CORE LABORATORIES, INC. Petroleum Reservoir Engineering DALLAS, TEXAS July 1, 1971

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Ryan Oil Company 900 Bank of New Mexico Building Albuquerque, New Mexico 87101

> Subject: Water Analysis Slick Rock Field San Juan County, New Mexico Our File Number: IWTL-7150

Gentlemen:

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This report presents the results of an analysis on one sample of water from the Slick Rock Field. Gravimetric procedures were used in determining the barium and the sulfate contents. Total iron determination was made by electrophotometric means, and the remainder of the constituents were analyzed with conventional titrimetric procedures.

We are pleased to be of service.

Very truly yours,

Core Laboratories, Inc.

Dave K. Keilon (Rhc)

Dare K. Keelan, Manager Industrial Water Technology

DKK:RLC:dl 3 cc. - Addressee



CORE LABORATORIES, INC. Petroleum Reserve Engineering

DALLAS, TEXAS

WATER ANALYSIS

				-	Pa Fil	age 1 of	1
]	Mixture of No	s. 9. 11		
Company Ry	an Oil Compan	y	Well Name	& 13	Sa	mple No	
Formation	Dakota	Depth_			Sampled From		
Location		Field	Slick Ro	ock(County San Juan	State New	<u>Mexico</u>
Date Sampled	6-1-71	Date A	nalyzed	6-16-71	Analyst	RLC	
Total Dissolved	Solids 3584 1	mg/L_calc	ulated	-	Specific Gravity	1.0123 1.0095_@	60• F. <u>74</u> _F.
Resistivity 2.	53 ohm-meters @	7 <u>4_</u> ∘F. <u>∎</u>	pH_		Hydrogen Sulfide_	present	
* Constituents	meq/L	mg/L	1	Constituents	meq/L	mg∠L	
Sodium	49	1127		Chloride	15	532	
Calcium	0.4	8		Bicarbona	ate 17	1056	
Magnesiun	n 0.6	7		Sulfate	18	854	(Grav.)
Iron	Trace			Carbonate	e -0-	-0-	
Barium	-0-	-0-	(Grav.)	Hydroxid	e -0-	-0-	
20 10 Na	akalmhalmhalmhal 12	10 Improproproprogram	2	<mark>dendendendenskanden bereiten</mark> O 2	10 15 nhaqaadaabadaabaadaa	doorlooplaathool Cl 50	10
1 Ga	ndundandundun unlanlaadun) and surface free free free free free free free fr			ufuntuu suufuntuu una m		1
1 Mg	almdaalaadaa						1

Scale: meq/L

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* All analyses except iron determination performed on a filtered sample.

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		NEW MEYICO OIL CONSERVATION COMMISSION
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		EXAMINER HEARING
UC No.	8	
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	3	IN THE MATTER OF:
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a S	V	Application of Rijan Oil) Case No. 4560
<u>ا</u> الم	3	Company, Inc., for a pressure)
	Ē	maintenance project, San Juan)
		County, New Mexico.)
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	0.	BEFORE: DANIEL S. NUTTER, EXAMINER
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1	MR. NUTTER: Call next Case Number 4560.
2	MR. HATCH: Case 4560. Application of Rijan Oil
3	Company, Inc. for a pressure maintenance project, San Juan
4	County, New Mexico.
5	MR. KELLAHIN: If the Examiner please, Jason
6	Kellahin, Kellahin and Fox, Santa Fe, appearing for the
7	applicant.
8	We have one witness I would like to have sworn.
9	(Witness sworn)
10	VAL R. REESE
11	having been first duly sworn according to law, upon his
12	oath testified as follows:
13	DIRECT EXAMINATION
14	BY MR. KELLAHIN:
15	Q Would you state your name, please?
16	A Val R. Reese.
17	Q What business are you engaged in, Mr. Reese?
18	A I am a consulting geologist.
19	Q And where are you located?
20	A I live in Albuquerque, New Mexico.
21	Q Do you have any connection with the applicants in this
22	case, Rijan Oil Company?
23	A Yes. I work or do consulting work for the Rijan
24	Oil Company, Inc.
25	Q And in connection with your consulting work, have you

PAGE 2

		PAGE 3
1		studied the proposed pressure maintenance project, as
2		Plat Four in Case 4560?
3	A	Yes, I have. I have prepared a structure map and a
4		schematic diagram, as well as the check, or gone over
5		and prepared a land map.
6	Q	Have you ever testified before the Oil Conservation
7		Commission and made your qualifications a matter of
8		record?
9	A	Yes, I have. I testified for Pacific Northwest
10		Pipeline when I was with Pacific.
11		MR. KELLAHIN: Are the witnesses' qualifications
12	acce	ptable?
13		MR. NUTTER: Yes, they are.
14	Q	(Mr. Kellahin continuing) Mr. Reese, briefly, what
15		is proposed by the applicant in Case 4560?
16	A	In reference to the land map
17	Q	You are referring to what has been marked as Exhibit
18		Number 1; is that correct?
19	A	Yes. Rijan Oil Company has Section 31 of Township
20		30 North, Range 16 West, in the San Juan County,
21		New Mexico, which is an Indian, a Navajo Indian lease,
22		and Rijan Oil Company has drilled several shallow wells
23		on the tract which are about 900 feet in depth, and
24		has produced Dakota oil from these wells.
25	0	Is that in the Slick Rock Dakota Pool?

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1	A	It is in the Slick Rock Dakota Pool, and the proposal
2		is to pressure up or reinject produced water on flank
3		wells, and in an attempt to extract more oil from the
4		present producing wells.
5	Q	Now, on Exhibit Number 1 it also shows the offsetting
6		wells and the ownerships of the other leases in the
7		area, does it not?
8	A	Yes, sir. Yes, it does. Section 36 to the west is
9		operated by Clyde C. Kennedy, and Section 6 to the
10		south is operated by Walter Duncan, and the acreage
11		to the north and the east is on leased Navajo land.
12	Q	Now, referring to what has been marked as the
13		Applicant's Exhibit Number 2, would you identify that
14		exhibit, please?
15	A	This Exhibit Number 2 is a Dakota structure map.
16		Datum is for the top of the Dakota Sand Stone, and
17		the structure map shows northeast trending anticline
18		in which Rijan's Numbers 9 and 11 and 13 wells are
19		located.
20		Contrary interval on the map is five feet.
21		Enclosure on the structure is approximately twenty
22		feet.
23		And on the southwest side of the structure, a
24		structurally low area is present, as determined from
25		the subsurface information and the wells drilled in

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1 this anticlinal area. 2 The Rijan Number 10 well is on the northeast 3 side of the structure, and the Rijan Number 14 well is 4 on the southeast side, and on the Rijan Number 12 is --5 on the southwest flank, and these are structurally low 6 wells, and incur proposal to inject produced water into 7 the Rijan 12 -- 10, 12 and 14 wells from the 8 producing wells, also. 9 We may produce some water from the Rijan Number 10 15 by perforating the overlying Gallup formation. 11 That is in the event you need additional water? 0 12 In the event that we need it, yes. Ά What volume of water are you producing from those 13 0 14 wells at the present time? 15 Approximately sixty-five to seventy barrels of water Α per day. 16 What is the producing mechanism in the Slick Rock 17 Q Dakota Pool? 18 It is a water drive. There is very little gas. 19 A The Dakota formation has an excellent low pressure water 20 drive. 21 One reason for my proceeding with this method 22 of expecting more oil is that, from the formation, is 23 that the hug back oil field located due south of this 24 small closure has had water. 25

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1 It produced water, injected on the flanks of 2 the well, and it seems to keep the field in balance, 3 and results in sustained production. 4 These three wells have produced through May, the 5 end of May, approximately, or very close to 20,000 6 barrels of oil. 7 MR. NUTTER: Which wells do you mean, Mr. 8 Reese? 9 THE WITNESS: The Numbers 9, 11 and 13 wells, 10 and the Number 9 was originally flowing well. Also, the 11 Number 11, the Number 13 would bring oil to the surface, 12 but it was not possible to flow it to the tanks. 13 (Mr. Kellahin continuing) At the present time you are 0 14 pumping all three of the wells; is that correct? 15 All three wells are on pump, and the reservoir Α 16 pressure has declined enough to where none of the 17 wells will flow. 18 At the present time the wells are shut in. We 19 shut the wells in at the end of June, partially to 20 allow the pressure to stabalize, and also because 21 that we have water problems. 22 We have a large pit by the Number 9, but the ground does not absorb the water, and we do need 23 to dispose of that water underground. 24 What is the well head pressure at the present time, 25 0

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T		approximately?
2	A	It is very low. We haven't taken a well head
3		pressure. The original pressure I saw on the well
4		head is about a hundred pounds.
5		I would say the pressure now is about ten or
6		fifteen pounds. It probably will go up as the wells
7		go, the longer that they are left shut in.
8	Q	Now, referring to what has been marked as Exhibits
9		3, 4 and 5, would you identify those exhibits?
10	A	Exhibit 3 is a set of logs. The first one is the
11		Number 10 well. The log has the formation tops
12		marked on it.
13		The Dakota Sand Stone, and this well is at 909
14		feet, and the total depth is 925.
15		The log on the Number 12 well
16	Q	Exhibit Number 4.
17	A	Would this be all part of the same exhibit?
18	Q	3, 4 and 5.
19	A	Oh, Exhibit Number 4 is the Navajo Tribal Number 12
20		well, and the top of the Dakota Sand Stone is at 883
21		in this well, and it's open hole to 899 total depth.
22		Exhibit Number 5 is the Rijan Number 14 well,
23		top of the Dakota Sand Stone is 891, for the total
24		depth at 912, 912 feet.
25	Q	Now, referring to the next series of exhibits. Numbers

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1		6, 7 and 8, would you discuss the information shown
2		on those?
3	А	Exhibit 6 is a schematic diagram of the Rijan Number
4		10 well. It shows four and a half inch casing set
5		to 912 feet, and cemented with sixty sacks of regular
6		cement from 912 feet to 280 feet from the surface.
7		Open hole in this well is from 912 to 925 feet.
8		Exhibit Number 7 is Rijan Number 12 well, which shows
9		the four and a half inch casing set to 887 feet.
10		Total depth is 899 feet, and this well was
11		cemented with seventy sacks of regular cement from
12		887 feet to 166 feet.
13		Exhibit Number 8 is Rijan Number 14 well, with
14		the casing set at 901 feet, and total depth to
15		912 feet, and the well was cemented with seventy
16		sacks of cement from 901 feet to 160 feet from the
17		surface.
18	Q	Now, how do you propose to complete those three wells
19		for water injection, Mr. Reese? Can you inject on
20		the casing, or how do you propose to do it?
21	Α	I guess we will inject right through the casing into
22		the open hole.
23	Q	Now, you have cemented behind the pipes through all
24		the producing formations; is that correct?
25	А	That's right. The top of the cement is above the

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1		Gallup Sand Stone at 314 feet, and to where the pipe
2		is set at the top of the Dakota formation.
3	Q	Now, at the surface is there any water formation or
4		any other water formation that could be damaged by
5		water?
6	A	No. There is no surface no known formation. It
7		is in the Mancos shale, except for the Gallup Sand
8		Stone member of this.
9	Q	Now, this is produced water you are going to inject
10		in these wells; is that correct?
11	A	That's correct.
12	Q	Now, referring to Exhibit Number 9, would you
13		identify that exhibit?
14	A	Exhibit Number 9 is water analysis prepared by Core
15		Laboratories in Farmington, New Mexico.
16	Q	Now, does that analysis indicate that that water
17		would be corrosive and possibly cause damage through
18		the casing to which you propose to inject?
19	A	No, sir. The total dissolved solids is 3584 parts
20		per million, and the chemical analysis does not show any
21		corrosion.
22	Q	In your past experience in handling that produced
23		water, have you had any corrosion problems?
24	A	No, we haven't.
25	Q	None whatever?

1	A	None, no.
2	Q	Do you think it would be safe, then, to inject that
3		type of water down the casing of these wells?
4	A	I believe it would. I can't see why, from the
5		analysis, it would harm the casing or cause damage
6		to any formation.
7	Q	Now, in your opinion, will the injection of water in
8		these three wells cause any damage to the offsetting
9		operators?
10	A	No, I don't believe it will, because this is a
11		close structure, and I believe that the water will
12		the way we are planning and putting this water in is
13		to try and get the wells in balance, and that will
14		only affect the area of your close structure.
15	Q	You only affect the applicant's wells in this; is
16		that right?
17	A	That's correct, yes, on our land.
18	Õ.	In your opinion, will it result in the recovery of
19		oil that would not otherwise be recovered?
20	А	Yes. I think it will recover additional oil. Our
21		present production, before we ceased producing, was
22		about twenty to thirty barrels per day, and I think
23		if we don't inject this, that our production will
24		decline further, that the wells could be produced
25		for a long time, but I believe by repressuring, we

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1		would bring this production back up to about a
2	1	hundred barrels, estimated, about a hundred barrels
3		per day, and that we would be more economically able
4		to recover this additional oil.
5		We have produced approximately twenty thousand
6		barrels, and I believe we can produce as much as
7		fifty thousand barrels additional.
8	Q	Additional oil?
9	A	Yes, estimated.
10	Q	Were exhibits 1 through 8 prepared by you or under
11		your supervision?
12	А	Yes, sir.
13	Q	And Exhibit 9 is a water analysis furnished to you
14		by Core Laboratories?
15	A	That's correct.
16		MR. KELLAHIN: At this time I would like to
17	ente	r in evidence Exhibits 1 through 9, inclusive.
18		MR. NUTTER: Applicant's Exhibits 1 through 9
19	will	be admitted in evidence.
20	Q	(Mr. Kellahin continuing) Do you have anything else,
21		Mr. Reese?
22	A	No, I don't. I would like to thank the commission
23		for setting this hearing up from the original time.
24		I wasn't able to get here at that time, and I
25		appreciate the commission's setting the time up.

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	MR. NUTTER: That's perfectly all right.
	CROSS EXAMINATION
BY M	R. NUTTER:
Q	Mr. Reese, I notice from Exhibits 3 I guess it's
	4 and 5 that you have indicated that the Mancos shale
	extends from the surface down to some 340 or 300 and
	some odd feet.
A	That's correct.
Q	So we have no gravel beds or any other source of
	water in these wells that might be contaminated; is
	this correct?
A	That's correct.
Q	And do you visualize having to use any pressure
	for the injection of this water?
A	Yes. I think we will have to inject it about two
	hundred pounds pressure.
Q	About two hundred pounds pressure?
A	Yes.
Q	Now, I interpret from your structure map, being
	Exhibit Number 2, that you feel that Rijan occupies
	a small anticline completely to itself from the rest

of the pool and that you are separated by this

into your anticline wouldn't affect the other

anticlinal load that extends across the southwest

quarter of Section 31, and therefore, any injection

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1		production; is this correct?
2	А	Yes, that's correct. Our Rijan Number 4 well, we
3		offset the producer just to the west, the Number
4		31, and expect it to be at least as high structurally
5		as that well.
6		The well came in low, and finally to help to find
7		this structure resulted in a dry hole and showed a
8		structural separation from the section or Number 31
9		well of Slick Kennedy's.
10	Q	So you have depicted this incline just coming right
11		through the middle of that well?
12	A	Yes, I have. That is my structural control extending
13		from the Humble One K and the Rijan Number 3 to the
14		southeast.
15	Q	Now, what amount of relief do you have on this
16		anticline that you have depicted here from that
17		Rijan 4? What contour would it be on?
18	A	It is between the Class 4185 contour and the plus
19		4190. There is a little bit a little better than
20		twenty-five feet.
21	Q	I see.
22	A	I mean twenty feet almost twenty-five feet.
23		MR. NUTTER: Are there any further questions of
24	Mr.	Reese? He may be excused.
25		(Witness excused)

1	MR. NUTTER: Do you have anything further, Mr.
2	Kellahin?
3	MR. KELLAHIN: That's all, Mr. Nutter. Thank
4	you.
5	MR. NUTTER: Does anyone have anything they wish
6	to offer in Case Number 4560?
7	We'll take the case under advisement.
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2	WITNESS	PAGE
3	VAL R. REESE	
4	Direct Examination by Mr. Kellahin	2
5	Cross Examination by Mr. Nutter	12
6		
7	<u>E X H I B I T S</u>	
8	Applicant's Exhibits 1 - 9	
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STATE OF NEW MEXICO) COUNTY OF BERNALILLO)

I, LINDA MALONE, Court Reporter, do hereby certify that the foregoing and attached Transcript of Hearing before the New Mexico Oil Conservation Commission was reported by me; and that the same is a true and correct record of the said

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proceedings, to the best of my knowledge, skill and ability. Court Reporter t do hereby cartify that the feregoing is t received a record of the proceedings the line hearing of these to 4570. N8 00 1971 Mile Beesine New Mexico 011 Conservation Commission

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SPECIALIZING IN: DEPOSITIONS, HEARINGS, STATE MENTS, EXPERT TESTIMONY, DAILY COPY, CONVENTIONS BEFORE THE NEW MEXICO OIL CONSERVATION COMMISSION Santa Fe, New Mexico June 30, 1971 EXAMINER HEARING 209 SIMMS BLDG. • P.O. BOX 1092 • PHONE 243-6691 • ALBUQUERQUE, NEW MEXICO IN THE MATTER OF: Application of Rijan Oil Company, Case No. 4560) Inc. for a pressure maintenance project, San Juan County, New Mexico. BEFORE: Elvis A. Utz, Examiner. TRANSCRIPT OF HEARING

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1	MR. UTZ: Case 4560.
2	MR. HATCH: Application of Rijan Oil Company, Inc.
3	for a pressure maintenance project, San Juan County, New
4	Mexico.
5	The Applicant has requested that this case be
6	continued, and I suggest it be continued to the Examiner
7	Hearing on July 14th.
8	MR. UTZ: Case 4560 will be continued to July 14th.
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STATE OF NEW MEXICO)) ss COUNTY OF BERNALILLO)

I, BRENDA BURKS, Court Reporter in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Hearing before the New Mexico Oil Conservation Commission was reported by me; and that the same is a true and correct record of the said proceedings to the best of my knowledge, skill and ability.

Brenda

Court Reporter

I do hereby cortify that the foregoing is a consista reacri of the process the in the Susainer hearing of Gave Ho.4 560, DESTA BY MO 🚞 Kesalaar ÍA. Fer Mexico Oil Conservetton Cossisuion

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