUNICE MONUMENT SOUTH UNIT #247	12/1/23	14824	743	3700	740		R-7766 0.2 PSI/foot	**3**	0.666
30-025-29575	EUNICE MONUMENT SOUTH UNIT #247	3/1/24	14910	741	3700	740		R-7766 0.2 PSI/foot	**1**	0.665
30-025-29575	EUNICE MONUMENT SOUTH UNIT #247	5/1/24	15751	741	3700	740		R-7766 0.2 PSI/foot	**1**	0.665
30-025-08702	EUNICE MONUMENT SOUTH UNIT #253	12/1/22	259456	790	3761	752		R-7766 0.2 PSI/foot	**38**	0.675
30-025-08702	EUNICE MONUMENT SOUTH UNIT #253	11/1/22	25032	786	3761	752		R-7766 0.2 PSI/foot	**34**	0.674
30-025-08702	EUNICE MONUMENT SOUTH UNIT #253	10/1/22	25782	782	3761	752		R-7766 0.2 PSI/foot	**30**	0.673
30-025-08702	EUNICE MONUMENT SOUTH UNIT #253	1/1/22	26516	771	3761	752		R-7766 0.2 PSI/foot	**19**	0.670
30-025-08702	EUNICE MONUMENT SOUTH UNIT #253	1/1/23	26516	771	3761	752		R-7766 0.2 PSI/foot	**19**	0.670
30-025-08702	EUNICE MONUMENT SOUTH UNIT #253	8/1/22	10575	768	3761	752		R-7766 0.2 PSI/foot	**16**	0.669
30-025-08702	EUNICE MONUMENT SOUTH UNIT #253	6/1/23	23843	758	3761	752		R-7766 0.2 PSI/foot	**6**	0.667
30-025-04496	EUNICE MONUMENT SOUTH UNIT #257	10/1/23	25110	756	3774	755		R-7766 0.2 PSI/foot	**1**	0.665
30-025-04471	EUNICE MONUMENT SOUTH UNIT #261	4/1/23	0	805	3795	759		R-7766 0.2 PSI/foot	**46**	0.677
30-025-04471	EUNICE MONUMENT SOUTH UNIT #261	4/1/22	0	805	3795	759		R-7766 0.2 PSI/foot	**46**	0.677
30-025-04471	EUNICE MONUMENT SOUTH UNIT #261	3/1/22	0	796	3795	759		R-7766 0.2 PSI/foot	**37**	0.675
30-025-04471	EUNICE MONUMENT SOUTH UNIT #261	3/1/23	0	796	3795	759		R-7766 0.2 PSI/foot	**37**	0.675
30-025-04471	EUNICE MONUMENT SOUTH UNIT #261	8/1/22	1072	796	3795	759		R-7766 0.2 PSI/foot	**37**	0.675
30-025-04471	EUNICE MONUMENT SOUTH UNIT #261	1/1/23	0	794	3795	759		R-7766 0.2 PSI/foot	**35**	0.674
30-025-04471	EUNICE MONUMENT SOUTH UNIT #261	1/1/22	0	794	3795	759		R-7766 0.2 PSI/foot	**35**	0.674
30-025-04471	EUNICE MONUMENT SOUTH UNIT #261	5/1/22	0	793	3795	759		R-7766 0.2 PSI/foot	**34**	0.674
30-025-04471	EUNICE MONUMENT SOUTH UNIT #261	7/1/22	0	785	3795	759		R-7766 0.2 PSI/foot	**26**	0.672
30-025-04471	EUNICE MONUMENT SOUTH UNIT #261	6/1/22	0	779	3795	759		R-7766 0.2 PSI/foot	**20**	0.670
30-025-04471	EUNICE MONUMENT SOUTH UNIT #261	11/1/23	12192	769	3795	759		R-7766 0.2 PSI/foot	**10**	0.668
30-025-04598	EUNICE MONUMENT SOUTH UNIT #275	6/1/22	0	850	3741	748		R-7766 0.2 PSI/foot	**102**	0.692
30-025-04598	EUNICE MONUMENT SOUTH UNIT #275	7/1/22	6	839	3741	748		R-7766 0.2 PSI/foot	**91**	0.689
30-025-04598	EUNICE MONUMENT SOUTH UNIT #275	8/1/22	12	838	3741	748		R-7766 0.2 PSI/foot	**90**	0.689
30-025-04598	EUNICE MONUMENT SOUTH UNIT #275	5/1/22	5346	832	3741	748		R-7766 0.2 PSI/foot	**84**	0.687
30-025-04598	EUNICE MONUMENT SOUTH UNIT #275	10/1/22	3555	817	3741	748		R-7766 0.2 PSI/foot	**69**	0.683
30-025-04598	EUNICE MONUMENT SOUTH UNIT #275	11/1/22	3555	817	3741	748		R-7766 0.2 PSI/foot	**69**	0.683
30-025-04598	EUNICE MONUMENT SOUTH UNIT #275	4/1/24	5901	778	3741	748		R-7766 0.2 PSI/foot	**30**	0.673
30-025-04598	EUNICE MONUMENT SOUTH UNIT #275	3/1/24	10281	754	3741	748		R-7766 0.2 PSI/foot	**6**	0.667
30-025-04598	EUNICE MONUMENT SOUTH UNIT #275	12/1/22	18243	750	3741	748		R-7766 0.2 PSI/foot	**2**	0.665
30-025-04598	EUNICE MONUMENT SOUTH UNIT #275	2/1/24	819	750	3741	748		R-7766 0.2 PSI/foot	**2**	0.665
30-025-04539	EUNICE MONUMENT SOUTH UNIT #293	4/1/23	0	792	3745	749		R-7766 0.2 PSI/foot	**43**	0.676
30-025-04539	EUNICE MONUMENT SOUTH UNIT #293	4/1/22	0	792	3745	749		R-7766 0.2 PSI/foot	**43**	0.676
30-025-04539	EUNICE MONUMENT SOUTH UNIT #293	1/1/23	0	769	3745	749		R-7766 0.2 PSI/foot	**20**	0.670
30-025-04539	EUNICE MONUMENT SOUTH UNIT #293	1/1/22	0	769	3745	749		R-7766 0.2 PSI/foot	**20**	0.670
30-025-04568	EUNICE MONUMENT SOUTH UNIT #297	10/1/23	42258	751	3720	744		R-7766 0.2 PSI/foot	**7**	0.667
30-025-04568	EUNICE MONUMENT SOUTH UNIT #297	4/1/22	42015	747	3720	744		R-7766 0.2 PSI/foot	**3**	0.666
30-025-04568	EUNICE MONUMENT SOUTH UNIT #297	4/1/23	42015	747	3720	744		R-7766 0.2 PSI/foot	**3**	0.666
30-025-04571	EUNICE MONUMENT SOUTH UNIT #299	1/1/22	4194	793	3675	735		R-7766 0.2 PSI/foot	**58**	0.681
30-025-04571	EUNICE MONUMENT SOUTH UNIT #299	1/1/23	4194	793	3675	735		R-7766 0.2 PSI/foot	**58**	0.681
30-025-04571	EUNICE MONUMENT SOUTH UNIT #299	5/1/24	11985	741	3675	735		R-7766 0.2 PSI/foot	**6**	0.667
30-025-04605	EUNICE MONUMENT SOUTH UNIT #314	5/1/23	0	791	3787	757		R-7766 0.2 PSI/foot	**34**	0.674
30-025-04554	EUNICE MONUMENT SOUTH UNIT #324	1/1/22	2339	889	3720	744	875	875 (IPI-183)(R-7766)	**14**	0.704
30-025-04554	EUNICE MONUMENT SOUTH UNIT #324	1/1/23	2339	889	3720	744	875	875 (IPI-183)(R-7766)	**14**	0.704
30-025-04583	EUNICE MONUMENT SOUTH UNIT #342	8/1/22	14456	765	3760	752		R-7766 0.2 PSI/foot	**13**	0.668
30-025-04583	EUNICE MONUMENT SOUTH UNIT #342	12/1/22	10721	765	3760	752		R-7766 0.2 PSI/foot	**13**	0.668
30-025-04583	EUNICE MONUMENT SOUTH UNIT #342	11/1/22	10598	760	3760	752		R-7766 0.2 PSI/foot	**8**	0.667
30-025-04583	EUNICE MONUMENT SOUTH UNIT #342	10/1/22	13879	759	3760	752		R-7766 0.2 PSI/foot	**7**	0.667
30-025-04583	EUNICE MONUMENT SOUTH UNIT #342	6/1/22	12490	758	3760	752		R-7766 0.2 PSI/foot	**6**	0.667
30-025-04583	EUNICE MONUMENT SOUTH UNIT #342	7/1/22	13392	754	3760	752		R-7766 0.2 PSI/foot	**2**	0.666

30-025-04592	EUNICE MONUMENT SOUTH UNIT #344	11/1/23	7692	768	3771	754	R-7766 0.2 PSI/foot	**14**	0.669
30-025-04592	EUNICE MONUMENT SOUTH UNIT #344	1/1/22	13117	761	3771	754	R-7766 0.2 PSI/foot	**7**	0.667
30-025-04592	EUNICE MONUMENT SOUTH UNIT #344	1/1/23	13117	761	3771	754	R-7766 0.2 PSI/foot	**7**	0.667
30-025-04592	EUNICE MONUMENT SOUTH UNIT #344	12/1/23	13317	760	3771	754	R-7766 0.2 PSI/foot	**6**	0.667
30-025-04640	EUNICE MONUMENT SOUTH UNIT #354	12/1/22	8921	789	3718	744	744 744 (IPI-183)(R-7766)	**45**	0.677
30-025-04640	EUNICE MONUMENT SOUTH UNIT #354	11/1/22	8533	787	3718	744	744 744 (IPI-183)(R-7766)	**43**	0.677
30-025-04640	EUNICE MONUMENT SOUTH UNIT #354	10/1/22	1241	786	3718	744	744 744 (IPI-183)(R-7766)	**42**	0.676
30-025-04640	EUNICE MONUMENT SOUTH UNIT #354	8/1/22	8988	782	3718	744	744 744 (IPI-183)(R-7766)	**38**	0.675
30-025-04640	EUNICE MONUMENT SOUTH UNIT #354	5/1/22	8141	778	3718	744	744 744 (IPI-183)(R-7766)	**34**	0.674
30-025-04640	EUNICE MONUMENT SOUTH UNIT #354	7/1/22	9502	778	3718	744	744 744 (IPI-183)(R-7766)	**34**	0.674
30-025-04640	EUNICE MONUMENT SOUTH UNIT #354	6/1/22	9281	775	3718	744	744 744 (IPI-183)(R-7766)	**31**	0.673
30-025-04640	EUNICE MONUMENT SOUTH UNIT #354	4/1/22	5494	764	3718	744	744 744 (IPI-183)(R-7766)	**20**	0.670
30-025-04640	EUNICE MONUMENT SOUTH UNIT #354	4/1/23	5494	764	3718	744	744 744 (IPI-183)(R-7766)	**20**	0.670
30-025-04640	EUNICE MONUMENT SOUTH UNIT #354	1/1/23	0	748	3718	744	744 744 (IPI-183)(R-7766)	**4**	0.666
30-025-04629	EUNICE MONUMENT SOUTH UNIT #356	5/1/22	23575	837	3645	729	R-7766 0.2 PSI/foot	**108**	0.695
30-025-04629	EUNICE MONUMENT SOUTH UNIT #356	12/1/22	23276	788	3645	729	R-7766 0.2 PSI/foot	**59**	0.681
30-025-04629	EUNICE MONUMENT SOUTH UNIT #356	11/1/22	23051	783	3645	729	R-7766 0.2 PSI/foot	**54**	0.680
30-025-04629	EUNICE MONUMENT SOUTH UNIT #356	10/1/22	23610	777	3645	729	R-7766 0.2 PSI/foot	**48**	0.678
30-025-04629	EUNICE MONUMENT SOUTH UNIT #356	6/1/22	22604	776	3645	729	R-7766 0.2 PSI/foot	**47**	0.678
30-025-04629	EUNICE MONUMENT SOUTH UNIT #356	8/1/22	22930	763	3645	729	R-7766 0.2 PSI/foot	**34**	0.674
30-025-04629	EUNICE MONUMENT SOUTH UNIT #356	7/1/22	22857	755	3645	729	R-7766 0.2 PSI/foot	**26**	0.672
30-025-04643	EUNICE MONUMENT SOUTH UNIT #357	10/1/23	12356	793	3684	737	WFX-785 741 PSI (0.2 psi/foot)	**52**	0.680
30-025-04643	EUNICE MONUMENT SOUTH UNIT #357	1/1/24	12376	791	3684	737	WFX-785 741 PSI (0.2 psi/foot)	**50**	0.680
30-025-04643	EUNICE MONUMENT SOUTH UNIT #357	4/1/22	10523	765	3684	737	WFX-785 741 PSI (0.2 psi/foot)	**24**	0.673
30-025-04643	EUNICE MONUMENT SOUTH UNIT #357	12/1/22	10923	765	3684	737	WFX-785 741 PSI (0.2 psi/foot)	**24**	0.673
30-025-04643	EUNICE MONUMENT SOUTH UNIT #357	4/1/23	10523	765	3684	737	WFX-785 741 PSI (0.2 psi/foot)	**24**	0.673
30-025-04643	EUNICE MONUMENT SOUTH UNIT #357	11/1/23	11576	764	3684	737	WFX-785 741 PSI (0.2 psi/foot)	**23**	0.672
30-025-04643	EUNICE MONUMENT SOUTH UNIT #357	12/1/23	12014	762	3684	737	WFX-785 741 PSI (0.2 psi/foot)	**21**	0.672
30-025-04643	EUNICE MONUMENT SOUTH UNIT #357	1/1/22	10543	761	3684	737	WFX-785 741 PSI (0.2 psi/foot)	**20**	0.672
30-025-04643	EUNICE MONUMENT SOUTH UNIT #357	1/1/23	10543	761	3684	737	WFX-785 741 PSI (0.2 psi/foot)	**20**	0.672
30-025-04643	EUNICE MONUMENT SOUTH UNIT #357	5/1/22	11170	760	3684	737	WFX-785 741 PSI (0.2 psi/foot)	**19**	0.671
30-025-04643	EUNICE MONUMENT SOUTH UNIT #357	11/1/22	10780	759	3684	737	WFX-785 741 PSI (0.2 psi/foot)	**18**	0.671
30-025-04643	EUNICE MONUMENT SOUTH UNIT #357	3/1/22	10250	756	3684	737	WFX-785 741 PSI (0.2 psi/foot)	**15**	0.670
30-025-04643	EUNICE MONUMENT SOUTH UNIT #357	3/1/23	10250	756	3684	737	WFX-785 741 PSI (0.2 psi/foot)	**15**	0.670
30-025-04643	EUNICE MONUMENT SOUTH UNIT #357	10/1/22	11057	755	3684	737	WFX-785 741 PSI (0.2 psi/foot)	**14**	0.670
30-025-04643	EUNICE MONUMENT SOUTH UNIT #357	6/1/22	10720	752	3684	737	WFX-785 741 PSI (0.2 psi/foot)	**11**	0.669
30-025-04643	EUNICE MONUMENT SOUTH UNIT #357	7/1/22	11165	748	3684	737	WFX-785 741 PSI (0.2 psi/foot)	**7**	0.668
30-025-04642	EUNICE MONUMENT SOUTH UNIT #358	4/1/24	7350	870	3691	738	R-7766 0.2 PSI/foot	**132**	0.701
30-025-04642	EUNICE MONUMENT SOUTH UNIT #358	3/1/24	8864	778	3691	738	R-7766 0.2 PSI/foot	**40**	0.676
30-025-04697	EUNICE MONUMENT SOUTH UNIT #368	1/1/23	0	759	3726	745	R-7766 0.2 PSI/foot	**14**	0.669
30-025-04697	EUNICE MONUMENT SOUTH UNIT #368	1/1/22	0	759	3726	745	R-7766 0.2 PSI/foot	**14**	0.669
30-025-04697	EUNICE MONUMENT SOUTH UNIT #368	7/1/22	0	747	3726	745	R-7766 0.2 PSI/foot	**2**	0.665
30-025-04641	EUNICE MONUMENT SOUTH UNIT #388	3/1/23	0	786	3693	739	R-7766 0.2 PSI/foot	**47**	0.678
30-025-04641	EUNICE MONUMENT SOUTH UNIT #388	1/1/23	0	785	3693	739	R-7766 0.2 PSI/foot	**46**	0.678
30-025-04641	EUNICE MONUMENT SOUTH UNIT #388	1/1/22	0	785	3693	739	R-7766 0.2 PSI/foot	**46**	0.678
30-025-04641	EUNICE MONUMENT SOUTH UNIT #388	4/1/22	14569	782	3693	739	R-7766 0.2 PSI/foot	**43**	0.677
30-025-04641	EUNICE MONUMENT SOUTH UNIT #388	4/1/23	14569	782	3693	739	R-7766 0.2 PSI/foot	**43**	0.677
30-025-04641	EUNICE MONUMENT SOUTH UNIT #388	4/1/24	24932	779	3693	739	R-7766 0.2 PSI/foot	**40**	0.676
30-025-04641	EUNICE MONUMENT SOUTH UNIT #388	3/1/24	26487	761	3693	739	R-7766 0.2 PSI/foot	**22**	0.671
30-025-04641	EUNICE MONUMENT SOUTH UNIT #388	2/1/24	19932	757	3693	739	R-7766 0.2 PSI/foot	**18**	0.670
30-025-04641	EUNICE MONUMENT SOUTH UNIT #388	1/1/24	1	748	3693	739	R-7766 0.2 PSI/foot	**9**	0.668
30-025-04641	EUNICE MONUMENT SOUTH UNIT #388	12/1/23	18257	747	3693	739	R-7766 0.2 PSI/foot	**8**	0.667
30-025-04641	EUNICE MONUMENT SOUTH UNIT #388	10/1/23	27285	745	3693	739	R-7766 0.2 PSI/foot	**6**	0.667
30-025-04641	EUNICE MONUMENT SOUTH UNIT #388	11/1/23	26565	745	3693	739	R-7766 0.2 PSI/foot	**6**	0.667
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	12/1/22	3734	826	3676	735	R-7766 0.2 PSI/foot	**91**	0.690
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	1/1/22	3249	818	3676	735	R-7766 0.2 PSI/foot	**83**	0.688
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	1/1/23	3249	818	3676	735	R-7766 0.2 PSI/foot	**83**	0.688
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	3/1/22	2562	808	3676	735	R-7766 0.2 PSI/foot	**73**	0.685
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	3/1/23	2562	808	3676	735	R-7766 0.2 PSI/foot	**73**	0.685
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	4/1/22	3454	804	3676	735	R-7766 0.2 PSI/foot	**69**	0.684
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	4/1/23	3454	804	3676	735	R-7766 0.2 PSI/foot	**69**	0.684
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	5/1/22	3418	799	3676	735	R-7766 0.2 PSI/foot	**64**	0.682

30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	6/1/22	2284	799	3676	735	R-7766 0.2 PSI/foot	**64**	0.682
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	7/1/22	3969	796	3676	735	R-7766 0.2 PSI/foot	**61**	0.682
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	8/1/22	3760	796	3676	735	R-7766 0.2 PSI/foot	**61**	0.682
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	11/1/22	3751	796	3676	735	R-7766 0.2 PSI/foot	**61**	0.682
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	10/1/22	3684	785	3676	735	R-7766 0.2 PSI/foot	**50**	0.679
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	11/1/23	4307	752	3676	735	R-7766 0.2 PSI/foot	**17**	0.670
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	10/1/23	5146	751	3676	735	R-7766 0.2 PSI/foot	**16**	0.669
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	1/1/24	4455	750	3676	735	R-7766 0.2 PSI/foot	**15**	0.669
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	4/1/24	4132	749	3676	735	R-7766 0.2 PSI/foot	**14**	0.669
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	12/1/23	4508	748	3676	735	R-7766 0.2 PSI/foot	**13**	0.668
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	5/1/24	4297	748	3676	735	R-7766 0.2 PSI/foot	**13**	0.668
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	3/1/24	4269	748	3676	735	R-7766 0.2 PSI/foot	**13**	0.668
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	2/1/24	4112	747	3676	735	R-7766 0.2 PSI/foot	**12**	0.668
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	6/1/23	3161	745	3676	735	R-7766 0.2 PSI/foot	**10**	0.668
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	2/1/22	1386	737	3676	735	R-7766 0.2 PSI/foot	**2**	0.665
30-025-04633	EUNICE MONUMENT SOUTH UNIT #396	2/1/23	1386	737	3676	735	R-7766 0.2 PSI/foot	**2**	0.665
30-025-04647	EUNICE MONUMENT SOUTH UNIT #398	1/1/23	0	758	3689	738	R-7766 0.2 PSI/foot	**20**	0.670
30-025-04647	EUNICE MONUMENT SOUTH UNIT #398	1/1/22	0	758	3689	738	R-7766 0.2 PSI/foot	**20**	0.670
30-025-04647	EUNICE MONUMENT SOUTH UNIT #398	3/1/23	0	755	3689	738	R-7766 0.2 PSI/foot	**17**	0.670
30-025-04647	EUNICE MONUMENT SOUTH UNIT #398	11/1/23	7184	754	3689	738	R-7766 0.2 PSI/foot	**16**	0.669
30-025-04647	EUNICE MONUMENT SOUTH UNIT #398	10/1/23	12878	751	3689	738	R-7766 0.2 PSI/foot	**13**	0.669
30-025-04647	EUNICE MONUMENT SOUTH UNIT #398	12/1/22	0	746	3689	738	R-7766 0.2 PSI/foot	**8**	0.667
30-025-04647	EUNICE MONUMENT SOUTH UNIT #398	4/1/22	2589	746	3689	738	R-7766 0.2 PSI/foot	**8**	0.667
30-025-04647	EUNICE MONUMENT SOUTH UNIT #398	4/1/23	2589	746	3689	738	R-7766 0.2 PSI/foot	**8**	0.667
30-025-04647	EUNICE MONUMENT SOUTH UNIT #398	8/1/23	1	740	3689	738	R-7766 0.2 PSI/foot	**2**	0.666

API	Count of Pressure Exceedances
30-025-04330	5
30-025-04419	1
30-025-04425	3
30-025-04464	4
30-025-04469	7
30-025-04471	11
30-025-04472	6
30-025-04496	1
30-025-04503	9
30-025-04518	15
30-025-04532	5
30-025-04539	4
30-025-04554	2
30-025-04568	3
30-025-04571	3
30-025-04583	6
30-025-04592	4
30-025-04598	10
30-025-04605	1
30-025-04629	7
30-025-04633	24
30-025-04640	10
30-025-04641	12
30-025-04642	2
30-025-04643	16
30-025-04647	9
30-025-04697	3
30-025-06283	1
30-025-06290	9
30-025-06304	1
30-025-06306	14
30-025-08702	7
30-025-12543	2
30-025-29575	19
30-025-29598	11
30-025-29615	19
30-025-29867	6
Grand Total	**272**

OCD Unit Hearing Document
08397_4647

Geological Data
Injection Zones
in the
Proposed Eunice Monument South Unit

Penrose - Approx. depth 3,400'-3,800*, approx. 170 gross feet.

The Penrose is the lower portion of the Queen formation and overlies the Grayburg. The Penrose is composed of alternating layers of hard dolomite and sand lenses. The Penrose is productive of oil and/or gas, depending on structural position.

Grayburg - Approx. depth 3,500'-3,900*, approx. 490 gross feet.

The Grayburg is a massive dolomite with thin stringers of sand interspersed within it. The majority of oil production comes from intercrystalline porosity in the dolomite.

The range in depths to the top of the Grayburg is due to an asymmetrical anticlinal structure running NW to SE through the Eunice-Monument Pool. The structure dips steeply along the western and southern flanks and therefore the Grayburg top runs deeper, approximately 3,700'-3,900'. Along the axis and the gently dipping eastern flank of the anticline the Grayburg depths run at approximately 3,500-3,700 feet.

San Andres - Approx. depth 4,100'-4,500*, approx. 1,130 gross feet.

The San Andres is a massive dolomite with intercrystalline porosity, which lies directly below the Grayburg. The contact between the Grayburg and the San Andres is gradational and there is no clear marker for the top of the San Andres which can be traced across the field. The San Andres contributes very little if any oil production to the field and serves primarily as a source for injection make-up water and as a zone for salt water disposal.

There are no known faults cutting through the San Andres and Grayburg which would act as a conduit for gas, oil or injection water to seep into fresh water horizons above the injection zones in the Grayburg and San Andres.

* Depth depends upon structural position of the well.

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-15
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775,
24018 – 24020, 24025, 24123

The EMSU Waterflood Project: A Case History of Infill Drilling, Completions, and Workovers

R.K. Mitchell, SPE, Chevron U.S.A., and **G.S. Salvo,** SPE, Greenhill Petroleum Corp.

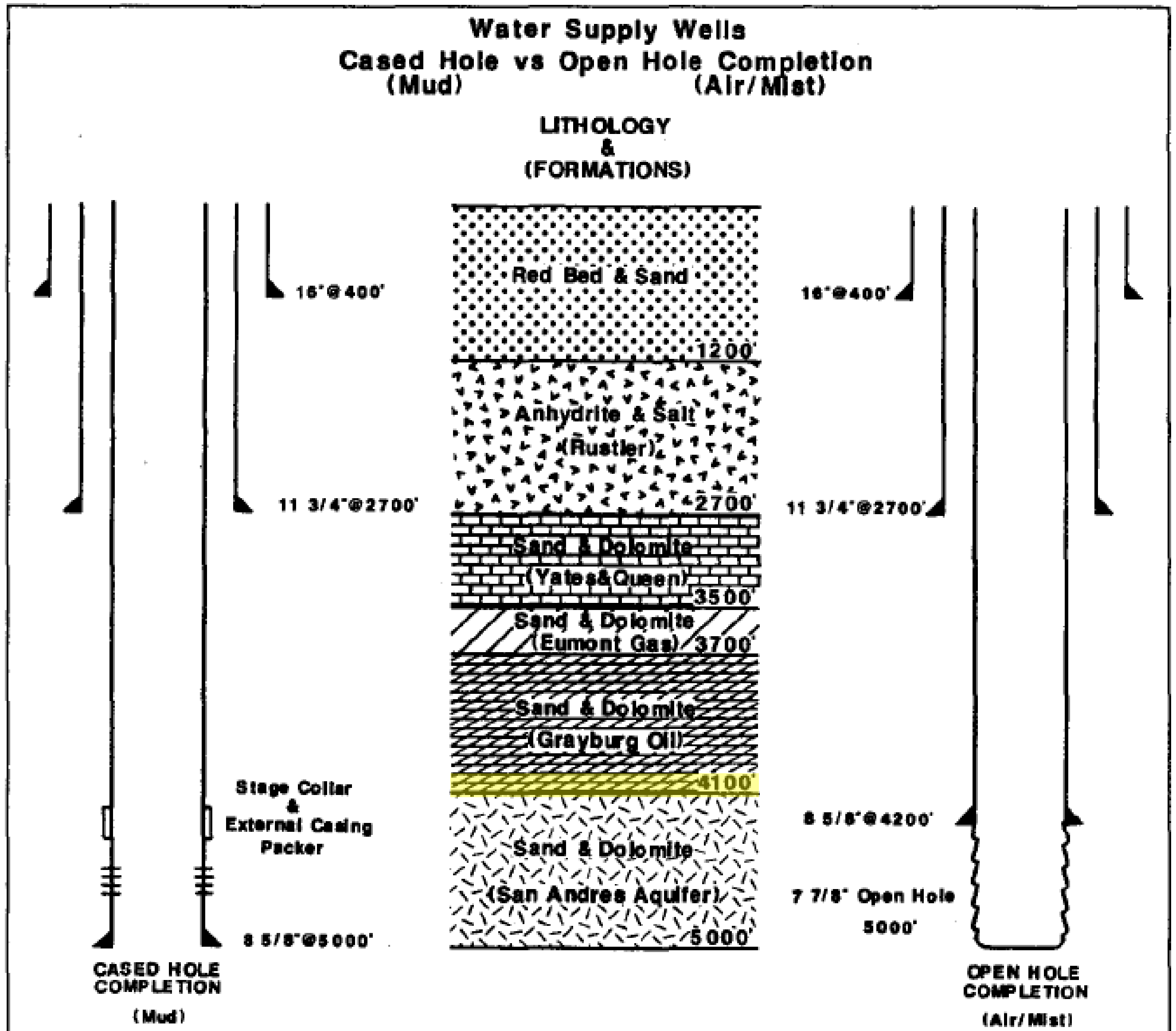


Fig. 6—EMSU water-supply casing programs and lithology diagram.

resulted in high mud costs and large stimulation treatments to begin production. It also required two-stage cementing techniques to ensure good cement bonding across the low-pressure San Andres aquifer.

The first and second water-supply wells were drilled in a similar fashion. The 16-in. surface casing was set at 400 ft, and 11¾-in. intermediate casing was later run to the base of the salt section at 2,700 ft. Both wells were then cored through the Grayburg pay zone and reached TD in the lower San Andres at 5,000 ft. Then, 8⅝-in. production casing was run to TD and cemented to surface in two stages with a stage collar and an external casing packer (**Fig. 6**). The larger-casing program was necessary to facilitate the running of large-OD submersible pumps.

Although the first two supply wells were successful (production rates were 10,500 and 14,800 BWPD, respectively), several problems still existed. The mud costs and formation damage were excessive. The first well (EMSU No. 457WSW) required three separate acid-stimulation jobs to initiate the expected production. The second well (EMSU No. 461WSW) required a large two-stage acid-stimulation treatment to remove the formation damage. Also, the cement-bond logs run across the San Andres aquifer showed poor bonding.

Because of these problems and the successes seen with the air/mist drilling system, the borehole configuration of the following water-supply wells were altered slightly. Instead of drilling 10⅝-in. production hole and running 8⅝-in. casing to TD, 10⅝-in. hole was drilled to the top of the San Andres (roughly 4,200 ft) and cased off. After 8⅝-in. casing was run, the air/mist system was rigged up, 7⅞-in. hole was drilled to TD at 5,000 ft, and the San Andres open hole was completed (Fig. 6). These changes decreased mud costs from $24,000 to $4,000/well, increased ROP from 25 to 45 ft/hr, and eliminated the need for stimulation treatments (Figs. 4 and 5). The decreased costs on the last four water-supply wells (six were drilled), a result of drilling with the air/mist system, setting 8⅝-in. casing at the top of the San Andres, and openhole completion, cut total well costs by 15%. The decrease in completion costs alone was more than 24%. In total, more than $250,000 was saved on the last four water-supply wells.

The high-volume water-supply wells were completed with state-of-the-art large-horsepower submersible pumps. Several important design criteria, such as reduced torque and voltage startup and minimized startups/shutdowns, were incorporated into the running of these submersible pumps. Because of the large voltage and amperage requirements (3,000 V, 100 A), the resulting startup torque and backlash of the 300-hp motors was of sufficient magnitude to create backoff of the production tubing. Therefore, surface voltage-reducing equipment was used to minimize startup torque and to decrease power surges to the motor.

Results with the state-of-the-art surface and downhole submersible equipment have been outstanding. Currently, the six water-supply wells are capable of producing nearly 90,000 BWPD. To date, these six wells have produced more than 20,000,000 bbl of water with only one motor/pump failure. This failure was attributed to a surface power surge and not an actual motor problem. Most recently, one of the six pumps was upgraded from 300 to 440 hp, which increased production from 13,000 to 22,000 BWPD. Future upgradings are planned as water needs increase.

Workover Deepenings

To complete preparation of the five-spot waterflood patterns, more than 298 existing wells had to be worked over and/or deepened. This task was to be the largest of the proposed waterflood because the average age of the 298 existing wellbores was more than 50 years. Most of the wells were originally openhole completed in the top of the Grayburg oil zone; therefore, more than 270 of these wells (roughly 90%) required deepening to penetrate the overall oil-producing interval.

The first 75 wells were deepened with mud containing large quantities of LCM. Results with the mud system were very similar to those seen during drilling of the early replacement wells. Large volumes of mud were lost to the formation, and the subsequent acid-cleanup jobs were detrimental to the depleted Grayburg pay zone. Load-water losses to the formation averaged more than 800 bbl/well and delayed oil production from 1 month to as long as 1 year. Workovers averaged more than $67,000/well and lasted 9 days.

Because of these problems, several air/mist packages consisting of a 1,200-ft^3/min compressor, a 3,000-ft^3/min booster, and 1,500-psi triplex mist pump were used in the field. Initially, we were concerned about the economics of using the complete air/mist packages on relatively low-cost workovers. The results, however, showed a substantial savings in all aspects of operations.

First, the average deepening on an EMSU workover was 110 ft. ROP's with mud averaged 6.7 ft/hr (4¾-in. hole), while ROP's with the air/mist system averaged more than 13.2 ft/hr (4¾-in. hole), a 97% difference in ROP (Fig. 4). Second, load water lost to the formation decreased from more than 800 to less than 400 bbl/well. Stimulation treatments after cleaning out and deepening with the air/mist system were minimized and often eliminated on the basis of postdeepening swab tests. Oil production after deepening through the depleted Grayburg zone with the air/mist system was almost instantaneous. By eliminating mud usage, increasing ROP, and minimizing stimulation requirements, we cut workover costs to less than $51,000/well and days per workover to less than 7.

Overall, use of the air/mist system cut job time by more than 22%, decreased load-water losses by more than 50%, and increased ROP by 97%. Workover costs were cut by more than 24% ($16,000/well) with the air/mist system (Fig. 5). To date, this represents a cost saving of more than $2.32 million. Total cost savings for the project are estimated to be more than $3.3 million.

Remedial Workovers

Years of production have severely depleted the EMSU reservoir and corroded the wellbores. Also, most of the existing well files were poorly kept and lack necessary information. During workover operations, nearly one of every four wells encountered junk during cleanout and deepening operations. The type and extent of the junk encountered was often unknown, which tended to compound fishing problems. To date, 10 wells have encountered junk that cannot be fished or have been named uneconomical for fishing operations. Of these 10 wells, two were sidetracked with cement plugs in the open hole, while the other eight cut windows through the existing casing strings. All 10 sidetrack operations were successful from both operational and economic standpoints. By salvaging these wellbores and making them usable, we saved more than $750,000 in replacement well costs in the past 2 years.

Also, more than 20 liners have been run to provide zonal isolation, to shut off high-water-producing intervals, and to cover damaged or parted casing. Liner sizes have varied from 4 to 5½ in. Of the 20 liners run, 18 were successfully cemented; the remaining two required small-liner top-squeeze jobs. One 4-in. flush-joint casing string was successfully run through three intervals of parted and misaligned casing by welding of a mule-shoed/doglegged tubing sub as an alignment guide on the float shoe. To date, more than 270 workovers have been performed with only one wellbore lost. This success rate is the greatest accomplishment of the project, considering the age and type of wells.

The liners and deeper casing leaks were cemented with a controlled-fluid-loss Class C slurry containing small quantities of LCM. Controlled-fluid-loss slurries were necessary to prevent instantaneous setting of the cement when it came in contact with the semidry formation walls caused by air/mist drilling. Casing leaks and water shutoffs were squeezed by leading with controlled-fluid-loss Class C cement and tailing with Class C neat cement. This two-slurry system was very successful; the success rate during squeezing was >90%.

During cleanout and deepening operations, the junk encountered included rod pumps, tubing, openhole packers, and various types of cable tool equipment. Most of the junk was severely corroded and had to be washed over and crammed into the washpipe to catch the fish effectively. During fishing with the air/mist system, higher fluid rates (2 to 3 bbl/min vs. ½ to 1 bbl/min) were needed to cool the washover shoes. Two fishing jobs resulted from early metal fatigue. Increasing the fluid rates solved this problem.

EMSU Water Supply Well Reported SADR Tops

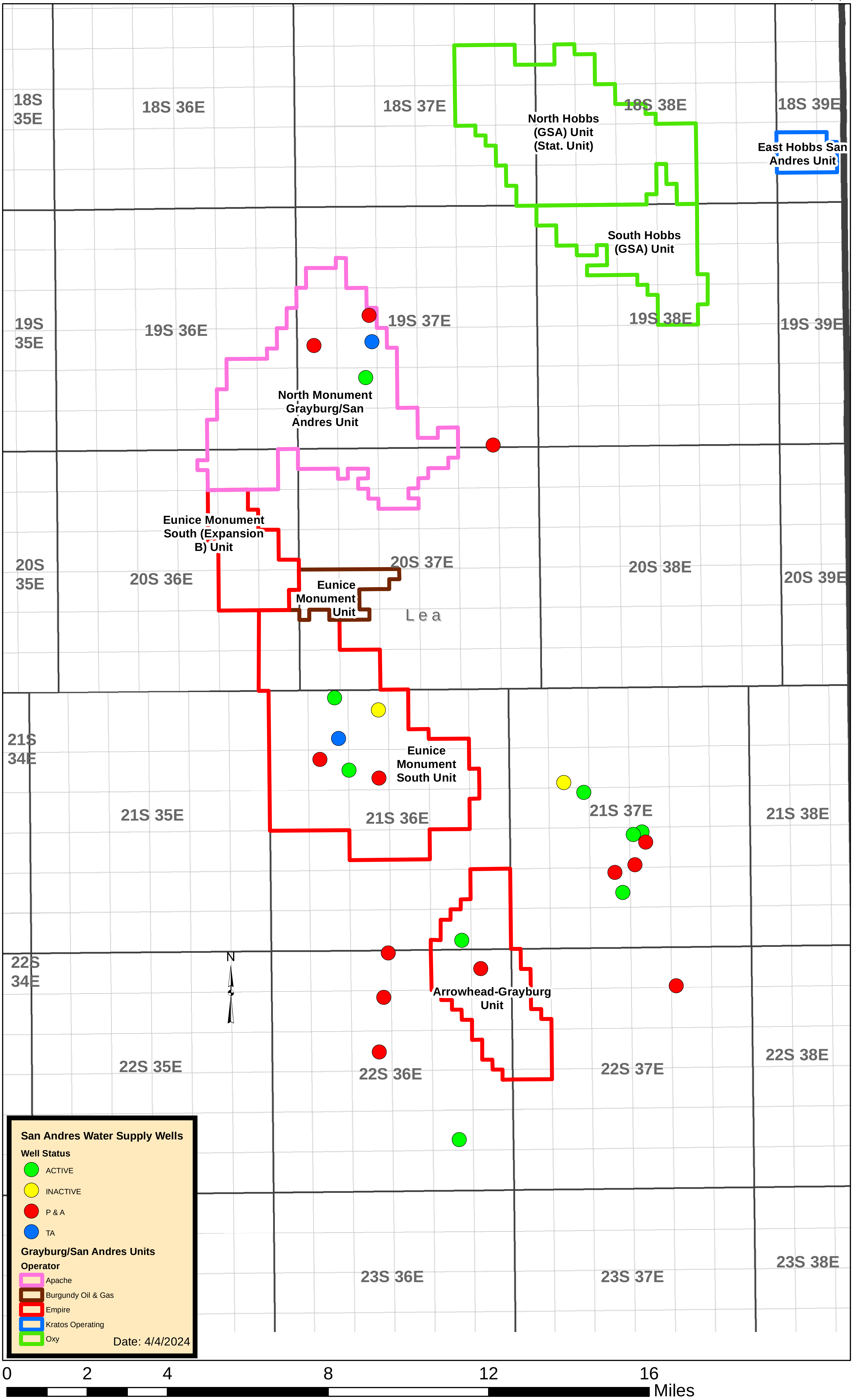
API	Well Name	Well Number	GNM SADR Pick	Well File SADR Pick	GNM/File Pick Diff	Well File GRBG Iso	GNM GRB Iso	
30-025-29149	EMSU	457	4216	4232	-16	509	493	
30-025-29618	EMSU	458	4050	4050	0	410	410	
30-025-29826	EMSU	459	4070	4120	-50	498	448	
30-025-29620	EMSU	460	4280	4276	4	512	516	
30-025-29621	EMSU	461	4195	4002	193	255	448	
30-025-29622	EMSU	462	4236	4200	36	439	475	
						437	465	AVG GRBG Thickness

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-17
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775,
24018 – 24020, 24025, 24123

EMSU Water Supply Well NAME	API		Location	Status	Start	End	Years as Active WSW	Documented Measured Volumes	Reconstructed from Tests and Modeled Averages	Total Water Bbls extracted from the San Andres
Chevron WSW EMSU #457	025	29149	Q - 5 - 21S - 36E	T&A	1987	2004	17	27,292,824	14,876,823	42,169,647
Chevron WSW EMSU #458	025	29618	I - 4 - 21S - 36E	Active	1987	2013	26	35,546,076	13,986,538	49,532,614
Chevron WSW EMSU #459	025	29826	B - 5 - 21S - 36E	Active	1987	2024	37	78,806,786	24,744,166	103,550,952
Chevron WSW EMSU #460	025	29620	C - 8 - 21S - 36E	P&A	1987	2002	15	33,145,521	31,972,778	65,118,299
Chevron WSW EMSU #461	025	29621	I - 9 - 21S - 36E	P&A	1987	2002	15	8,452,395	10,912,797	19,365,192
Chevron WSW EMSU #462	025	29622	L - 9 - 21S - 36E	recomplete	1987	2005	18	45,502,836	25,974,689	71,477,525
								Barrels	**Barrels**	**Barrels**
								228,746,438	122,467,791	351,214,229

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-18
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775,
24018 – 24020, 24025, 24123

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-19
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775, 24018 – 24020, 24025, 24123



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Dawson Drilling Report
Day 6

Well Name:	Andre Dawson SWD #1				Date:	12/05/2022		Day:	6	Report:	8	Planned TD	5,720'
Spud Date/Time:	08:30 hours 11/30/22				Rig Name:	UDI #52		Rig Manager / Number:					
Present Ops:	Drilling 12 1/4" Vertical hole					Consultant:		Jeremy Counahan (day) & Cole Dame (night)				Deviation Surveys	
TVD:	4,140'	TMD:	4,140'		Footage:	790'	Consult. #	806-777-3049 ; 432-557-0505				Depth	Angle
Ops for Next 24hrs:		Continue Drilling 12 1/4" Hole					Satellite #					3,324'	0.8 / 89.1
Mud Type	Wt	Vis	PH		Pm	Pf / Mf	Gel Strengths 10/10		Daily OBM Total Volume			3,514'	0.8 / 86.1
Spud Mud/Native	10.3	30	10									3,609'	0.6 / 83.2
DP/DC Volume	Solids	Chlorides	Calcium		Total Hard	Pv	Yp	WL	OBM Losses Daily/Cum			3,800'	0.3 / 76.1
									/			3,894'	0.3 / 86.3
Annular Vol DC							Btms Up	Full Circ	Diesel Added to OBM Daily/Cum			3,989'	0.3 / 102.5
									/			4,084'	0.4 / 114.9
Annular Vol DP	WOB Min / Max		RPM Min / Max		SPM	GPS	GPM	BPS	On/Off B Pressure		Rot Wt	PU Wt	SO Wt
	4 to 20		25-60		115	4.91	585	0.117	1,850	1,550	147	149	142
Pit Volume									On Bottom Torque			KOP	EOC
700bbl									7,850				
									Off Bottom Torque				
									3500				
Notable Weather Conditions													

From	To	Hours	Activity for Previous 24 Hours
6:00	15:30	9.50	Drill 12 1/4 vertical hole F/3350' to /3,670' 320'@ 33.6 fph, 55 RPM, 1,775 psi, 5-20K WOB
15:30	16:30	1.00	Slide drilling 12 1/4 vertical hole F/3,670' to / 3,685' 15' @ 15 fph, 0 rpm , 1750 psi, 6k WOB
16:30	0:00	7.50	Drill 12 1/4 vertical hole F/3670' to 3961' 291' @ 38.8 fph, 55 RPM, 1,775 psi, 5-20K WOB
0:00	6:00	6.00	Drill 12 1/4 vertical hole F/3961' to 4140' 179' @ 29.8 fph, 55 RPM, 1,775 psi, 5-20K WOB
		0.00	
		0.00	
		0.00	
		0.00	
		0.00	
		0.00	
		0.00	
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		0.00	
		0.00	
		0.00	
		0.00	
		0.00	Minor Seepage Noticed @ 4000' Began adding Magma Fiber to control
		0.00	Received 81 Joints of 9 5/8" Casing
		0.00	losing 22 BPH started @ 4,295'
		0.00	Top of rustler came in @ 1,365'

“Losing 22 BPH started @ 4,295”

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-20
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775,
24018 – 24020, 24025, 24123

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Dawson Drilling Report
Day 7

"We have been dry drilling with total losses from 4,564. We have pumped an estimated 7,700 bbls of produced water down hole"

Well Name:	Andre Dawson SWD #1				Date:	12/06/2022		Day:	7	Report:	9	Planned TD	5,720'
Spud Date/Time:	08:30 hours 11/30/22				Rig Name:	UDI #52		Rig Manager / Number:					
Present Ops:	Drilling 12 1/4" Vertical hole					Consultant:		Jeremy Counahan (day) & Cole Dame (night)				Deviation Surveys	
TVD:	4,970'	TMD:	4,970'		Footage:	830'	Consult. #	806-777-3049 ; 432-557-0505				Depth	Angle
Ops for Next 24hrs:		Continue Drilling 12 1/4" Hole					Satellite #					4,178'	0.5
Mud Type	Wt	Vis	PH		Pm	Pf / Mf	Gel Strengths 10/10		Daily OBM Total Volume			4,274'	0.7
Spud Mud/Native	10.3	30	10									4,396'	0.6
DP/DC Volume	Solids	Chlorides	Calcium		Total Hard	Pv	Yp	WL	OBM Losses Daily/Cum			4,464'	0.7
									/			4,559'	0.6
Annular Vol DC							Btms Up	Full Circ	Diesel Added to OBM Daily/Cum			4,749'	0.6
									/			4,844'	0.7
Annular Vol DP	WOB Min / Max		RPM Min / Max		SPM	GPS	GPM	BPS	On/Off B Pressure		Rot Wt	PU Wt	SO Wt
	4 to 20		25-60		85	4.91	440	0.117	1,850	1,550	147	149	142
Pit Volume									On Bottom Torque			KOP	EOC
700bbl									7,850				
									Off Bottom Torque				
									3500				
Notable Weather Conditions													

From	To	Hours	Activity for Previous 24 Hours
6:00	16:30	10.50	Drill 12 1/4 vertical hole F/4,140' to 4,560' 420' @ 40 fph, 55 RPM, 1,775 psi, 5-20K WOB (Lost Returns @ 4,562')
16:30	0:00	7.50	Drill 12 1/4 vertical hole F/4,560' to 4,786' 226' @ 30.1 fph, 55 RPM, 1,775 psi, 5-20K WOB (Dry Drill)
0:00	6:00	6.00	Drill 12 1/4 vertical hole F/4,786' to '4,970 ' 186 @ 30.0 fph, 55 RPM, 600 psi, 5-20K WOB (Dry Drill)
		0.00	
		0.00	
		0.00	
		0.00	
		0.00	
		0.00	We have been dry drilling with total losses from 4,562'. We have pumped an estimated 7,700 bbls of produced water down hole
		0.00	
		0.00	
		0.00	
		0.00	

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Dawson Drilling Report Day 8

"Drill 12 ¼ vertical hole F/5,740 to 5,760 A 20 fph, 600 psi, 5-20K WOB (Dry Drill)"

Well Name:	Andre Dawson SWD #1	**Date:**	12/07/2022	**Day:**	9	**Report:**	11	**Planned TD**	5,7[illegible]0'
Spud Date/Time:	08:30 hours 11/30/22	**Rig Name:**	UDI #52	**Rig Manager / Number:**					
Present Ops:	Drilling 12 1/4" Vertical hole	**Consultant:**	Jeremy Counahan (day) & Cole Dame (night)						
TVD:	5,760'	**TMD:**	5,760'	**Footage:**	20'	**Consult. #**	806-777-3049 ; 432-557-0505		
Ops for Next 24hrs:	Continue Drilling 12 1/4" Hole	**Satellite #**							

Mud Type	**Wt**	**Vis**	**PH**	**Pm**	**Pf / Mf**	**Gel Strengths 10/10**		**Daily OBM Total Volume**	
Spud Mud/Native	10.3	30	10						
DP/DC Volume	**Solids**	**Chlorides**	**Calcium**	**Total Hard**	**Pv**	**Yp**	**WL**	**OBM Losses Daily/Cum**	
								/	
Annular Vol DC						**Btms Up**	**Full Circ**	**Diesel Added to OBM Daily/Cum**	
								/	
Annular Vol DP	**WOB Min / Max**	**RPM Min / Max**	**SPM**	**GPS**	**GPM**	**BPS**	**On/Off B Pressure**		**Rot Wt**
	4 to 20	25-60	100	4.91	490	0.117	1,175	900	178
Pit Volume							**On Bottom Torque**		
700bbl							7,850		
							Off Bottom Torque		
							3500		
Notable Weather Conditions									

Deviation Surveys	
Depth	**Angle**
4,940'	0.6 / 77.1
5,130'	0.7 / 56.2
5,226'	0.7 / 74.2
5,321'	0.8 / 54.0
5,416'	0.8 / 59.9
5,510'	0.8 / 64.1
5,605'	1.1 / 86.5
PU Wt	**SO Wt**
182	173
KOP	**EOC**

From	To	Hours	Activity for Previous 24 Hours
6:00	7:00	1.00	Drill 12 1/4 vertical hole F/5,740' to 5,760' @ 20 fph, 55 RPM, 600 psi, 5-20K WOB (Dry Drill)
7:00	10:00	3.00	Circulate well clean for short trip / pump 3 sweeps high-vis downhole
10:00	12:00	2.00	Short trip to the hole to 3,000' and back to bottom before laying down dp & bha
12:00	15:00	3.00	Condition hole for 9 5/8" csg
15:00	20:00	5.00	TOH laying to 4 1/2 DP
20:00	21:00	1.00	Lay Down 12 1/4" BHA
21:00	22:00	1.00	Pull Wear Bushing and Prep Floor for running casing
22:00	0:00	2.00	Rig Up Casing Crew
0:00	6:00	6.00	Run 9 5/8" Casing F/0' T/3,600'
		0.00	

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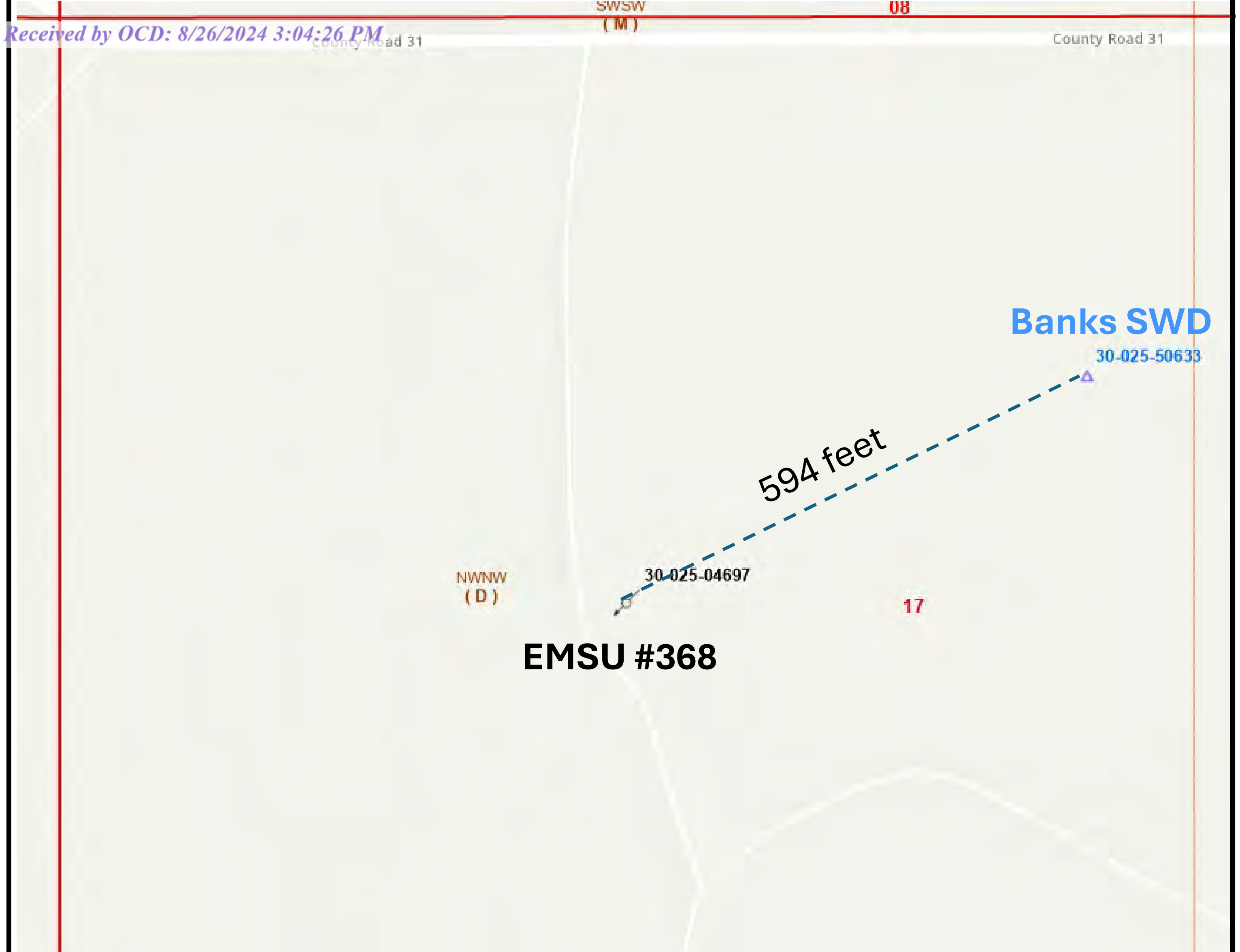
Well	FL Date	SITP	FL (from SL)	Top Perf	Mid Perf	Base Perf	BHP at Mid Perf	Gradient	SW Gradient
Dawson #1	7/20/2024	-13	894	4370	4948	5525	1872	0.378	0.465
Ernie Banks #1	7/20/2024	-13	860	4490	4955	5420	1891	0.382	
Nolan Ryan #1	7/20/2024	-13	781	4486	4575	4664	1751	0.383	
Pedro #1	7/20/2024	-10	826	4440	5270	6100	2056	0.390	
Piper #2	7/20/2024	-10	1042	4100	4368	4635	1536	0.352	
Ryno 17 #1	7/20/2024	-13	868	4380	4970	5560	1894	0.381	
Sosa 17 #2	7/20/2024	-13	901	4592	4961	5330	1875	0.378	
Scully State #1	7/20/2024	-11	811	4624	5187	5750	2024	0.390	
Ted 28 #1	7/20/2024	-10	847	4630	5432	6234	2122	0.391	
Yaz 28 #1	7/20/2024	-10	801	4650	5014	5378	1949	0.389	
			863				**1897**	**0.381**	
			AVG FL				**AVG BHP**	**AVG Gradient**	

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-21
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775,
24018 – 24020, 24025, 24123

API	Well Name	OCD C-115 Report Month	Inj. BBLs	Reported SITP	Top Perf	Mid Perf	Bottom Perf	BHP @ Mid Perf	Gradient	SW Gradient
30-025-06306	EUNICE MONUMENT SOUTH UNIT #134	Sep-23	0	308	3732	3786	3840	2068	0.546	0.465
30-025-04493	EUNICE MONUMENT SOUTH UNIT #183	Sep-23	0	674	3700	3752	3803	2418	0.645	
30-025-29683	EUNICE MONUMENT SOUTH UNIT #225	Sep-23	0	121	3788	3889	3990	1929	0.496	
30-025-04467	EUNICE MONUMENT SOUTH UNIT #229	Sep-23	0	583	3646	3755	3864	2329	0.620	
30-025-04489	EUNICE MONUMENT SOUTH UNIT #241	Sep-23	0	641	3660	3778	3896	2398	0.635	
30-025-04518	EUNICE MONUMENT SOUTH UNIT #243	Sep-23	0	375	3772	3906	4040	2191	0.561	
30-025-04571	EUNICE MONUMENT SOUTH UNIT #299	Sep-23	0	587	3718	3808	3897	2357	0.619	
30-025-04616	EUNICE MONUMENT SOUTH UNIT #312	Sep-23	0	6	3723	3782	3841	1765	0.467	
30-025-29882	EUNICE MONUMENT SOUTH UNIT #316	Sep-23	0	637	3752	3771	3790	2391	0.634	
30-025-04544	EUNICE MONUMENT SOUTH UNIT #334	Sep-23	0	518	3788	3903	4018	2333	0.598	
30-025-04583	EUNICE MONUMENT SOUTH UNIT #342	Sep-23	0	25	3706	3816	3925	1799	0.472	
30-025-04607	EUNICE MONUMENT SOUTH UNIT #348	Sep-23	0	449	3763	3865	3967	2246	0.581	
30-025-04652	EUNICE MONUMENT SOUTH UNIT #386	Sep-23	0	603	3422	3649	3875	2300	0.630	
30-025-04653	EUNICE MONUMENT SOUTH UNIT #400	Sep-23	0	585	3718	3875	4031	2387	0.616	
30-025-04665	EUNICE MONUMENT SOUTH UNIT #402	Sep-23	0	592	3794	3842	3890	2379	0.619	
30-025-04688	EUNICE MONUMENT SOUTH UNIT #404	Sep-23	0	604	3764	3898	4032	2417	0.620	
30-025-08711	EUNICE MONUMENT SOUTH UNIT #426	Sep-23	0	556	3772	3911	4050	2375	0.607	
30-025-35454	EUNICE MONUMENT SOUTH UNIT #622	Sep-23	0	592	3760	3871	3981	2392	0.618	
30-025-04272	EUNICE MONUMENT SOUTH UNIT B #885	Sep-23	0	554	3782	3843	3904	2341	0.609	
30-025-04290	EUNICE MONUMENT SOUTH UNIT B #903	Sep-23	0	664	3840	4095	4350	2568	0.627	
30-025-04289	EUNICE MONUMENT SOUTH UNIT B #916	Sep-23	0	217	3824	4137	4450	2141	0.517	
			AVG SITP	**471**			**AVG BHP**	**2263**	**0.587**	**AVG Gradient**

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-22
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775, 24018 – 24020, 24025, 24123

Received by OCD: 8/26/2024 3:04:26 PM



BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-23
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775,
24018 – 24020, 24025, 24123

Banks SWD		
1/8/2024	PSI	Flow Rate
2:46:00 AM	-15	0
7:45:00 AM	-15	0
2:50:00 PM	-16	0
5:10:00 PM	-16	0
8:16:00 PM	-15	0
11:51:00 PM	-14	0

AVG PSI: -15

EMSU 368		
1/8/2024	PSI	Rate
2:03:09 AM	694	0
5:10:00 AM	692	0
8:16:52 AM	696	0
11:23:44 AM	698	0
2:30:36 PM	697	0
5:37:28 PM	697	0
8:44:19 PM	698	0
11:51:11 PM	699	0

AVG PSI: 696

Released to Imaging: 8/27/2024 11:10:50 AM

NEW MEXICO ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT

GARY E. JOHNSON
Governor
BETTY RIVERA
Cabinet Secretary

Lori Wrotenbery
Director
Oil Conservation Division

July 25, 2002

ChevronTexaco
15 Smith Road
Midland, Texas 79705

Attn: Mr. Kevin Hickey

RE: Injection Pressure Increase,
Eunice Monument South Unit
Waterflood Project
Lea County, New Mexico

Dear Mr. Hickey:

Reference is made to your request dated June 25, 2002, to increase the surface injection pressure on eleven wells within the above-referenced water flood project. This request is based on step rate tests conducted on the subject wells during October 2000, and held in suspense pending outcome of Division Case 12320. This case has been dismissed, test results have been reviewed, and we feel an increase in injection pressure on these wells is justified at this time.

Current tubing sizes remaining the same, you are therefore authorized to increase the surface injection pressure on the wells shown on Exhibit "A". The Division Director may rescind this injection pressure increase if it becomes apparent that the injected fluid is not being confined to the injection zone or is endangering any fresh water aquifers.

Sincerely,

Lori Wrotenbery (WVJ)

Lori Wrotenbery,
Director

LW/WVJ

cc: Oil Conservation Division - Hobbs
Files: R-7766; IPI-2002
Attachment

Exhibit "A"
ChevronTexaco
Eunice Monument South Unit (EMSU)
Lea County, New Mexico
Injection Pressure Increases

Injection Well and Location	Top Perf Depth Feet	Maximum Surface Injection Pressure
EMSU Well No. 126, API No. 30-025-06288 Lot 4, Section 30, T-20S, R-37E	3714	930 PSIG
EMSU Well No. 164, API No. 30-025-29820 (Unit K), Section 36, T-20S, R-36E	3762	1260 PSIG
EMSU Well No. 185, API No. 30-025-04512 Lot 2, Section 5, T-21S, R-36E	3670	870 PSIG
EMSU Well No. 245, API No. 30-025-04498 (Unit I), Section 5, T-21S, R-36E	3770	755 PSIG
EMSU Well No. 295, API No. 30-025-04560 (Unit F), Section 8, T-21S, R-36E	3745	770 PSIG
EMSU Well No. 307, API No. 30-025-08708 (Unit F), Section 11, T-21S, R-36E	3700	840 PSIG
EMSU Well No. 312, API No. 30-025-04616 (Unit J), Section 11, T-21S, R-36E	3723	860 PSIG
EMSU Well No. 318, API No. 30-025-29901 (Unit L), Section 10, T-21S, R-36E	3718	860 PSIG
EMSU Well No. 324, API No. 30-025-04554 (Unit J), Section 8, T-21S, R-36E	3707	875 PSIG
EMSU Well No. 336, API No. 30-025-04557 (Unit N), Section 8, T-21S, R-36E	3742	815 PSIG
EMSU Well No. 354, API No. 30-025-4640 (Unit B), Section 14, T-21S, R-36E	3720	744 PSIG

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-24
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775,
24018 – 24020, 24025, 24123

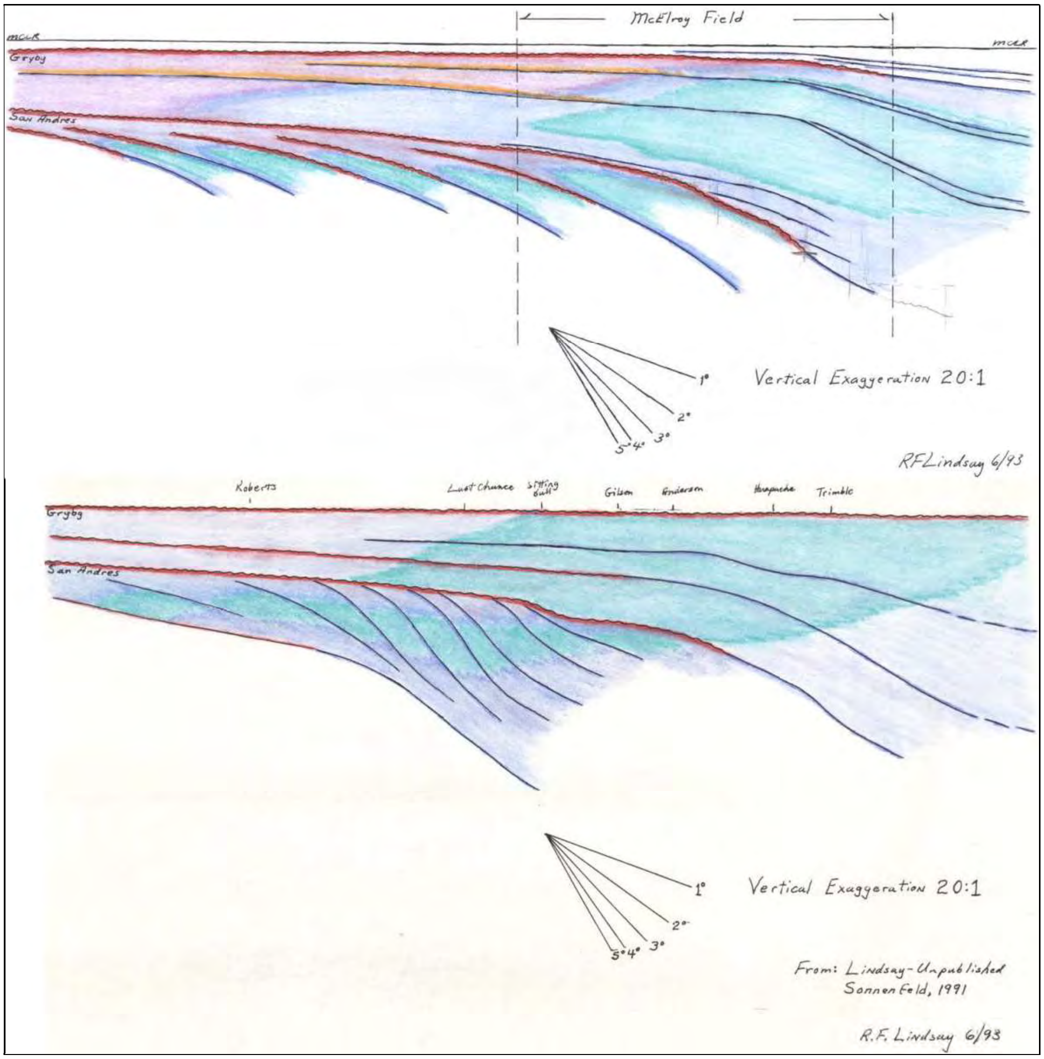


Figure 5.22. Conceptual model of the sequence stratigraphy of the Upper San Andres Formation and Grayburg Formation in McElroy field (top) and Guadalupe Mountains (bottom). Basinward shift of the Grayburg Formation was approximately 13 km (8 miles). Thickness and distance is not shown, but are to scale with a 20:1 vertical exaggeration. Basinward dip is shown in degrees. Similar lithofacies are similar colors. From Lindsay (1993) Chevron in-house data base. Upper San Andres Formation lithofacies and clinoforms in the Guadalupe Mountains are from Sonnenfeld (1991).

5.10a.10. Reservoir Seal

It has been found that the composite sequence boundary at the top of the Upper San Andres Formation acts as a reservoir seal and does not allow fluids to communicate with Grayburg Formation fluids. The ultimate test has come from pressure data that shows one pressure system associated with the Upper San Andres Formation and a different pressure system associated with the Grayburg Formation. The reason why the composite sequence boundary is not porous pathway from the Upper San Andres Formation up section into the Grayburg Formation is explained by subaerial exposure and karstification associated with the Upper San Andres Formation was cemented to form a tight non-porous interval of strata. Dolomitic sandstones at the base of the Grayburg Formation contain enough dolomitized carbonate matrix that they are also non-porous and non-permeable. Between these two the non-porous karst and non-porous basal sandstone a seal (aquiclude) was formed within the top of the Upper San Andres Formation and the basal Grayburg Formation.

The only way fluids have been found to flow from the Upper San Andres Formation up section into the Grayburg Formation was when paleotopography was present as is the case in North Monument Grayburg Unit (NMGU). In NMGU the Upper San Andres Formation paleotopographic ridge is the site of active bottom water ascending up section into Grayburg Formation strata. This process of a natural waterflood has swept the Grayburg Formation of any secondary recovery potential directly above the paleo-ridge. Another way that Upper San Andres Formation fluids mix with Grayburg Formation fluids is by faults/fractures connecting the two composite sequences. There have been places found in EMSU, EMSUB, and AGU where faults/fractures have allowed Upper San Andres Formation fluids to move up section into Grayburg Formation strata, which form vertically-oriented plumes of Upper San Andres Formation water within the Grayburg Formation. These localities tend to be only associated with one well, indicating that faults/fractures are localized in small areas.

5.10a.11. Conclusions

The following conclusions can be reached about the top of the Upper San Andres Formation composite sequence boundary that separates the Upper San Andres Formation from the Grayburg Formation:

- The disconformity that rests atop the Upper San Andres Formation is a type 1 sequence boundary
- The subaerial exposure surface (disconformity) at the top the Upper San Andres Formation was correlated throughout the subsurface of the Permian Basin by the 1930's
- In the Grayburg Formation type section and nearby subsurface reference section in the Northwest Shelf the top of the Upper San Andres Formation is capped by a subaerial exposure surface that was karstified
- In the Guadalupe Mountains (Carlsbad Shelf) on the west side of the Queen Plateau (north end of Shattuck Valley) the top of the Upper San Andres Formation is capped by a subaerial exposure surface with karstification

penetrating to at least 10.4 m (34 ft) down section along a solution-widened fracture to form an inverted (upside down mushroom shaped) sinkhole and cave system that was filled with dolomitic sandstone by the basal Grayburg Formation transgression

- In the Brokeoff Mountains the top of the Upper San Andres Formation was subaerially exposed and karstified to a depth of 30 m (100 ft)
- In the Eunice Monument complex of unitized oil fields the top of the Upper San Andres Formation contains 19.8 m (65 ft) of topographic relief in the North Monument Grayburg Unit (NMGU), with karstification extending to a depth of 21 m (69 ft) in Eunice Monument South Unit (EMSU) and an estimated maximum amount of relative sea level fall of 59.7 m to 61.3 m (196 ft to 201 ft) (the Eunice Monument structure experienced structural growth during Grayburg Formation deposition, which may have created an over estimation of the amount of Upper San Andres Formation relative sea level fall)
- In the Hobbs Unit (northwest corner–Central Basin Platform) the Upper San Andres Formation karst profile contains cave horizons up to 2 m (6.5 ft) thick
- In McElroy field the top of the Upper San Andres Formation is karstified to a depth of at least 19.8 m (65 ft) and the karst surface has been imaged on 3-d and 2-d seimic tracts
- In Yates field (southernmost tip of the Central Basin Platform) the Upper San Andres Formation contains a series of cave horizons that were mapped by bit drops in numerous wells, which produced some of the highest known rates of hydrocarbon production from a karstified carbonate reservoir in the world
- When the Upper San Andres Formation strata is compared to overlying Grayburg Formation strata the two formations contain a classic basinward shift of lithofacies and oil field production that is approximately 13 km (8 miles)
- The Upper San Andres Formation composite sequence boundary and immediate overlying basal Grayburg Formation strata act as a vertical reservoir seal (aquiclude) that does not allow Upper San Andres Formation fluids to communicate with Grayburg Formation fluids (separate pressure systems–separate reservoirs), with communication only possible where Upper San Andres Formation paleotopography exists or where faults/fractures are present

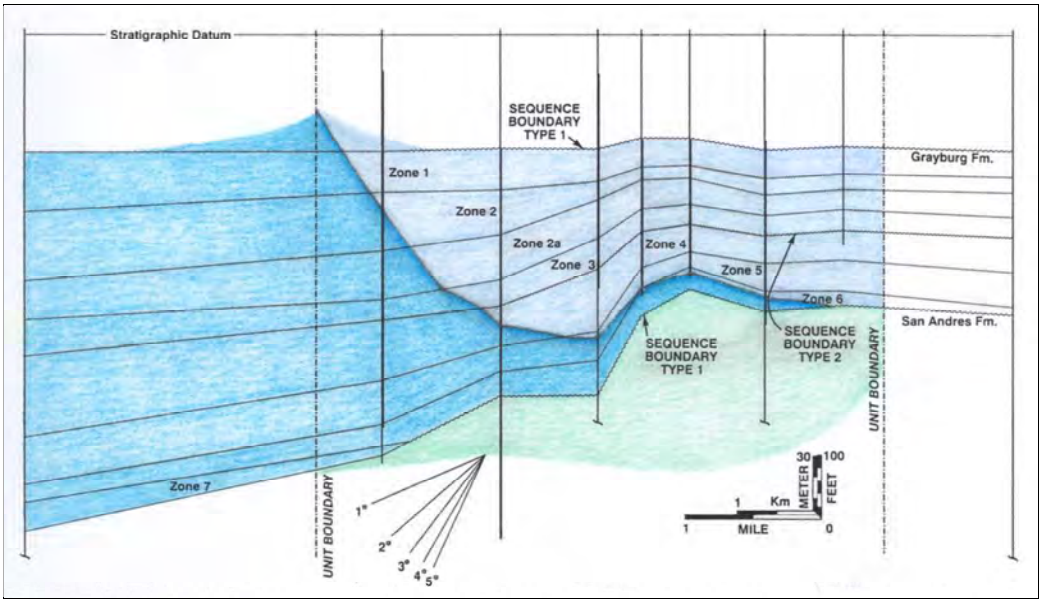


Figure 5.42. Third generation, stratigraphic, dip-oriented, sequence stratigraphic model of the Grayburg Formation in EMSU (December, 1997). The Grayburg Formation reservoir contains sulphate-poor meteoric edge water (dark blue) and connate water (light blue). The underlying Upper San Andres Formation reservoir contains sulphate-rich meteoric bottom water (green). Reservoir zones 1-6 are show. Stratigraphic datum is the Penrose marker in the lower Queen Formaiton. From Lindsay (1997) Chevron in-house data base.

One key feature about having the Goat Seep dolostone attached directly to the erosional headwall of the Grayburg is that within EMSU and AGU there is a weak edge water drive that has delivered sulphate-poor meteoric water into the west side of these unitized oil fields (Figures 5.42 and 5.43). It is believed that the Goat Seep dolostone is the delivery pipeline for these fluids, which was recharged from the Guadalupe and Glass mountains (Figures 1.1 and 4.14). Delivery of the meteoric water into these Grayburg Formation reservoirs was through porous and permeable grainstone strata as the pressure dropped within the reservoirs due to years of production of hydrocarbons without pressure support. This edge water has been proven by geochemical studies to not be from the underlying Upper San Andres Formation (Carpenter and Stewart, Chevron Oil Field Research, internal report). Meteoric water from the Upper San Andres Formation, beneath EMSU and AGU, is sulphate-rich (SO_4) from recharge and dissolution of evaporite strata in the dip slope of the present-day Sacramento Mountains. A key feature is that the Upper San Andres Formation composite sequence boundary that separates Upper San Andres Formation porous dolostones from the overlying Grayburg Formation porous dolostones forms a significant barrier (aquaclude) to fluid flow. It is therefore imperative to understand the sequence stratigraphy that bounds and the Grayburg Formation as best as possible.

- **Upper San Andres Formation composite sequence boundary** was described in the: 1) Grayburg Formation type section and Grayburg Formation subsurface reference section in the Northwest Shelf; 2) Guadalupe Mountains on both the east and west sides of the Queen Plateau; 3) in the Brokeoff Mountains; 4) Eunice Monument complex of unitized oil fields; 5) in the Hobbs Unit; 6) McElroy field; and 7) in Yates field. The top of the Upper San Andres Formation was regionally correlated throughout ramp margins surrounding the Permian Basin as early as the 1930's. Subaerial exposure and accompanying karstification penetrated down section at least 20 m (65 ft). The composite sequence boundary forms an effective seal (aquaclude) to fluid communication between underlying Upper San Andres Formation porous and permeable dolostones and overlying Grayburg Formation porous and permeable dolostones.

Upper Grayburg is 42.5 m (139.5 ft) thick and composed of the following three members, which in stratigraphic order are;

- Stone Canyon Dolostone and Sandstone Member is located between 830.4 m to 845.5 m (2,724.5 ft to 2,774 ft) in the J.T. McElroy 1202 cored well and is 15.1 m (49.5 ft) thick
- Upper Dolostone Member is between 845.5 m to 871.7 m (2,774 ft to 2,860 ft) in the J.T. McElroy 1202 cored well and is 26.2 m (86 ft) thick
- Loco Hills Sandstone Member is located between 871.7 m to 872.9 m (2,860 ft to 2,864 ft) in the J.T. McElroy 1202 cored well and is 1.2 m (4 ft) thick

Lower Grayburg is 55.5 m (182 ft) thick and composed of the following three members, which in stratigraphic order are;

- Metex Dolostone and Sandstone Member is located between 872.9 m to 879 m (2,864 ft to 2,884 ft) in the J.T. McElroy 1202 cored well and is 6.1 m (20 ft) thick
- Lower Dolostone Member is located between 879 m to 927.2 m (2,884 ft to 3,042 ft) in the J.T. McElroy 1202 cored well and is 48.2 m (158 ft) thick
- Premier Sandstone Member is located between 927.2 m to 928.4 m (3,042 ft to 3,046 ft) in the J.T. McElroy 1202 cored well and is 1.2 m (4 ft) thick

10.3. GRAYBURG FORMATION CYCLICITY

10.3a. Upper San Andres Formation Composite Sequence Boundary

The following conclusions can be reached about the top of the Upper San Andres Formation composite sequence boundary that separates the Upper San Andres Formation from the Grayburg Formation:

- The disconformity that rests atop the Upper San Andres Formation is a type 1 sequence boundary
- The subaerial exposure surface (disconformity) at the top the Upper San Andres Formation was correlated throughout the subsurface of the Permian Basin by the 1930's
- In the Grayburg Formation type section and nearby subsurface reference section in the Northwest Shelf the top of the Upper San Andres Formation is capped by a subaerial exposure surface that was karstified
- In the Guadalupe Mountains (Carlsbad Shelf) on the west side of the Queen Plateau (north end of Shattuck Valley) the top of the Upper San Andres Formation is capped by a subaerial exposure surface with karstification penetrating to at least 10.4 m (34 ft) down section along a solution-widened

fracture to form an inverted (upside down mushroom shaped) sinkhole and cave system that was filled with dolomitic sandstone by the basal Grayburg Formation transgression

- In the Brokeoff Mountains the top of the Upper San Andres Formation was subaerially exposed and karstified to a depth of 30 m (100 ft)
- In the Eunice Monument complex of unitized oil fields the top of the Upper San Andres Formation contains 19.8 m (65 ft) of topographic relief in the North Monument Grayburg Unit (NMGU), with karstification extending to a depth of 21 m (69 ft) in Eunice Monument South Unit (EMSU) and an estimated maximum amount of relative sea level fall of 59.7 m to 61.3 m (196 ft to 201 ft) (the Eunice Monument structure experienced structural growth during Grayburg Formation deposition, which may have created an over estimation of the amount of Upper San Andres Formation relative sea level fall)
- In the Hobbs Unit (northwest corner–Central Basin Platform) the Upper San Andres Formation karst profile contains cave horizons up to 2 m (6.5 ft) thick
- In McElroy field the top of the Upper San Andres Formation is karstified to a depth of at least 19.8 m (65 ft) and the karst surface has been imaged on 3-d and 2-d seimic tracts
- In Yates field (southernmost tip of the Central Basin Platform) the Upper San Andres Formation contains a series of cave horizons that were mapped by bit drops in numerous wells, which produced some of the highest known rates of hydrocarbon production from a karstified carbonate reservoir in the world
- When the Upper San Andres Formation strata is compared to overlying Grayburg Formation strata the two formations contain a classic basinward shift of lithofacies and oil field production that is approximately 13 km (8 miles)
- The Upper San Andres Formation composite sequence boundary and immediate overlying basal Grayburg Formation strata act as a vertical reservoir seal (aquiclude) that does not allow Upper San Andres Formation fluids to communicate with Grayburg Formation fluids (separate pressure systems–separate reservoirs), with communication only possible where Upper San Andres Formation paleotopography exists or where faults/fractures are present

example of GHFS 2 can be studied along the Shattuck Valley Escarpment on the west side of the Queen Plateau in the Guadalupe Mountains in Devils Den Canyon, Deer Hill, and Hooper Canyon measured sections. A second place to study GHFS 2 is in McElroy field were it has been cored and has been correlated to open-hole well logs, and can be imaged on 2-d and 3-d seismic. In McElroy key wells to study GHFS 2 are C. McElroy 113, C. McElroy 328, and J.T. McElroy 926 in the middle of the field. GHFS 2 was not deposited on the Carlsbad Shelf (up-dip north part of the Guadallupe Mountains), Northwest Shelf, or the Central Basin Platform.

- **GHFS 1** was deposited farthest down-dip in the Permian Basin and onlapped onto the top of the Upper San Andres Formation composite sequence. GHFS 1 was not deposited upon the tops of the ramp margins that surrounded the Permian Basin. These tops of the ramp margins were subaerially exposed during deposition of GHFS 1. GHFS 1 is an onlapping transgressively dominated high frequency sequence. The best example of GHFS 1 can be studied along the Shattuck Valley Escarpment on the west side of the Queen Plateau in the Guadalupe Mountains in the Deer Hill and Hooper Canyon measured sections. The second place to study GHFS 1 is in McElroy field where it can be studied in core, open-hole well logs, and on 2-d and 3-d seismic. GHFS 1 was not deposited upon the Carlsbad Shelf (Guadalupe Mountains), Northwest Shelf, or Central Basin Platform.
- **Upper San Andres Formation composite sequence boundary** was described in the: 1) Grayburg Formation type section and Grayburg Formation subsurface reference section in the Northwest Shelf; 2) Guadalupe Mountains on both the east and west sides of the Queen Plateau; 3) in the Brokeoff Mountains; 4) Eunice Monument complex of unitized oil fields; 5) in the Hobbs Unit; 6) McElroy field; and 7) in Yates field. The top of the Upper San Andres Formation was regionally correlated throughout ramp margins surrounding the Permian Basin as early as the 1930's. Subaerial exposure and accompanying karstification penetrated down section at least 20 m (65 ft). The composite sequence boundary forms an effective seal (aquaclude) to fluid communication between underlying Upper San Andres Formation porous and permeable dolostones and overlying Grayburg Formation porous and permeable dolostones.

30 025 31009

BEFORE THE OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. B-26
Submitted by: Goodnight Midstream Permian, LLC
Hearing Date: September 23, 2024
Case Nos. 23614-23617, 23775,
24018 – 24020, 24025, 24123

Memorandum

Midland, Texas
January 24, 1991

FRACTURE STUDY OF EMSU WELL
NO. 679 ORIENTED CORE

G. W. BURG

One hundred and twenty feet of oriented core, through the Grayburg Formation in the base of zone 4, all of zone 5, and the upper half of zone 6, was analyzed for fracture orientation in EMSU Well No. 679 (Fig. 1). Three hundred and thirteen (313) fractures were measured (Fig. 2). Most fractures are small, discontinuous, en echelon, vertical breaks that have average lengths of only a few inches. A few intervals contain longer, more continuous vertical fractures, with lengths of 1 to 3 feet (Fig. 3). Longer fractures primarily trend in a west-northwest to east-southeast direction, north 50-70° west. They appear to not be mineralized, except for one which had a small amount of pyrite lining it.

Many of the small vertical fractures origin off of stylolitized horizons. These are referred to as stylolitic tension gashes. Some of these are solution-widened and most are not filled with cement. In other fractures there is a small amount of pyrite lining them. Pyrite also partially fills some stylolites and moldic to microvugular pores (Fig. 4). This pattern of small, solution-widened fractures associated with stylolites (stylolitic tension gashes), which are lined with sporatic and discontinuous amounts of pyrite, are also present in the Amerada Hess Monument Abo Well No. 1 core in Monument Grayburg field.

The small vertical oriented stylolitic tension gashes probably formed during deep burial at or following stylolitization (pressure solutioning). These small fractures were solution-widened by fluids which first moved along stylolite boundaries and then moved up or down through the fractures.

Pyrite is preferentially emplaced along some, but not all, stylolites and in some, but not all, small, solution-widened stylolitic tension gashes. The emplacement of pyrite probably represents a low-temperature Mississippi Valley Type (MVT) deposit. Fluids moving up and out of the Delaware Basin most likely emplaced the pyrite in the Grayburg Section. These fluids were warm and never became very hot, because no other gangue minerals or metals were emplaced.

Four intervals of collapse breccia are present in the 120 feet of oriented core. Small fractures, which extend only a few inches, are associated with the collapse breccias. Three separate one foot intervals of core show the contact between breccia clasts, deposited in solution-pipes or small sink holes, and the intact country rock (Fig. 5). These contacts are sharp, linear features and represent fractures that underwent solution-widening during subaerial exposure. Azimuths of these fractures are east-west or northeast-southwest. Similar solution widened fractures associated with breccia fills are present in the north end of EMSU (EMSU Well No. 101). Similar fracture controlled karst features are present in outcrops of the uppermost San Andres Formation in the Guadalupe Mountains. The Madison Limestone in Wyoming also displays fracture controlled karst features, such as, fracture controlled sink hole development.

This study has revealed that in general a well developed northwesterly and a poorly developed northeasterly set of fractures are developed and are part of a conjugate joint system in EMSU Well No. 679. However, there is alot of scatter of the data, which is due primarily to measuring very small fractures (stylolitic tension gashes) which origined off of stylolites.

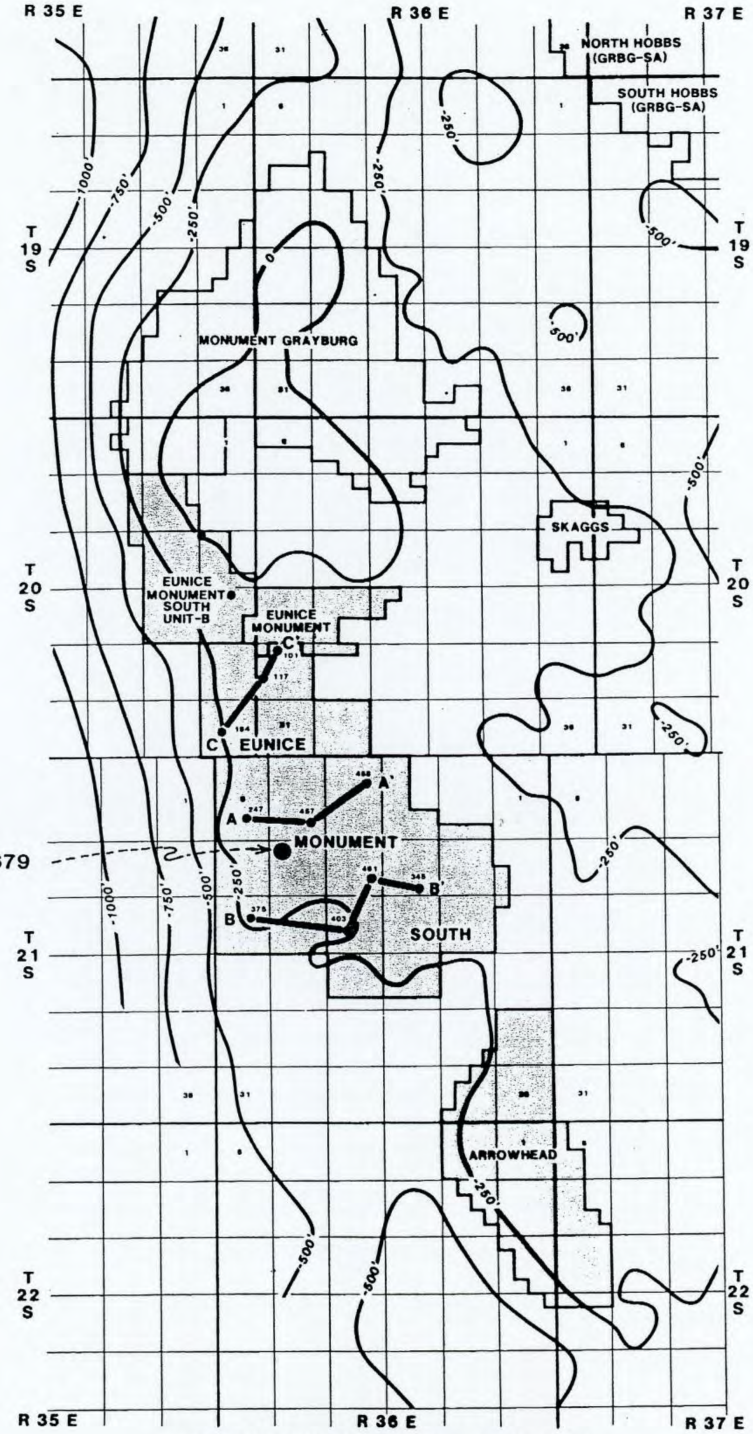
Most routine fracture studies may not account for these very small fractures. An appendix of all raw data is included.

R. F. LINDSAY

RFL/raj
EGE10122.11

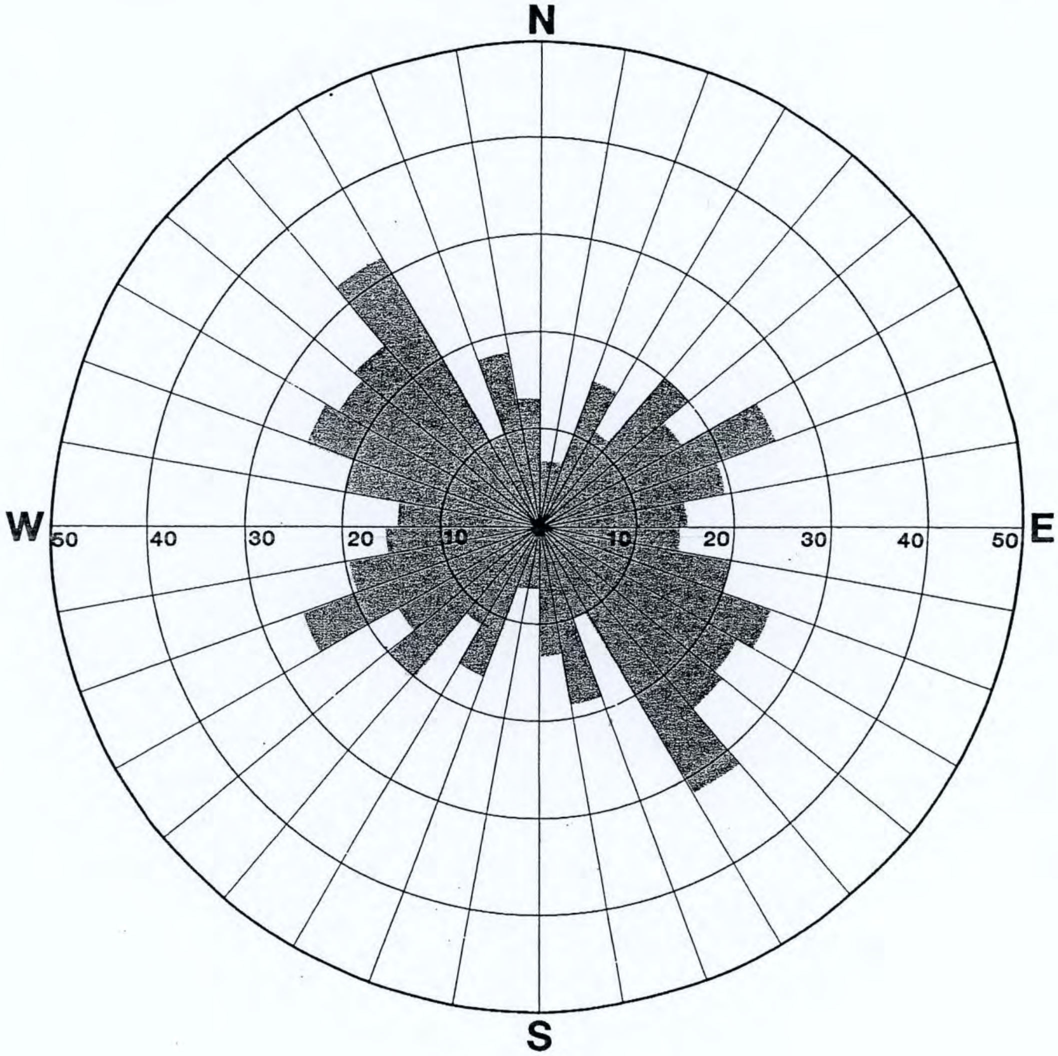
Attachment

cc: M. D. Wittstrom
R. H. Jones
D. L. Lindsey
S. T. Luthy



GRAYBURG FORMATION RESERVOIRS
NORTHWEST PORTION CENTRAL BASIN PLATFORM
LEA COUNTY, NEW MEXICO
5 MILES
BY: R.F. LINDSAY 7-90

FIGURE # 1

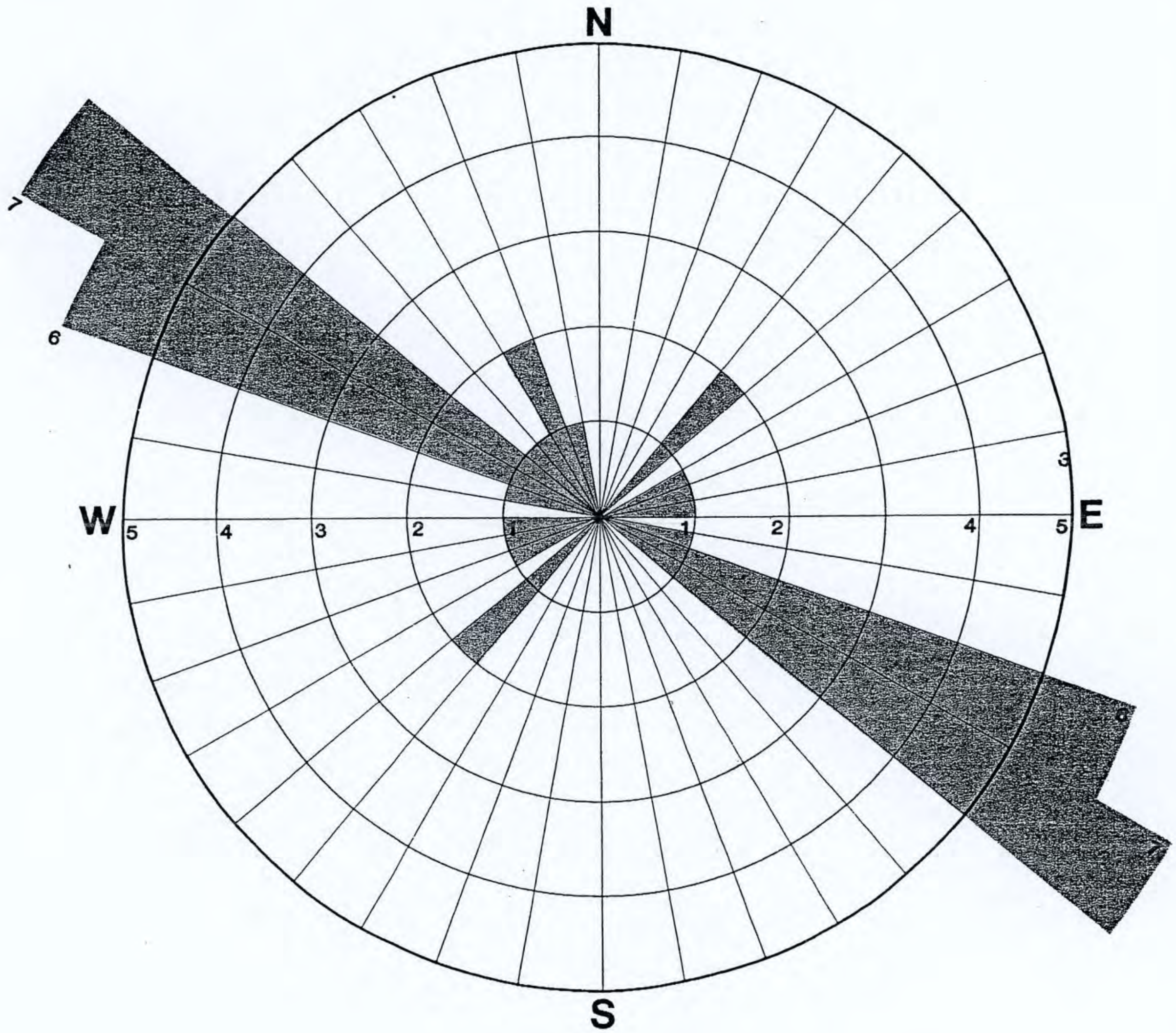


TOTAL FRACTURES

(313)

FIGURE # 2

EMSU-679 RFL 1/91

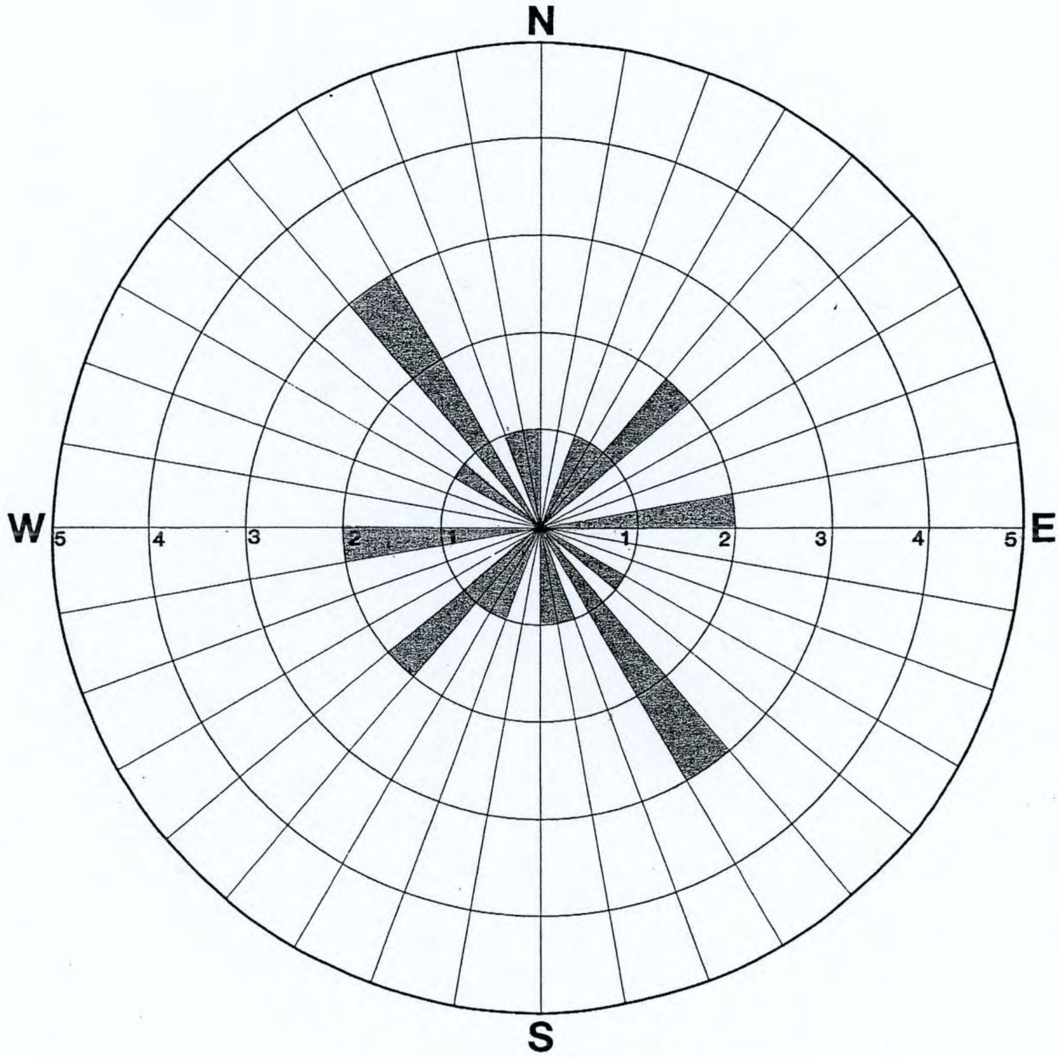


LARGE VERTICAL FRACTURES
1-3 FEET IN LENGTH
(24 TOTAL)

FIGURE # 3

EMSU-679 RFL 1/91

ENM OCD 23614-17: 00286

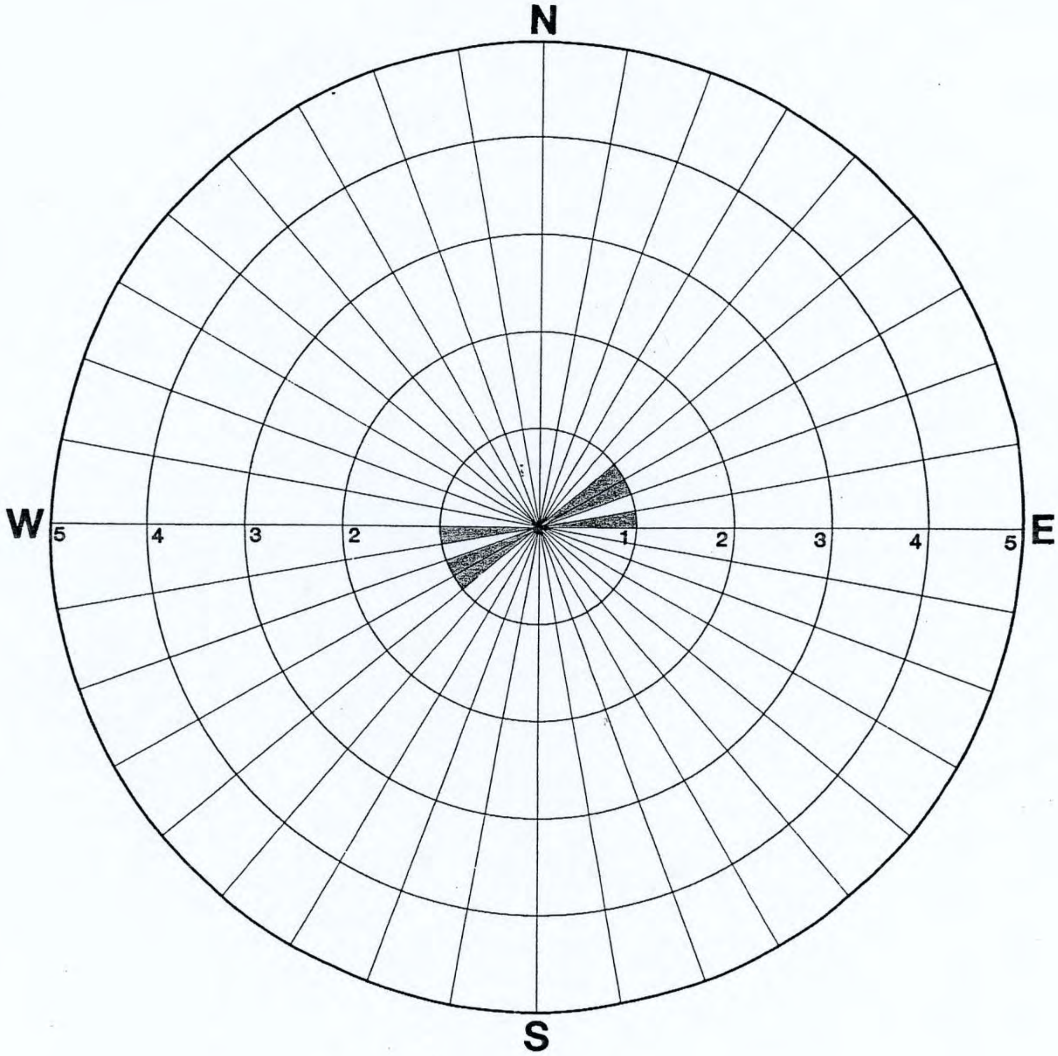


PYRITE DISTRIBUTION
ALONG FRACTURES
(12 TOTAL)

FIGURE # 4

EMSU-679 RFL 1/91

ENM OCD 23614-17: 00287



FRACTURES BOUNDING COLLAPSE BRECCIAS AND SOLUTION PIPES (3 TOTAL)

FIGURE # 5

EMSU-679 RFL 1/91

EMSU No. 679 Oriented Core
Fracture Azimuths

R.F. Lindsay
1/16/91
Midland, TX

Azimuth	Total Fractures	Large Fractures	Pyrite	Collapse Breccia Country Rock Fx
N1-10°E	7			
11-20°E	6			
21-30°E	16		1	
31-40°E	11		1	
41-50°E	19	2	2	
51-60°E	16			1
61-70°E	25	1		1
71-80°E	19	1		
81-90°E	15	1	2	1
N0-10°W	13		1	
11-20°W	18	1	1	
21-30°W	10	2		
31-40°W	32	1	3	
41-50°W	24	1		
51-60°W	23	7	1	
61-70°W	25	6		
71-80°W	20	1		
81-90°W	14			
	(313)	(24)	(12)	(3)

K.F. Lindsay
1/15/91
Midland, TX

EMSU No. 679 Oriented Core
Fracture Azimuths

4059-60 N1°E, N41°E
4060-61 –
61-62 –
62-63 –
63-64 N63°E, N65°E
64-65 N30°E
65-66 –
66-67 –
67-68 –
68-69 N8°W
69-70 N32°W pyrite
4070-71 N2°E, N81°W
71-72 N12°E, N36°W (3)
72-73 N0°N, N59°W
73-74 N15°W (2)
74-75 N44°E, N5°W
75-76 N63°E
76-77 N9°W, N51°W, N52°W, N78°W (2)
77-78 N66°E
78-79 N73°E
79-80 N66°E, N69°E, N26°W, N47°W, N57°W, N58°W, N59°W, N67°W, N72°
4080-81 N28°W
81-82 N2°E, N3°W, N20°W, N84°W
82-83 N30°E (2), N50°E, N72°E, N75°E, N68°W, N69°W
83-84 N10°E, N74°E, N53°W
84-85 N19°E, N41°W, N56°W
85-86 N86°E, N87°W
86-87 N74°E
87-88 N70°E, N73°E, N6°W, N52°W, N69°W
88-89 Rubble due to Fx's N52°W
4089-90 Lost Core

(Margin notes, 4059–4079: Small Fractures 2-3" avg; Origin off of stylolites)

(Margin notes, 4080–4090: Longer + Smaller Fractures; 1-2' Fx.)

R F Lindsay
1/15/91
Midland, TX

EMSU No. 679 Oriented Core
Fracture Azimuths

4090-91	Lost Core
91-92	⊥
92-93	Rubble due to Fx's N53°W
93-94	N11°E, N53°W, N66°W
94-95	N81°E
95-96	N81°E
96-97	N71°E
97-98	N48°E, N54°W
98-99	N59°W pyrite
99-00	N33°W (2), N39°W
4100-01	—
01-02	N39°E
02-03	Lost Core thru 03.7'
03-04	—
04-05	Rubble from plugging
05-06	N64°W
06-07	N66°E
07-08	N58°E, N38°W, N86°W
08-09	N70°W (2)
09-10	—
4110-11	N22°E (2), N37°E (2)
11-12	N30°E, N47°W
12-13	N30°E pyrite, N54°E, N57°W
13-14	N50°E, N87°E
14-15	N16°W (2), N18°W, N44°W
15-16	N37°E, N70°E, N15°W, N36°W, N41°W, N46°W, N47°W (2), N50°W, N55°W, N64°W, N67°W, N70°W, N77°W
16-17	N84°E pyrite, N23°W, N39°W, N54°W
17-18	N52°E pyrite, N19°W pyrite, N34°W, N44°W
18-19	—
4119-20	N5°E, N9°W(2), N24°W(2), [illegible]

Longer + Smaller Fractures

Collapse Breccia

Small Fx's

N53°W

R F Lindsay
11-5-91
Midland, Tx

EMSU No. 679 Oriented Core
Fracture Azimuths

4120-21	—	
21-22	N85°E, N86°E, N47°W, N51°W	Small Fx's
22-23	N32°W pyrite, N39°W pyrite, N50°W, N86°W	
23-24	N83°W	
24-25	N39°E, N72°W	
25-26	—	
26-27	—	
27-28	—	
28-29	N24°E, N51°E, N67°W	Lg Fx's
29-30	N25°E, N32°E, N64°E, N11°W, N17°W, N77°W	
4130-31	N43°E, N82°E, N69°W	Small Fx's
31-32	N86°E	
32-33	N78°W (2), N83°W	
33-34	N78°E	
34-35	N15°W, N19°W, N52°W	
35-36	N47°E, N70°W	Large Fx's
36-37	N41°E, N52°W	
37-38	N28°E, N10°W, N75°W	
38-39	N31°E, N16°W, N29°W, N42°W, N48°W, N70°W	
39-40	N69°W	
4140-41	—	Collapse Breccia Small Fx's
41-42	N72°E, N65°W	
42-43	N9°W pyrite	
43-44	N7°W, N81°W, N83°W	
44-45	N40°E (2), N58°E	Fusulinid Facies Small Fx's
45-46	N50°E (2), N35°W, N39°W	
46-47	N34°W, N42°W, N43°W	
47-48	N49°E, N59°E, N73°E, N82°E, N88°E, N56°W, N64°W, N73°W, N80°W, N84°W, N86°W	
48-49	N56°E, N64°E, N65°E (2), N80°W (2), N84°W	Highly broken
4149-50	N47°E Rubble	

ENM OCD 23614-17: 00292

EMSU No. 679 Oriented Core
Fracture Azimuths

R.F. Lindsay
11/5/91
Midland, Tx

4150-51 N14°W, N23°W, N49°W, N74°W
51-52 N18°E, N49°E (2) pyrite, N88°E pyrite
52-53 N5°E, N17°E, N25°E, N34°E pyrite, N32°W, N45°W, N64°W, N71°W
53-54 N52°E, N55°E, N72°E, N76°E (4), N40°W, N64°W, N74°W
54-55 N55°E, N71°E (2), N22°W, N36°W, N86°W
55-56 N17°E, N46°E, N62°E, N66°E, N67°E, N71°E, N77°W, N87°W
56-57 N50°E (2), N58°E, N68°E, N75°E, N13°W, N45°W, N50°W
57-58 N52°E, N82°E, N27°W, N30°W, N52°W, N77°W
58-59 N21°E, N23°E, N59°W, N61°W, N64°W, N66°W
59-60 N60°E, N68°E, N84°E, N9°W
4160-61 N66°E, N43°W
61-62 N24°E, N86°E Core broken-up during coring
62-63 N27°E, N62°E
63-64 —
64-65 N60°E, N18°W
65-66 N28°W, N70°W
66-67 N20°W, N62°W
67-68 N34°W
68-69 N52°E
69-70 N43°E, N70°E
4170-71 N2°E, N33°W
71-72 N38°E, N42°W, N49°W
72-73 —
73-74 N53°E
74-75 —
75-76 N80°E, N89°E
76-77 N7°W
77-78 —
78-79 N27°E, N43°E, N14°W, N34°W, N36°W, N69°W
[illegible]

Collapse Breccia
Small Fx's
Small Fx's
Collapse Breccia

Allan Chamberlain School of Mines

CORE LABORATORIES

CHEVRON U.S.A., INC.
E.M.S.U. NO. 679
1220' FNL & 1220' FWL, SEC. 8, T-21-S, R-36-E
LEA COUNTY, NEW MEXICO

Field : EUNICE MONUMENT SOUTH
Formation : GRAYBURG
Coring Fluid : BRINE
Elevation : 3585.5' GL

File No.: 57181-16203
Date : 10-16-90
API No. : 30-025-31009
Analysts: OLSON

CORE ANALYSIS RESULTS

Total Fractures Recorded: 313

SAMPLE NUMBER	DEPTH ft	Fractures	PERMEABILITY KA MAX md	PERMEABILITY 90 DEG md	PERMEABILITY N/S md	PERMEABILITY E/W md	PERMEABILITY (VERTICAL) Kair md	POROSITY (HELIUM) %	SATURATION (PORE VOLUME) OIL %	SATURATION (PORE VOLUME) WATER %	GRAIN DENSITY gm/cc	DESCRIPTION
	CORE NO. 1 4059-4120 CUT 61' REC 56'											
1	4059.0- 60.0	N1°E, N4°E			28.0	28.0	1.80	14.9	12.6	25.3	2.83	Dol vug foss styl
2	4060.0- 61.0				1.10	1.10	0.07	13.0	10.6	30.4	2.80	Dol vug styl
3	4061.0- 62.0	–			2.10	1.50	0.69	11.3	20.1	21.1	2.82	Dol sli/anhy sli/anhy p.p. sh lam
4	4062.0- 63.0	–			0.04	0.04	0.05	9.4	14.1	24.1	2.85	Dol sdy sli/anhy p.p. sh lam
5	4063.0- 64.0	N63°E, N65°E			3.10	3.50	0.48	11.1	10.0	31.4	2.84	Dol sli/sdy sli/vug sh lam
6	4064.0- 65.0	N30°E,			4.70	2.90	3.20	14.8	13.7	25.2	2.78	Dol sdy sli/anhy p.p.
7	4065.0- 66.0	–			1.10	0.98	0.29	13.0	9.7	25.9	2.79	Dol sdy p.p. foss
8	4066.0- 67.0	–			1.10	1.00	0.23	13.4	15.9	19.9	2.75	Dol sdy sli/anhy p.p.
9	4067.0- 68.0	–			0.64	0.62	0.20	11.7	18.4	15.8	2.79	Dol sli/sdy p.p.
10	4068.0- 69.0	N8°W			4.30	7.10	0.82	10.9	11.1	32.0	2.83	Dol sli/sdy sli/anhy vug sh lam styl
11	4069.0- 70.0	N32°W M/pyrite			6.50	6.10	0.39	11.8	10.3	32.3	2.84	Dol sli/anhy vug styl
12	4070.0- 71.0	N2°E, N81°W			10.0	1.80	0.23	12.7	8.0	38.9	2.83	Dol sli/anhy vug sh lam styl
13	4071.0- 72.0	N12°E, N36°W(3)			11.0	10.0	1.00	11.8	10.2	32.0	2.82	Dol sli/sdy F vug styl
14	4072.0- 73.0	0°N, N59°W			26.0	29.0	9.80	11.3	9.5	30.5	2.84	Dol p.p. styl
15	4073.0- 74.0	N15°W(2)			9.70	5.50	2.50	7.3	18.5	26.4	2.85	Dol sli/sdy F styl
16	4074.0- 75.0	N44°E, N5°W			28.0	14.0	7.00	8.9	11.7	30.0	2.85	Dol sli/sdy p.p. styl
17	4075.0- 76.0	N63°E			16.0	17.0	14.0	9.7	16.6	27.6	2.84	Dol sli/sdy F
18	4076.0- 77.0	N51°W, N78°W(2), N52°W, N9°W			4.20	5.20	2.80	8.8	15.6	24.2	2.85	Dol vf p.p.
19	4077.0- 78.0	N66°E			3.30	7.50	1.20	13.0	15.7	23.5	2.79	Dol sdy p.p. styl
20	4078.0- 79.0	N73°E			7.80	7.40	1.80	11.9	11.5	22.9	2.82	Dol sli/sdy p.p. styl
21	4079.0- 80.0	N47°W, N72°W, N69°E, N67°W, N58°W, N57°W, N59°W, N26°W, N66°E			61.0	184.	82.0	12.7	12.6	35.9	2.85	Dol sli/anhy vf p.p.
22	4080.0- 81.0	N28°W			285.	90.0	211.	14.6	15.3	36.4	2.85	Dol sli/anhy vf p.p. styl
23	4081.0- 82.0	N3°W, N84°W, N2°E, N30°W			611.	164.	59.0	12.8	18.6	29.8	2.85	Dol sli/anhy p.p. styl
24	4082.0- 83.0	N68°W, N72°E, N30°E(2), N50°E, N69°W, N?°E			8056.	861.	1969.	12.0	13.6	29.1	2.90	Dol anhy F p.p.
25	4083.0- 84.0	N10°E, N53°W, N74°E			49.0	46.0	33.0	12.5	23.6	28.3	2.84	Dol F p.p.

Ss: 2.65 2.68 2.71 2.86

Small frs. 2-3' avg.

Longitudinal

CORE LABORATORIES

CHEVRON U.S.A., INC.
E.M.S.U. NO. 679

Field : EUNICE MONUMENT SOUTH
Formation : GRAYBURG

File No.: 57181-16203
Date : 10-16-90

C O R E   A N A L Y S I S   R E S U L T S

	SAMPLE NUMBER	DEPTH ft	PERMEABILITY KA MAX md	PERMEABILITY 90 DEG md	PERMEABILITY N/S md	PERMEABILITY E/W md	PERMEABILITY (VERTICAL) Kair md	POROSITY (HELIUM) %	SATURATION (PORE VOLUME) OIL %	SATURATION (PORE VOLUME) WATER %	GRAIN DENSITY gm/cc	DESCRIPTION
larger Fx's	26	4084.0- 85.0	N56°W, N19°E, N41°W		8.70	8.60	5.30	10.1	18.3	33.9	2.85	Dol sli/anhy p.p. styl
	27	4085.0- 86.0	N86°E, N87°W		4.90	5.10	5.10	12.1	22.3	21.3	2.84	Dol styl
plotted 1:25	28	4086.0- 87.0	N74°E		6.00	4.60	6.00	12.1	13.9	30.1	2.84	Dol sdy p.p.
	29	4087.0- 88.0	N69°W, N73°E, N70°E, N6?°W, N52°E		[illegible]	[illegible]06.	561.	11.0	16.2	32.4	2.84	Dol sdy F vf p.p.
*	30	4088.0- 88.6	rubble due to Fx's	17.0				12.4	26.2	26.2	2.85	Dol sli/anhy F p.p.
		4088.6- 92.0	Lost Core									Lost core
*	31	4092.0- 93.0	rubble due to Fx's	2.60				11.8	29.1	16.3	2.85	Dol sli/anhy F
	32	4093.0- 94.0	N53°W, N11°E, N66°W		5.00	0.97	1.00	12.1	22.2	27.7	2.85	Dol sli/anhy F
	33	4094.0- 95.0	N81°E, (?) same fx		2.70	2.30	2.50	12.2	27.8	20.0	2.85	Dol sdy sli/anhy p.p.
	34	4095.0- 96.0	N81°E		6.80	6.50	10.0	13.6	26.8	21.5	2.85	Dol sli/anhy p.p. styl
	35	4096.0- 97.0	N71°E		13.0	13.0	15.0	14.3	23.7	23.7	2.85	Dol sli/anhy p.p.
	36	4097.0- 98.0	N54°W, N48°E		15.0	12.0	545.	11.4	13.8	30.6	2.85	Dol vf
	37	4098.0- 99.0	N59°W pyritized Fx		0.09	0.05	0.03	7.1	28.1	24.6	2.85	Dol vf p.p. pyritized fx
	38	4099.0- 00.0	N39°W, N33°W(2)		3.20	2.30	3.80	10.8	22.7	25.6	2.84	Dol p.p.
	39	4100.0- 01.0	—		2.60	2.60	3.20	11.2	21.9	25.0	2.83	Dol p.p.
	40	4101.0- 02.0	N59°E		1.70	1.90	2.10	10.6	22.9	26.5	2.84	Dol p.p.
		4102.0- 03.7	Lost core									Lost core
		4103.7- 04.8	—									Removed By Client
*	41	4104.8- 05.0	rubble from plugging		3.00	6.60		12.6	21.4	28.5	2.84	Dol F
	42	4105.0- 06.0	N64°W		2.10	2.00	2.40	10.7	20.7	25.9	2.83	Dol p.p.
collapse Breccia	43	4106.0- 07.0	N66°E		38.0	15.0	19.0	11.6	13.9	31.7	2.83	Dol F sli/vug
	44	4107.0- 08.0	N38°E, N38°W, N86°W		31.0	53.0	15.0	10.8	14.7	38.6	2.84	Dol F styl
	45	4108.0- 09.0	N70°W(2)		6.30	12.0	3.20	9.5	16.3	40.8	2.82	Dol F sli/vug styl
	46	4109.0- 10.0			4.60	10.0	5.20	11.9	13.4	44.7	2.81	Dol sli/sdy F sli/vug styl
	47	4110.0- 11.0	N37°E(2), N22°E(2)		5.70	9.50	14.0	11.9	10.9	43.7	2.82	Dol vug
	48	4111.0- 12.0	N30°E, N47°W		17.0	17.0	12.0	12.1	13.9	36.6	2.83	Dol sli/vug styl
	49	4112.0- 13.0	N30°E pyrite, N54°E, N57°W		35.0	51.0	12.0	10.6	14.8	31.4	2.84	Dol vug styl
	50	4113.0- 14.0	N50°E, N81°E		3.20	7.10	3.40	13.3	17.1	23.1	2.82	Dol sli/sdy vug foss
	51	4114.0- 15.0	N18°W, N16°W(2), N44°W		26.0	45.0	6.60	6.6	13.4	38.3	2.83	Dol sli/cht vug styl

1 - 2

ENM OCD 23614-17: 00295

CORE LABORATORIES

CHEVRON U.S.A., INC.
E.M.S.U. NO. 679

Field : EUNICE MONUMENT SOUTH
Formation : GRAYBURG

File No.: 57181-16203
Date : 10-16-90

CORE ANALYSIS RESULTS

SAMPLE NUMBER	DEPTH ft	PERMEABILITY KA MAX md	PERMEABILITY 90 DEG md	PERMEABILITY N/S md	PERMEABILITY E/W md	PERMEABILITY (VERTICAL) Kair md	POROSITY (HELIUM) %	SATURATION (PORE VOLUME) OIL %	SATURATION (PORE VOLUME) WATER %	GRAIN DENSITY gm/cc	DESCRIPTION
52	4115.0- 16.0			11.0	14.0	5.00	8.4	9.8	35.2	2.81	Dol sli/cht vug styl
53	4116.0- 17.0			33.0	38.0	14.0	8.6	16.3	35.4	2.84	Dol cht vug styl
54	4117.0- 18.0			49.8	33.2	35.0	8.9	18.3	36.6	2.81	Dol sli/cht F vug styl
* 55	4118.0- 19.0		6.20				11.6	14.5	36.3	2.84	Dol sli/cht F styl
56	4119.0- 20.0			116.	33.0	8.70	8.7	17.1	34.2	2.86	Dol sli/cht vug styl
	CORE NO. 2 4120-4180 CUT 60' REC 60'										
57	4120.0- 21.0			0.07	0.05	<.01	10.8	16.1	29.6	2.81	Dol sli/sdy vf sli/vug
58	4121.0- 22.0			0.16	0.38	12.0	10.1	8.9	38.1	2.85	Dol sli/anhy vf sli/vug foss
59	4122.0- 23.0			11.0	11.0	2.40	5.4	4.4	43.6	2.84	Dol vf f vug
60	4123.0- 24.0			<.01	3.90	<.01	10.5	17.9	17.9	2.77	Dol sdy vf lam
61	4124.0- 25.0			0.10	0.13	0.09	13.6	12.8	20.0	2.76	Dol sdy
62	4125.0- 26.0			0.08	0.06	0.04	13.7	13.4	16.6	2.80	Dol sli/sdy
63	4126.0- 27.0			0.66	0.53	0.19	14.9	15.0	20.0	2.73	Dol v/sdy sli/cht
64	4127.0- 28.0			1.00	1.10	0.15	14.5	19.6	18.2	2.73	Dol v/sdy foss
* 65	4128.0- 29.0			0.54			15.5	14.0	32.4	2.69	Sd dol vf
66	4129.0- 30.0			0.46	0.20	84.0	12.8	17.6	29.6	2.69	Sd dol vf
67	4130.0- 31.0			0.27	0.14	0.65	13.7	16.5	20.6	2.76	Dol sdy vf
68	4131.0- 32.0			0.14	0.36	0.02	10.6	18.3	27.4	2.81	Dol vf styl
69	4132.0- 33.0			0.45	0.59	0.12	11.0	16.4	25.8	2.82	Dol sli/sdy vf
70	4133.0- 34.0			0.16	0.13	0.12	12.4	18.3	22.6	2.81	Dol sli/sdy
71	4134.0- 35.0			0.97	0.76	0.33	11.7	18.8	28.2	2.82	Dol sli/sdy vf
72	4135.0- 36.0			0.49	0.53	86.0	14.4	18.4	30.7	2.69	Sd dol vf
73	4136.0- 37.0			1.40	0.85	43.0	15.1	14.5	31.4	2.70	Sd dol vf
74	4137.0- 38.0			15.0	1.00	144.	15.2	17.8	30.5	2.69	Sd dol vf
75	4138.0- 39.0			50.	8.0	165.	15.4	14.8	31.1	2.70	Sd dol vf
76	4139.0- 40.0			0.15	0.17	0.12	12.7	14.3	24.4	2.72	Sd dol vf
77	4140.0- 41.0			0.02	<.01	<.01	11.2	10.7	39.7	2.79	Dol sdy sli/vug

CORE LABORATORIES

CHEVRON U.S.A., INC.
E.M.S.U. NO. 679

Field : EUNICE MONUMENT SOUTH
Formation : GRAYBURG

File No.: 57181-16203
Date : 10-16-90

CORE ANALYSIS RESULTS

SAMPLE NUMBER	DEPTH ft	PERMEABILITY KA MAX md	PERMEABILITY 90 DEG md	PERMEABILITY N/S md	PERMEABILITY E/W md	PERMEABILITY (VERTICAL) Kair md	POROSITY (HELIUM) %	SATURATION (PORE VOLUME) OIL %	SATURATION (PORE VOLUME) WATER %	GRAIN DENSITY gm/cc	DESCRIPTION	Handwritten notes
78	4141.0- 42.0			25.0	27.0	6.60	11.5	13.4	47.7	2.85	Dol sli/anhy f vug styl	N65°W, N72°E
79	4142.0- 43.0			294.	308.	5.30	11.9	13.1	44.8	2.85	Dol sli/anhy vug	N9°W pyrite
80	4143.0- 44.0			25.0	0.13	0.11	7.9	12.6	64.4	2.82	Dol vf vug	N7°W, N81°W, N83°W
81	4144.0- 45.0			9.20	8944.	606.	3.9	5.9	59.5	2.86	Dol sli/anhy vf f vug styl	N40°E(2), N58°E
82	4145.0- 46.0			0.56	0.35	0.33	3.3	1.6	65.3	2.84	Dol vug styl	N35°W, N39°W, N50°E(2)
83	4146.0- 47.0			14.0	268.	7.40	6.2	2.2	43.9	2.86	Dol sli/anhy F vuf vug	N34°W, N43°W, N12°W
84	4147.0- 48.0			0.57	4.60	1.40	4.8	6.0	60.2	2.82	Dol vf f vug	N56°W, N73°E, N58°E
85	4148.0- 49.0			66.0	317.	13.0	10.0	23.1	33.0	2.85	Dol vf f sli/vug styl	highly broken, N84°W
86	4149.0- 50.0			97.0	114.	906.	12.8	20.3	33.8	2.84	Dol vf f p.p.	N47°E
87	4150.0- 51.0			62.0	56.0	126.	6.5	0.0	55.8	2.89	Dol cht sli/pyr vf f vug	N23°W, N14°W, N74°W
88	4151.0- 52.0			40.0	10940.	5056.	6.4	0.0	68.0	2.87	Dol sli/cht sli/pyr vf f vug	N18°E, N49°E(2), N88°E
89	4152.0- 53.0			22.0	12.0	4.40	8.6	24.8	41.4	2.85	Dol sli/cht sli/pyr vf vug	N34°E pyrite, N45°W, N32°W
90	4153.0- 54.0			15.	218.	108.	11.8	15.8	40.7	2.86	Dol sli/anhy sli/cht vf vug	N40°W, N52°E, N55°E
91	4154.0- 55.0			530.	543.	75.0	11.1	1.1	44.6	2.86	Dol cht sli/anhy vf vug	N71°E(2), N55°E, N86°W, N36°W
92	4155.0- 56.0			560.	104.	830.	11.4	14.5	35.4	2.80	Dol cht vf vug	N46°E, N66°E, N62°E, N67°E
93	4156.0- 57.0			785.	610.	953.	14.6	21.2	32.4	2.85	Dol cht sli/anhy vf vug	N50°E(2), N68°E, N58°E, N50°W
94	4157.0- 58.0			34.0	26.0	6.60	8.0	21.0	42.1	2.83	Dol cht vf vug	N52°E, N27°W, N52°W
95	4158.0- 59.0			16.	21.8	4.90	6.0	25.0	34.4	2.86	Dol sli/anhy sli/cht vf f sli/vug	N61°W, N59°W, N66°W, N64°W, N23°E
96	4159.0- 60.0			1.70	0.15	0.07	4.3	1.9	94.5	2.86	Dol sli/anhy sli/shy vf f styl	N68°E, N84°E, N60°E, N9°W
97	4160.0- 61.0			<.01	0.04	0.07	4.1	1.3	91.6	2.86	Dol sli/anhy F styl	N43°W, N66°E
98	4161.0- 62.0			0.02	<.01		0.9	8.5	84.9	2.85	Dol sli/anhy sli/pyr F styl	N24°E, N86°E; Lots of Breccia - broken core
99	4162.0- 63.0			20.0	47.0	39.0	10.6	29.8	29.8	2.83	Dol sli/sdy p.p.	N62°E, N27°E
* 100	4163.0- 64.0		84.0			138.	11.7	14.0	46.6	2.83	Dol sli/sdy vf p.p. styl	—
101	4164.0- 65.0			36.0	25.0	43.0	9.0	25.7	31.9	2.83	Dol vf p.p.	N60°E, N18°W
102	4165.0- 66.0			711.	281.	61.0	9.6	27.9	31.9	2.85	Dol sli/anhy vf p.p. foss	N70°W, N28°W
103	4166.0- 67.0			20.0	20.0	0.66	11.2	26.0	31.2	2.83	Dol vf p.p. styl	N62°W, N20°W
104	4167.0- 68.0			1.70	1.80	1.70	11.0	22.8	32.5	2.89	Dol anhy p.p.	N34°W
105	4168.0- 69.0			4.50	5.00	3.50	10.7	20.8	36.3	2.87	Dol anhy sli/sdy vf p.p.	N52°E
106	4169.0- 70.0			3.10	3.80	3.10	10.7	23.5	33.8	2.85	Dol sli/sdy sli/anhy p.p.	N13°E, N13°E

ENM OCD 23614-17: 00297

CORE LABORATORIES

CHEVRON U.S.A., INC.
E.M.S.U. NO. 679

Field : EUNICE MONUMENT SOUTH
Formation : GRAYBURG

File No.: 57181-16203
Date : 10-16-90

C O R E A N A L Y S I S R E S U L T S

SAMPLE NUMBER	DEPTH ft	PERMEABILITY KA MAX md	PERMEABILITY 90 DEG md	PERMEABILITY N/S md	PERMEABILITY E/W md	PERMEABILITY (VERTICAL) Kair md	POROSITY (HELIUM) %	SATURATION (PORE VOLUME) OIL %	SATURATION (PORE VOLUME) WATER %	GRAIN DENSITY gm/cc	DESCRIPTION
107	4170.0- 71.0	N33°W, N12°E		52.0	21.0	13.0	10.7	23.9	34.1	2.85	Dol sli/sdy sli/anhy F p.p.
108	4171.0- 72.0	N49°W, N38°E, N42°W		0.86	0.76	0.52	8.6	23.3	33.3	2.84	Dol F bnd p.p.
109	4172.0- 73.0			7.80	12.0	1.10	8.8	33.1	25.3	2.84	Dol sli/sdy p.p.
110	4173.0- 74.0	N53°E		0.25	0.46	0.18	7.2	37.0	26.4	2.82	Dol sli/sdy F vf p.p.
111	4174.0- 75.0	–		21.0	1.30	0.16	6.7	32.1	33.4	2.84	Dol sli/sdy F p.p.
112	4175.0- 76.0	N89°E, N50°E		5.20	4.90	16.0	12.5	24.2	36.3	2.82	Dol sli/sdy p.p.
113	4176.0- 77.0	N7°W		226.	159.	58.0	16.1	25.7	37.0	2.84	Dol sli/sdy p.p. styl
114	4177.0- 78.0	–		232.	197.	165.	15.9	22.7	46.5	2.82	Dol sli/sdy p.p.
115	4178.0- 79.0	N34°W, N20°E, N43°E, N69°W, N36°W, N10/4°W		[illegible]	[illegible]	0.89	6.6	33.4	52.4	2.84	Dol sli/cht F styl
116	4179.0- 80.0	N84°W, N28°W, N67°W, N77°W		[illegible]	3.30	1.90	7.2	7.2	72.2	2.84	Dol cht F styl

CORE NO. 3 4180-4240 CUT 60' REC 60'

SAMPLE NUMBER	DEPTH ft	KA MAX md	90 DEG md	N/S md	E/W md	(VERTICAL) Kair md	POROSITY %	OIL %	WATER %	GRAIN DENSITY gm/cc	DESCRIPTION
117	4180.0- 81.0	5.50	4.80			3.20	10.5	25.2	37.9	2.86	Dol sli/sdy sli/anhy vf f p.p.
118	4181.0- 82.0	61.0	61.0			72.0	14.7	29.7	39.6	2.83	Dol sdy vf
119	4182.0- 83.0	12.0	11.0			24.0	12.7	24.9	37.4	2.82	Dol sli/sdy vf p.p.
120	4183.0- 84.0	5.10	4.00			2.60	9.5	35.3	31.1	2.83	Dol sli/sdy vf p.p. ool
121	4184.0- 85.0	5.70	5.10			4.30	6.3	26.5	60.7	2.80	Dol sli/sdy vf
122	4185.0- 86.0	0.95	0.35			1.00	4.9	28.5	52.2	2.85	Dol sli/anhy vf f sli/vug ool
123	4186.0- 87.0	12.0	1.10			2.40	6.8	4.2	75.2	2.84	Dol vf f ool
124	4187.0- 88.0	0.12	0.03			0.10	3.7	6.6	85.6	2.82	Dol vf f styl
125	4188.0- 89.0	0.90	0.24			0.14	3.2	2.7	81.3	2.84	Dol vf f styl
126	4189.0- 90.0	3.40	0.43			0.90	2.4	0.8	94.7	2.83	Dol vf f foss
127	4190.0- 91.0	0.04	0.02			0.40	5.3	3.9	85.4	2.84	Dol sli/pyr vf f p.p. foss
128	4191.0- 92.0	0.21	0.13			0.16	3.8	4.4	92.3	2.84	Dol vf f styl
129	4192.0- 93.0	0.98	0.91			0.24	5.9	4.0	79.4	2.83	Dol vf f vug
130	4193.0- 94.0	0.37	0.03			0.10	8.9	2.3	81.5	2.82	Dol vf f sli/vug
131	4194.0- 95.0	11.0	1.90			1.60	2.1	11.5	80.6	2.82	Dol sli/sdy vf f
132	4195.0- 96.0	71.0	15.0			7.30	10.0	7.8	65.9	2.81	Dol vf p.p.

CORE LABORATORIES

CHEVRON U.S.A., INC.
E.M.S.U. NO. 679

Field : EUNICE MONUMENT SOUTH
Formation : GRAYBURG

File No.: 57181-16203
Date : 10-16-90

CORE ANALYSIS RESULTS

SAMPLE NUMBER	DEPTH	PERMEABILITY				PERMEABILITY (VERTICAL)	POROSITY (HELIUM)	SATURATION (PORE VOLUME)		GRAIN DENSITY	DESCRIPTION
	ft	KA MAX md	90 DEG md	N/S md	E/W md	Kair md	%	OIL %	WATER %	gm/cc	
133	4196.0- 97.0	10.0	4.10			7.60	8.4	20.3	59.9	2.82	Dol vf f p.p.
134	4197.0- 98.0	3.20	2.40			0.90	6.1	38.9	51.9	2.82	Dol sli/shy vf f
135	4198.0- 99.0	32.0	18.0			3.80	10.1	27.5	52.9	2.82	Dol vf p.p.
136	4199.0- 00.0	113.	11.0			9.20	7.4	23.6	62.9	2.83	Dol sli/shy vf f sli/vug styl
137	4200.0- 01.0	1.70	0.94			0.53	5.7	1.3	79.7	2.83	Dol vf f p.p.
138	4201.0- 02.0	3.50	1.80			3.30	6.2	24.2	67.7	2.82	Dol vf f sli/vug
139	4202.0- 03.0	119.	98.0			26.0	6.8	25.2	60.5	2.84	Dol vf f vug
140	4203.0- 04.0	27.0	22.0			48.0	5.6	10.7	64.2	2.83	Dol f vf vug
141	4204.0- 05.0	4.90	1.70			3.10	9.8	13.9	62.0	2.80	Dol vf f sli/vug
142	4205.0- 06.0	11.0	11.0			11.0	7.9	12.4	74.6	2.82	Dol vf f vug styl
143	4206.0- 07.0	82.0	59.0			7.80	7.2	20.2	72.7	2.81	Dol vf f vug styl
144	4207.0- 08.0	30.0	29.0			24.0	13.4	19.7	59.9	2.85	Dol vf vug
145	4208.0- 09.0	24.0	14.0			2.80	10.5	21.3	53.2	2.86	Dol vf vug styl
146	4209.0- 10.0	5.80	1.60			5.50	8.8	15.6	62.2	2.77	Dol sli/pyr vf sli/vug
147	4210.0- 11.0	0.33	0.19			0.05	6.4	12.1	72.8	2.83	Dol vf f sli/vug
148	4211.0- 12.0	0.61	0.52			0.93	11.5	11.0	72.1	2.83	Dol vf f sli/vug
149	4212.0- 13.0	4.30	4.20			4.60	11.2	7.6	76.2	2.83	Dol vf f sli/vug
150	4213.0- 14.0	6.40	3.90			2.60	8.3	16.7	52.4	2.84	Dol vf
151	4214.0- 15.0	11.0	4.50			2.80	8.5	33.2	37.9	2.83	Dol sli/sdy sli/vug
152	4215.0- 16.0	3.50	1.50			1.60	9.4	28.5	39.2	2.83	Dol sli/sdy sli/vug p.p.
153	4216.0- 17.0	8.80	6.60			6.00	10.2	17.8	48.4	2.83	Dol sli/sdy vug
154	4217.0- 18.0	231.	141.			17.0	12.7	19.7	61.9	2.82	Dol sli/sdy vf vug
155	4218.0- 19.0	23.0	5.00			0.48	5.8	12.1	62.0	2.84	Dol vf p.p. styl
156	4219.0- 20.0	17.0	5.90			4.00	7.5	21.1	46.9	2.84	Dol sli/sdy vf p.p. styl
157	4220.0- 21.0	197.	100.			12.0	7.2	36.1	40.6	2.84	Dol vf f p.p. styl
158	4221.0- 22.0	0.44	0.22			0.15	8.5	26.9	49.3	2.84	Dol p.p.
159	4222.0- 23.0	25.0	2.40			33.0	5.8	18.0	59.8	2.82	Dol vf f p.p.
160	4223.0- 24.0	1.40	1.10			0.18	13.3	38.1	42.4	2.86	Dol vf p.p.
161	4224.0- 25.0	15.0	6.00			27.0	8.0	26.5	58.6	2.82	Dol vf

CORE LABORATORIES

CHEVRON U.S.A., INC.
E.M.S.U. NO. 679

Field : EUNICE MONUMENT SOUTH
Formation : GRAYBURG

File No.: 57181-16203
Date : 10-16-90

CORE ANALYSIS RESULTS

SAMPLE NUMBER	DEPTH ft	PERMEABILITY KA MAX md	PERMEABILITY 90 DEG md	PERMEABILITY N/S md	PERMEABILITY E/W md	PERMEABILITY (VERTICAL) Kair md	POROSITY (HELIUM) %	SATURATION (PORE VOLUME) OIL %	SATURATION (PORE VOLUME) WATER %	GRAIN DENSITY gm/cc	DESCRIPTION
162	4225.0- 26.0	6.80	6.00			9.90	10.7	34.0	34.0	2.83	Dol sli/anhy p.p.
163	4226.0- 27.0	0.95	0.91			16.0	10.0	35.4	26.0	2.87	Dol vf p.p.
164	4227.0- 28.0	35.0	1.90			89.0	9.4	34.3	30.1	2.84	Dol sli/anhy vf p.p.
165	4228.0- 29.0	0.44	0.35			0.33	7.5	39.4	33.8	2.84	Dol vf p.p.
166	4229.0- 30.0	2.00	0.37			1.00	6.4	37.2	39.1	2.83	Dol vf p.p.
167	4230.0- 31.0	5.10	2.00			3.30	7.6	29.4	37.8	2.87	Dol sli/anhy vf p.p. styl
168	4231.0- 32.0	1790.	0.04			4432.	3.9	13.6	59.9	2.84	Dol vf p.p.
169	4232.0- 33.0	9.90	6.80			14.0	5.4	35.1	50.2	2.83	Dol vf vug styl
170	4233.0- 34.0	1292.	102.			7.70	4.8	33.8	46.4	2.81	Dol vf f vug
171	4234.0- 35.0	1.60	1.20			0.88	5.6	29.8	59.6	2.83	Dol vf f sli/vug styl
172	4235.0- 36.0	1.70	1.30			1.10	6.7	37.1	42.9	2.84	Dol vf f sli/vug
173	4236.0- 37.0	8.30	7.30			4.40	9.5	28.4	38.6	2.84	Dol sli/anhy sli/vug
174	4237.0- 38.0	30.0	26.0			1.90	6.6	34.3	38.1	2.83	Dol sli/anhy vf p.p.
175	4238.0- 39.0	23.0	22.0			7.70	11.2	32.5	28.9	2.84	Dol sli/sdy p.p.
176	4239.0- 40.0	33.0	33.0			4.30	13.5	30.7	34.8	2.83	Dol sli/sdy p.p.
	CORE NO. 4 4240-4297 CUT 57' REC 41'										
177	4240.0- 41.0	19.0	17.0			40.0	14.9	38.4	28.4	2.82	Dol f sli/vug p.p.
178	4241.0- 42.0	42.0	41.0			5.90	13.2	21.0	41.9	2.83	Dol f sli/vug p.p.
179	4242.0- 43.0	5.30	3.50			6.20	9.8	25.4	42.4	2.84	Dol F p.p.
180	4243.0- 44.0	23.0	19.0			36.0	12.4	30.2	40.3	2.82	Dol F p.p.
181	4244.0- 45.0	164.	1.20			1895.	8.5	22.8	39.8	2.85	Dol F vf p.p.
182	4245.0- 46.0	2940.	0.41			96.0	8.8	19.9	39.8	2.88	Dol F vf p.p.
183	4246.0- 47.0	0.68	0.02			<.01	6.3	32.4	55.5	2.85	Dol F sli/vug p.p. styl
184	4247.0- 48.0	26.0	24.0			23.0	15.0	33.0	26.7	2.88	Dol F sli/vug p.p.
185	4248.0- 49.0	35.0	32.0			1.50	12.7	18.3	52.9	2.83	Dol F sli/vug p.p. foss
186	4249.0- 50.0	12.0	10.0			3.70	12.5	16.3	52.0	2.84	Dol sli/vug
187	4250.0- 51.0	7.00	6.50			3.00	12.1	17.3	41.9	2.87	Dol f sli/vug p.p. styl

CORE LABORATORIES

CHEVRON U.S.A., INC.
E.M.S.U. NO. 679

Field : EUNICE MONUMENT SOUTH
Formation : GRAYBURG

File No.: 57181-16203
Date : 10-16-90

C O R E   A N A L Y S I S   R E S U L T S

SAMPLE NUMBER	DEPTH ft	PERMEABILITY KA MAX md	PERMEABILITY 90 DEG md	PERMEABILITY N/S md	PERMEABILITY E/W md	PERMEABILITY (VERTICAL) Kair md	POROSITY (HELIUM) %	SATURATION (PORE VOLUME) OIL %	SATURATION (PORE VOLUME) WATER %	GRAIN DENSITY gm/cc	DESCRIPTION
188	4251.0- 52.0	197.	1.40			11.0	9.1	17.3	52.0	2.83	Dol vf sli/vug p.p.
189	4252.0- 53.0	1.80	1.20			1.40	5.9	5.2	77.8	2.85	Dol F sli/vug styl
190	4253.0- 54.0	1.10	1.10			1.40	4.9	4.0	88.0	2.85	Dol F sli/vug styl
191	4254.0- 55.0	0.88	0.08			0.20	9.2	10.5	54.8	2.84	Dol F sli/vug p.p. lam
192	4255.0- 56.0	0.39	0.14			0.06	8.0	8.2	59.3	2.83	Dol F sli/vug p.p. lam
193	4256.0- 57.0	0.21	0.20			0.06	8.2	24.4	40.7	2.85	Dol sli/arg f p.p. lam
194	4257.0- 58.0	0.87	0.58			0.69	10.1	18.8	43.4	2.87	Dol sli/arg sli/vug p.p.
195	4258.0- 59.0	7.40	5.20			4.80	11.4	15.9	49.9	2.85	Dol f sli/vug p.p.
196	4259.0- 60.0	3.10	1.20			0.93	11.4	17.8	54.3	2.85	Dol F vf sli/vug p.p.
197	4260.0- 61.0	2.20	2.10			1.90	12.4	13.6	48.5	2.85	Dol f p.p.
198	4261.0- 62.0	1.40	1.40			1.00	12.3	19.4	41.2	2.86	Dol f p.p.
199	4262.0- 63.0	1.20	0.11			<.01	3.5	20.0	79.8	2.85	Dol F vf p.p.
* 200	4263.0- 64.0		<.01			<.01	2.2	0.0	94.8	2.83	Dol F p.p.
* 201	4264.0- 65.0		<.01				2.1	0.0	92.0	2.80	Dol
* 202	4265.0- 66.0		<.01				2.5	4.1	87.2	2.84	Dol f
203	4266.0- 67.0	0.94	0.64			58.0	3.1	4.1	82.2	2.86	Dol F vf sli/vug
204	4267.0- 68.0	290.	193.			115.	19.6	13.5	75.7	2.82	Dol F p.p.
205	4268.0- 69.0	<.01	<.01			0.93	6.0	5.9	59.1	2.88	Dol F vf p.p.
206	4269.0- 70.0	0.41	0.34			0.48	8.2	17.3	61.5	2.84	Dol f sli/vug p.p.
207	4270.0- 71.0	14.0	8.60			7.00	7.0	17.5	67.4	2.83	Dol F vf p.p. styl
208	4271.0- 72.0	0.93	0.93			0.43	7.0	19.7	70.8	2.84	Dol F sli/vug p.p. styl
209	4272.0- 73.0	36.0	27.0			3.20	10.2	19.0	63.3	2.84	Dol F p.p.
* 210	4273.0- 74.0		4.80				12.6	15.7	67.3	2.83	Dol p.p.
* 211	4274.0- 75.0		3.10				10.2	10.3	73.9	2.83	Dol p.p.
* 212	4275.0- 76.0		46.0			35.0	14.3	12.2	69.9	2.82	Dol p.p.
213	4276.0- 77.0	6.60	2.80			8.70	9.9	11.2	52.2	2.86	Dol F vf p.p.
214	4277.0- 78.0	37.0	5.10			25.0	10.1	14.8	67.6	2.82	Dol F vf p.p.
* 215	4278.0- 79.0		276.				19.7	10.4	76.5	2.82	Dol p.p.
* 216	4279.0- 80.0		6.00				9.8	15.3	48.3	2.83	Dol sli/vug p.p.

CORE LABORATORIES

CHEVRON U.S.A., INC.
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Field : EUNICE MONUMENT SOUTH
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File No.: 57181-16203
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C O R E   A N A L Y S I S   R E S U L T S

	SAMPLE NUMBER	DEPTH ft	PERMEABILITY KA MAX md	PERMEABILITY 90 DEG md	PERMEABILITY N/S md	PERMEABILITY E/W md	PERMEABILITY (VERTICAL) Kair md	POROSITY (HELIUM) %	SATURATION (PORE VOLUME) OIL %	SATURATION (PORE VOLUME) WATER %	GRAIN DENSITY gm/cc	DESCRIPTION
*	217	4280.0- 81.0		14.0				14.3	16.1	54.5	2.84	Dol sli/vug p.p.
		4281.0- 97.0										Lost core
		CORE NO. 5 4297-4358 CUT 61' REC 61'										
	218	4297.0- 98.0	99.0	1.30			1.10	7.8	12.1	82.5	2.86	Dol F vf p.p. styl
*	219	4298.0- 99.0		<.01				1.8	8.1	81.3	2.83	Dol F vf sli/vug
	220	4299.0- 00.0	0.19	0.17			0.07	3.7	4.3	85.7	2.85	Dol F sli/vug
	221	4300.0- 01.0	0.09	0.08			<.01	5.4	2.6	92.1	2.86	Dol sli/pyr F biot styl
	222	4301.0- 02.0	0.75	0.15			0.05	11.8	1.7	93.6	2.77	Dol sli/sdy F sli/vug
	223	4302.0- 03.0	0.05	0.05			<.01	12.1	0.0	95.4	2.79	Dol sli/sdy sli/pyr
	224	4303.0- 04.0	0.17	0.16			<.01	13.6	2.6	79.4	2.82	Dol sli/sdy
	225	4304.0- 05.0	0.12	0.11			0.06	14.5	0.0	83.7	2.84	Dol sli/sdy
	226	4305.0- 06.0	0.25	0.24			0.13	14.8	0.0	85.0	2.83	Dol sli/sdy
	227	4306.0- 07.0	0.02	<.01			0.06	12.8	0.0	89.7	2.81	Dol sli/sdy
	228	4307.0- 08.0	1.50	1.10			0.16	12.4	0.0	96.6	2.85	Dol sli/sdy
	229	4308.0- 09.0	<.01	<.01			0.06	8.4	0.0	96.5	2.80	Dol sli/sdy sli/shy sh lam
	230	4309.0- 10.0	0.05	0.01			0.14	8.8	0.0	96.9	2.83	Dol F sli/shy sh lam
	231	4310.0- 11.0	3.60	2.70			2.40	12.1	4.6	83.6	2.83	Dol F sli/vug styl
	232	4311.0- 12.0	0.55	0.35			0.50	5.9	5.9	83.2	2.86	Dol anhy sli/vug
	233	4312.0- 13.0	0.13	0.08			0.12	8.5	1.6	87.5	2.86	Dol F p.p.
	234	4313.0- 14.0	0.13	0.10			0.13	9.7	2.0	94.0	2.84	Dol F shr p.p. styl
	235	4314.0- 15.0	0.10	0.10			0.28	5.7	12.0	82.6	2.82	Dol sli/vug shr foss
	236	4315.0- 16.0	3.40	0.91			0.92	10.1	19.8	59.3	2.84	Dol sli/lim F p.p.
	237	4316.0- 17.0	0.23	0.19			0.06	4.3	13.8	82.9	2.85	Dol F p.p. styl
	238	4317.0- 18.0	<.01	<.01			<.01	6.0	1.3	92.7	2.86	Dol shy sli/pyr vf sh lam styl
	239	4318.0- 19.0	0.08	0.03			0.09	7.0	2.6	89.8	2.85	Dol F vf styl
	240	4319.0- 20.0	1.20	0.19			0.76	10.3	8.1	62.3	2.85	Dol F
	241	4320.0- 21.0	0.14	0.14			<.01	8.0	4.7	93.2	2.84	Dol vf

CORE LABORATORIES

CHEVRON U.S.A., INC.
E.M.S.U. NO. 679

Field : EUNICE MONUMENT SOUTH
Formation : GRAYBURG

File No.: 57181-16203
Date : 10-16-90

C O R E   A N A L Y S I S   R E S U L T S

SAMPLE NUMBER	DEPTH	PERMEABILITY				PERMEABILITY (VERTICAL)	POROSITY (HELIUM)	SATURATION (PORE VOLUME)		GRAIN DENSITY	DESCRIPTION
	ft	KA MAX md	90 DEG md	N/S md	E/W md	Kair md	%	OIL %	WATER %	gm/cc	
242	4321.0- 22.0	0.11	0.06			<.01	9.3	2.7	93.7	2.85	Dol sli/shy sli/pyr sh lam
243	4322.0- 23.0	0.17	0.15			<.01	9.6	3.9	86.3	2.84	Dol p.p. styl
244	4323.0- 24.0	0.35	0.20			0.18	9.7	10.9	62.2	2.82	Dol vf sli/vug
245	4324.0- 25.0	0.13	0.06			<.01	9.6	6.8	84.0	2.84	Dol
246	4325.0- 26.0	1.90	1.20			0.83	5.4	5.7	91.7	2.84	Dol F
247	4326.0- 27.0	1.20	0.19			0.15	9.1	2.7	82.3	2.88	Dol styl
248	4327.0- 28.0	0.58	0.53			19.0	10.1	2.8	87.8	2.84	Dol vf
249	4328.0- 29.0	0.50	0.45			9944.	11.4	2.2	88.2	2.88	Dol vf
250	4329.0- 30.0	0.13	0.04			9101.	9.4	0.0	94.6	2.86	Dol vf
251	4330.0- 31.0	0.17	0.11			<.01	8.5	1.5	87.1	2.85	Dol F
252	4331.0- 32.0	0.11	0.04			0.04	9.6	0.0	91.0	2.85	Dol
253	4332.0- 33.0	0.86	0.66			1.10	9.1	0.0	93.4	2.85	Dol vf
254	4333.0- 34.0	11.0	2.20			9269.	5.8	0.0	92.2	2.86	Dol vf
255	4334.0- 35.0	0.24	0.09			0.03	8.8	0.0	96.8	2.84	Dol F styl
256	4335.0- 36.0	46.0	11.0			10.0	3.7	0.0	88.3	2.86	Dol sli/lim F vf
257	4336.0- 37.0	4705.	0.45			1962.	3.9	0.0	78.1	2.88	Dol vf
258	4337.0- 38.0	0.90	0.65			0.79	12.2	6.6	75.0	2.85	Dol sli/lim p.p.
259	4338.0- 39.0	1.30	1.10			0.82	11.3	7.4	76.9	2.85	Dol slil/vug
260	4339.0- 40.0	0.48	0.23			<.01	8.9	0.0	95.5	2.84	Dol vf
261	4340.0- 41.0	0.84	0.35			0.29	12.7	0.0	92.9	2.84	Dol F
262	4341.0- 42.0	1.60	1.30			0.28	9.5	0.0	92.9	2.84	Dol sli/shy F sh lam styl
263	4342.0- 43.0	9.60	2.40			<.01	6.3	0.0	96.7	2.85	Dol sli/lim sli/shy F styl
264	4343.0- 44.0	0.51	0.18			0.22	3.1	0.0	95.7	2.83	Dol sli/lim vf vug
265	4344.0- 45.0	1.10	0.58			0.34	3.2	6.5	51.6	2.89	Dol sli/lim F vug shr
266	4345.0- 46.0	4.20	1.70			2.10	2.1	8.8	80.7	2.85	Dol sli/im F sli/vug shr
* 267	4346.0- 47.0		<.01				0.7	0.0	91.7	2.85	Dol F vf sli/vug
268	4347.0- 48.0	0.17	0.09			0.05	2.3	0.0	80.0	2.86	Dol F p.p.
269	4348.0- 49.0	0.48	0.11			1.10	2.5	0.0	96.7	2.85	Dol F vf styl
270	4349.0- 50.0	0.40	0.20			0.23	2.7	0.0	80.0	2.87	Dol F

CORE LABORATORIES

CHEVRON U.S.A., INC.
E.M.S.U. NO. 679

Field : EUNICE MONUMENT SOUTH
Formation : GRAYBURG

File No.: 57181-16203
Date : 10-16-90

C O R E A N A L Y S I S R E S U L T S

SAMPLE NUMBER	DEPTH ft	PERMEABILITY KA MAX md	PERMEABILITY 90 DEG md	PERMEABILITY N/S md	PERMEABILITY E/W md	PERMEABILITY (VERTICAL) Kair md	POROSITY (HELIUM) %	SATURATION (PORE VOLUME) OIL %	SATURATION (PORE VOLUME) WATER %	GRAIN DENSITY gm/cc	DESCRIPTION
271	4350.0- 51.0	83.0	32.0			2.90	4.4	0.0	82.4	2.85	Dol sli/lim sli/pyr F vug styl
272	4351.0- 52.0	4.20	0.70			1.90	1.8	0.0	89.7	2.85	Dol sli/lim F vug
* 273	4352.0- 53.0		<.01				1.5	0.0	94.6	2.86	Dol F vf sli/vug
274	4353.0- 54.0	134.	19.0			42.0	4.9	0.0	82.8	2.86	Dol sli/lim F vug
275	4354.0- 55.0	143.	71.0			80.0	9.5	12.7	61.8	2.87	Dol sli/lim vug
276	4355.0- 56.0	7.20	5.90			2.60	6.5	18.9	69.4	2.82	Dol vf p.p.
277	4356.0- 57.0	109.	64.0			39.0	12.0	16.2	81.1	2.83	Dol p.p.
* 278	4357.0- 58.0		5.70				14.4	10.1	89.4	2.85	Dol F vf vug shr

* INDICATES PLUG PERMEABILITY

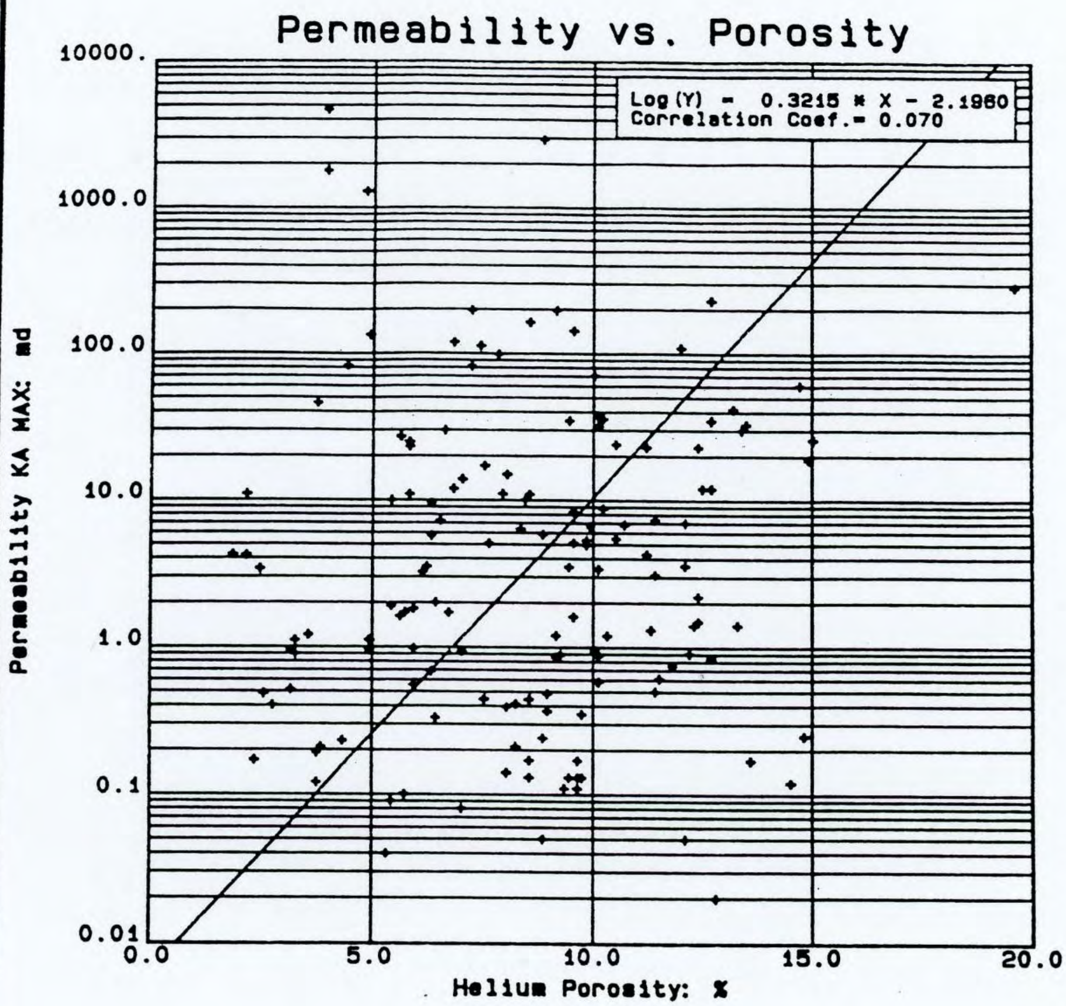
Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

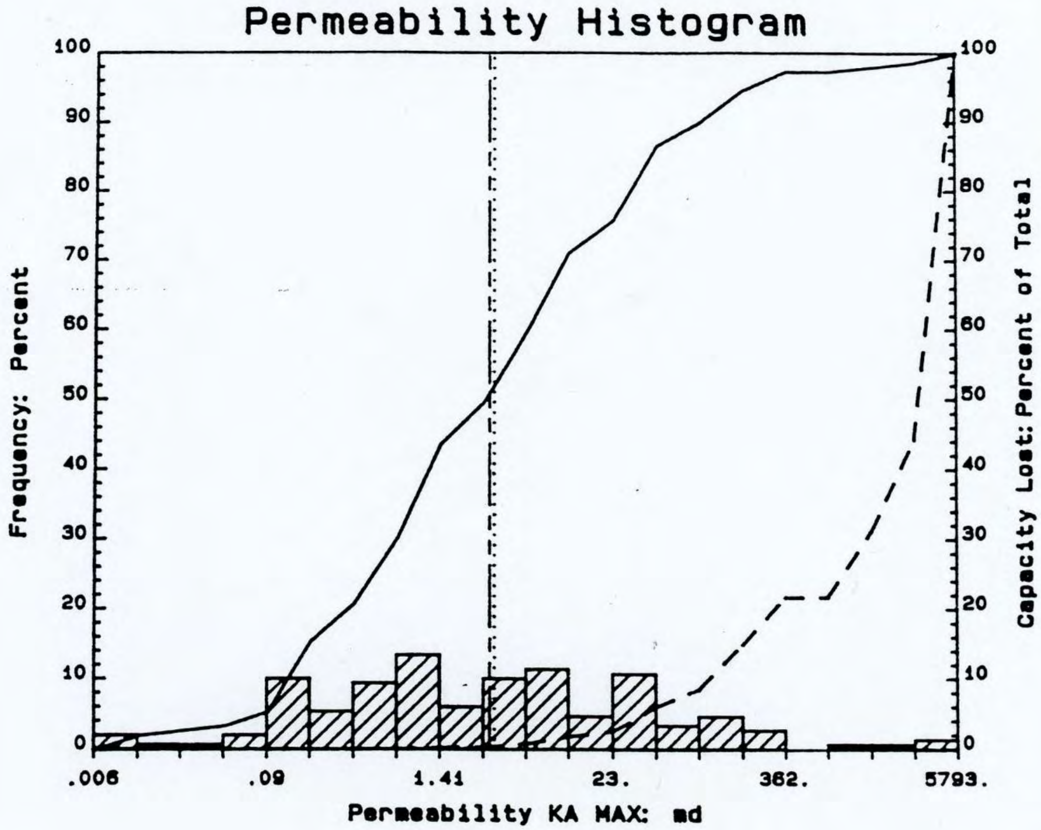
LITHOLOGICAL ABBREVIATIONS

Anhy, anhy	anhydrite (-ic)	Lim, lim	limestone
Ark, ark	arkose (-ic)	med gr	mediam grain
bnd	band (-ed)	Mtrx	matrix
Brec, brec	breccia	NA	interval not analyzed
Calc, calctc	calcite (-ic)	Nod, nod	nodules (-ar)
carb	carbonaceous	Ool, ool	oolite (-itic)
crs gr	course grained	Pisol, pisol	pisolite, pisolitic
Chk, chky	chalk (-y)	p.p.	pin-point (porosity)
Cht, cht	chert (-y)	Ptg	parting
Cgl, cgl	conglomerate (-ic)	Pyr, pyr	pyrite (-itized, -itic)
crs xln	coursely crystaline	Sd, sdy	sand (-y)
dns	dense	Sh, shy	shale (-ly)
Dol, dol	dolomite (-ic)	SHR	solid hydrocarbon residue
F	randomly oriented fractures	sli	slightly
f	slightly fractured	Slt, slty	silt (-y)
f gr	fine grained	styl	stylolite (-itic)
foss	fossil (-iferous)	suc	sucrosic
f xln	finely crystalline	Su, su	sulphur, sulphurous
Gil	gilsonite	TBFA	TOO BROKEN FOR ANALYSIS
Glauc, glauc	glauconite (-itic)	Trip, trip	tripoli (-itic)
Grt	granite	v	very
Gyp, gyp	gypsum (-iferous)	vf	predominantly vertically fractured
hor frac	perdominantly horizontally fractured	vug	vug (-gy)
incl	inclusion (-ded)	xbd	crossbedded
intbd	interbedded	xln	medium crystalline
lam	lamina (-tions, -ated)	xtl	crystal

THE FIRST WORD IN THE DESCRIPTION COLUMN OF THE CORE ANALYSIS REPORT DESCRIBES THE ROCK TYPE. FOLLOWING ARE ROCK MODIFIERS IN DECREASING ABUNDANCE AND MISCELLANEOUS DESCRIPTIVE TERMS.

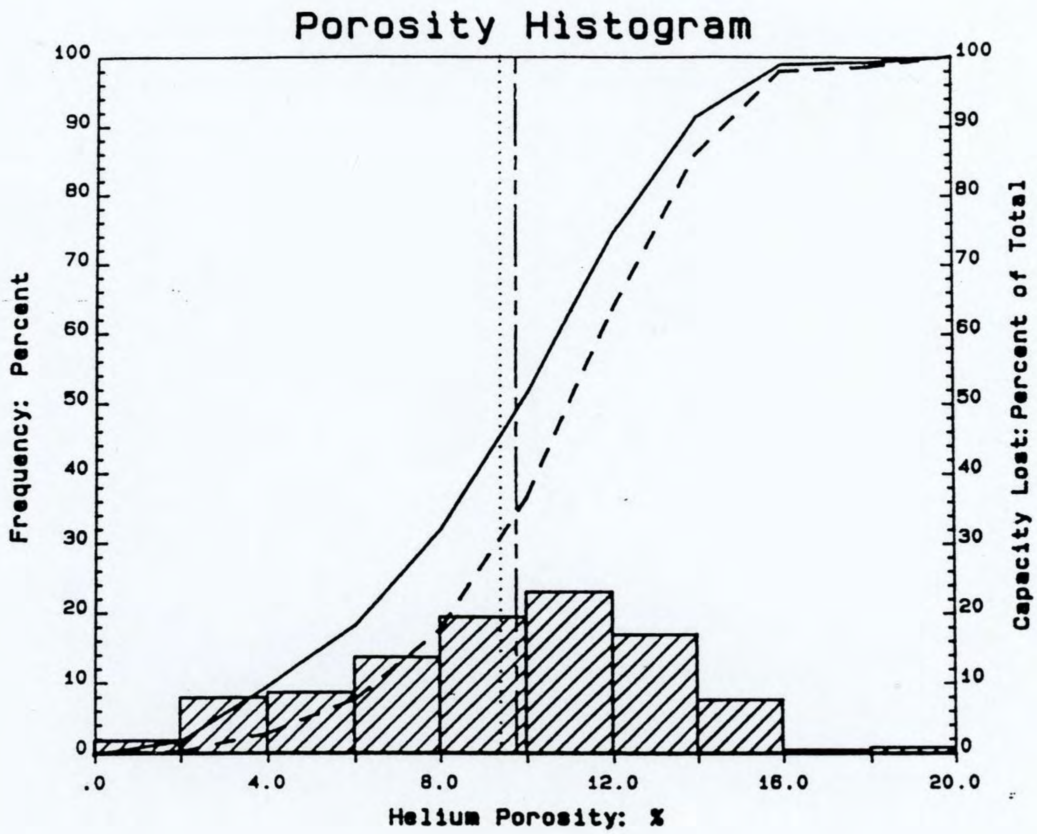


CHEVRON U.S.A., INC. E.M.S.U. NO. 679 EUNICE MONUMENT SOUTH FIELD GRAYBURG (4059-4358 feet) Core Laboratories 10-16-90	- LEGEND - GRAYBURG



CHEVRON U.S.A., INC. E.M.S.U. NO. 679 EUNICE MONUMENT SOUTH FIELD GRAYBURG (4059-4358 feet) Core Laboratories 10-16-90	- LEGEND - Median Value (3.10) Geom. Average (3.31) Cumulative Frequency Cumulative Capacity Lost 149 Samples

ENM OCD 23614-17: 00307



CHEVRON U.S.A., INC.
E.M.S.U. NO. 679
EUNICE MONUMENT SOUTH FIELD

GRAYBURG (4059-4358 feet)

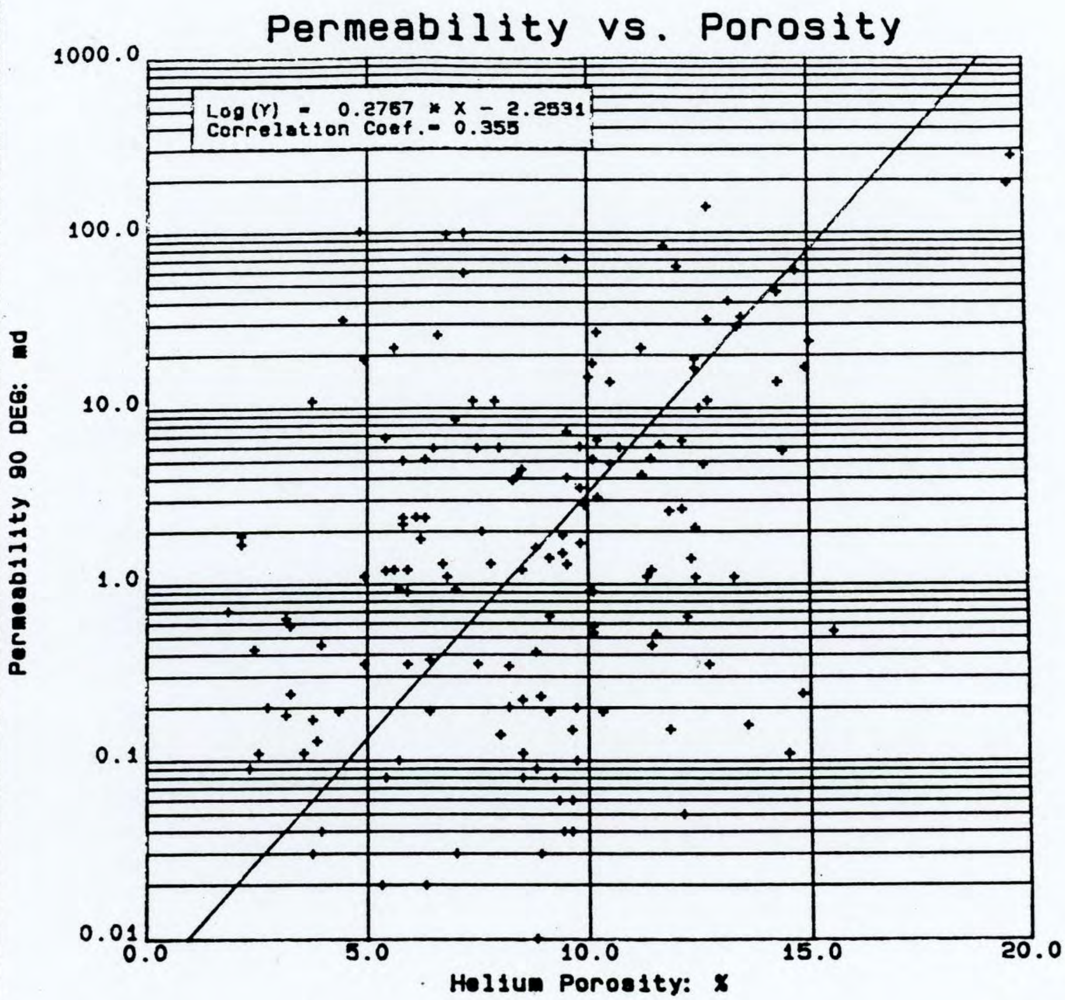
Core Laboratories 10-16-90

\- LEGEND -

Median Value (9.8)
Arith. Average (9.4)
Cumulative Frequency
Cumulative Capacity Lost

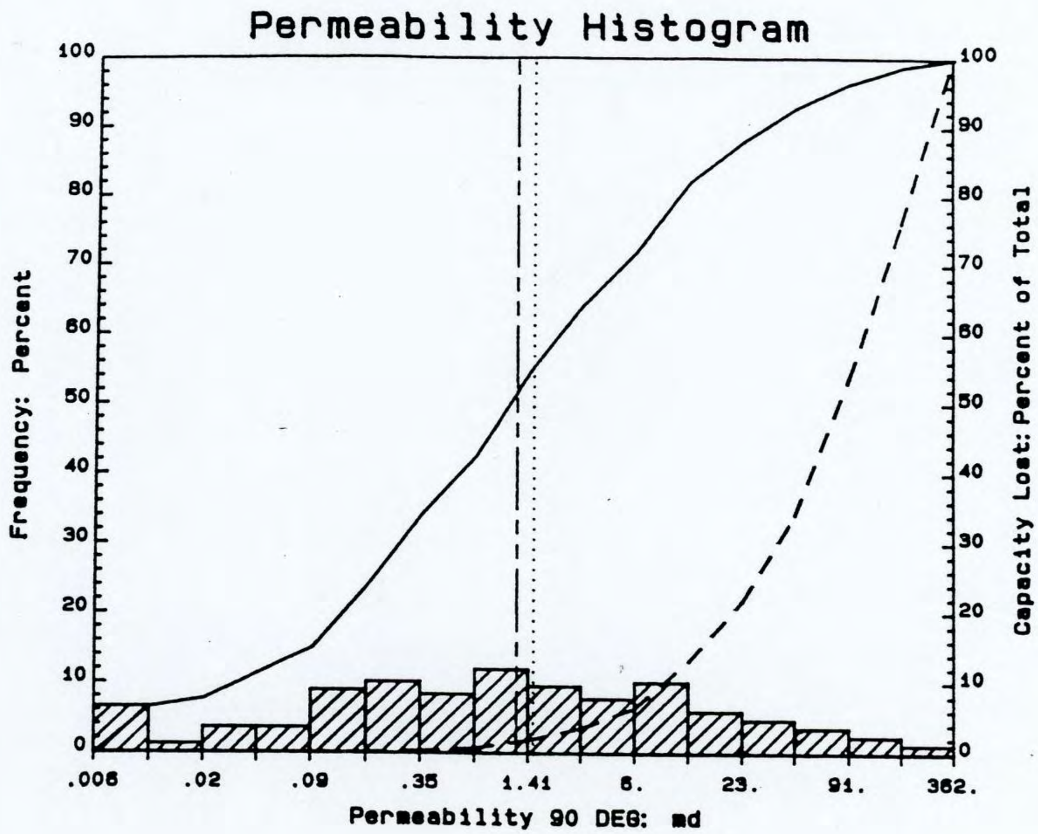
278 Samples

ENM OCD 23614-17: 00308



CHEVRON U.S.A., INC. E.M.S.U. NO. 679 EUNICE MONUMENT SOUTH FIELD GRAYBURG (4059-4358 feet) Core Laboratories 10-16-90	- LEGEND - GRAYBURG

ENM OCD 23614-17: 00309



CHEVRON U.S.A., INC.
E.M.S.U. NO. 679
EUNICE MONUMENT SOUTH FIELD

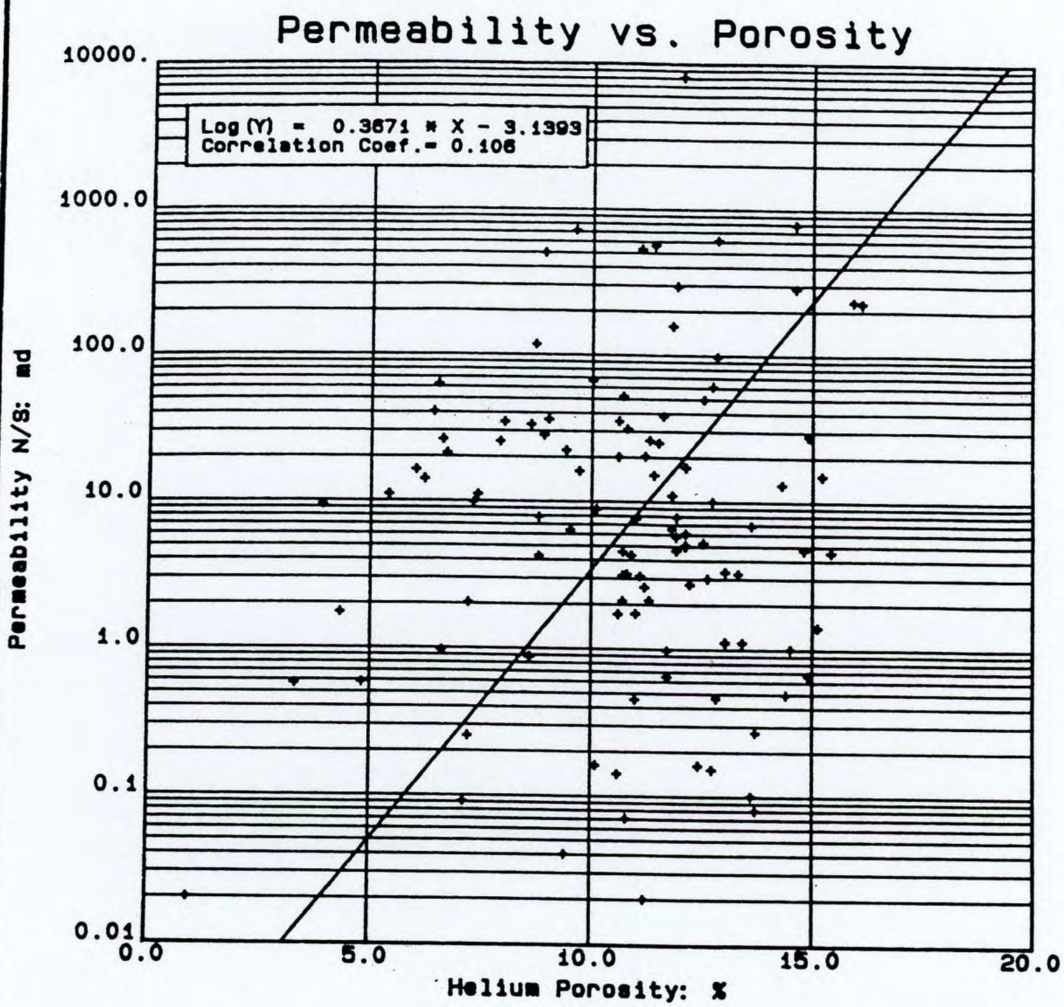
GRAYBURG (4059-4358 feet)

Core Laboratories 10-16-90

\- LEGEND -

- Median Value (1.20)
- Geom. Average (1.49)
- Cumulative Frequency
- Cumulative Capacity Lost

167 Samples



CHEVRON U.S.A., INC.
E.M.S.U. NO. 679
EUNICE MONUMENT SOUTH FIELD

GRAYBURG (4059-4358 feet)

Core Laboratories 10-16-90

- LEGEND -
GRAYBURG