WATERFLOOD PROJECT
PROPOSED EK PENROSE SAND UNIT
EK YATES – SEVEN RIVERS – QUEEN FIELD
LEA COUNTY, NEW MEXICO

Recommendation

It is proposed to form a unit consisting of parts of Sections 24 and 25 of T18S – R33E and parts of Sections 19, 20, 29 and 30 of T18S – R34E for the purpose of water flooding the Penrose Sand. The proposed Penrose Sand interval to be unitized and waterflooded is shown on Exhibit "8". The proposed unit area is shown on Exhibit "1".

Location and Geology

The proposed EK Penrose Sand Unit (EKPSU) is located 25 miles West of Hobbs, New Mexico and is situated on the South end of the EK Queen Unit (EKQU) that was a successful main Queen Waterflood developed by Mobil Oil Corporation in the late 1960's. Seely Oil Company has acquired the EKQU and is continuing to develop the Main Queen within and surrounding the EKQU. During the original drilling of the Main Queen, several wells were drilled deep enough to test the Lower Queen (known locally as the Penrose Sand), which is the subject of this study.

The Penrose Sand is a member of the Guadalupian series of Permian Age. The productive sand is a grey, fine to medium grain, friable quartz sandstone. The thickness varies from a few feet to about ten feet, as shown on the Net Pay Isopach Penrose Sand map (Exhibit "9"). The thickness was determined from available log and core data and is shown in Table I. The sand appears to be a wedge or bar deposit isolated by hard dense anhydrite above the pay and a red silty sand with calcerous or anhydritic cementation below the porosity developments. The productive Penrose in this area develops porosity in the very top of the Penrose section as shown on the enclosed cross-section (Exhibit "10").

As can be seen from the structure map (Exhibit "11"), the EK Penrose Sand Field shows minor structural relief with regional dip to the South-Southeast of 100-125 feet per mile. There appears to be a gas/oil contact in the Northwest part at an estimated –708 subsea. Several wells located above this subsea depth were reported to produce gas, but were not tested for any substantial length of time after the original completion. The wells were all plugged back to the main Queen sand very shortly after testing gas from the Penrose. There is no evidence that indicates the gas cap to have been an effective part of the primary producing mechanism. The primary depletion recovery mechanism is solution gas drive with no evidence of any significant water encroachment in the field; however, the recently completed Seely Oil Company McElvain Federal #10

BEFORE THE OIL CONSERVATION DIVISION
Santa Fe, New Mexico
Case Nos. 12964/12983 Exhibit No. 7
Submitted by:
Seely Oil Company
Hearing Date: January 9, 2003

well produces 50% water suggesting that there could be an oil/water contact to the Southeast.

Primary Production History

The Ibex Co. McElvain Federal #1 well was the discovery Penrose well and was completed in August, 1955, for an initial potential of 284 BOPD. All initial potentials are shown on the Penrose Sand Initial Potential Map (Exhibit "12"). As of January 1958, an additional 12 wells were drilled and attempted in the Penrose; eight (8) were oil, three (3) tested gas and one (1) dry hole. The one dry hole was the Ibex Co. McElvain Federal #4, located in the NE/4 NW/4 of Section 25 – 18S – 33E, which established the western limit on the field. During 1974 Armer Oil Company (now Seely Oil Company) extended the field to the East by drilling two successful oil wells in the SW/4 of Section 20 – 18S 34E. The eastern limit of the field was determined in February, 1975, by the Union Texas State #1 well drilled by Armer Oil Company in the SW/4 SE/4 of Section 20 and was further confirmed recently by the Seely Oil Company McElvain Federal #12, located in the NW/4 NE/4 Section 29 – 18S – 34E that encountered no Penrose sand. The northeastern limit was determined in 1975 by the General Operating Co. Scharbauer Cattle Co. #2, located in the NW/4 SW/4 of Section 20, which was not commercial in the Penrose. In 1981, C. W. Stumhoffer drilled the CS Federal #1 which had an initial potential of 30 BOPD. The CS Federal #1 well is the most northerly well to produce oil from the Penrose. In 1987, BTA Oil Producers drilled two (2) wells on the proposed unit acreage, located in the SE/4 NE/4 of Section 25 – 18S – 33E, and the SW/4 NW/4 of Section 30 – 18S – 34E. The EK-A 8701 JVP well, located in Section 25 ran a DST on the Penrose sand that recovered 3' of drilling mud. In addition, neither well appears to be productive from log evaluations. In 1990, the Morexco McElvain Federal #6, located in the SW/4 NE/4 of Section 25 – 18S – 33E was completed with an initial potential of 1 BOPD.

Two recent Penrose completions, the Citation #1 well (NW/4 SW/4 Section 20 – 18S – 34E) and the McElvain Federal #10 (SE/4 NW/4 Section 29 – 18S – 34E) extended the productive Penrose to the Northeast and Southeast.

In an attempt to better define the reservoir, a First 12 Months Oil Production Map was prepared and is attached as Exhibit "13".

There are 16 wells that have produced Penrose Oil within the proposed unit area. Table II lists all wells that have tested the Penrose Sand or are to be included in the development of the proposed EKPSU. Only four (4) of the original wells have produced continuously and have produced more than 50% of the total Penrose oil produced. The total Penrose oil production from the field as of January 1, 2002 is 395,252 barrels. The production of the field is shown on the enclosed production Penrose Sand Cumulative Production (Exhibit "14") and the EK Penrose Sand Production History (Exhibit "15"). At this point the only significant Penrose production is the Citation #1 well and the McElvain Federal #10 well, which produce 6 – 7 BOPD and 15 – 16 BOPD respectively.

The ultimate recovery of each is estimated to be 25,000 BO for the McElvain Federal #10 and 30,000 for the Citation #1.

Unitization of the Proposed EKPSU

A formula consisting of 80 percent for cumulative primary oil production as of January 1, 2002 and 20% for acreage is recommended for the unitization formula. In addition each usable well will receive a 10,000 barrel credit. For unitization purposes the estimated ultimate recovery of 30,000 BO is used for the Citation #1 and 25,000 BO for the McElvain Federal #10. The Yates Oil Corporation Howe Federal Lease (E/2 SW/4 Section 30-18S-34E) has 2 Bone Spring oil producers active at this time. When the Howe #1 well was drilled through the Penrose Sand, a drilling break and show were reported. In addition, the electric logs indicate that the Penrose Sand should be oil productive from the Penrose Sand in both wellbores. The Howe #1 is scheduled to be converted to a Penrose Sand water injection well, as shown on the Plan of Development. For unitization purposes, an ultimate recovery of 55,000 BO was assigned to the 80 acre Howe Federal lease. Although we believe that the net sand isopachous map is reasonably accurate, it is believed the best representation of secondary potential is the cumulative primary production,
modified to incorporate the estimated ultimate recovery mentioned above. Based upon the unitization formula as presented, the individual tract factors were determined and are shown on Table III.

Estimation of Secondary Reserves

Table IV is a summary of basic data and sets out the reservoir characteristics and reservoir volume. Table V sets out sample calculations used to determine original oil in place and secondary reserves. Based upon these calculations, the original oil in place is estimated to be 2,000,000 BO and the estimated secondary recovery is 460,000 BO.

LIST OF TABLES

LIST OF EXHIBITS

Type Log Showing Unitized Formation

Unit Map – EK Penrose Sand Unit

Net Pay Isopach Penrose Sand

Structural Cross Section A -A

Structure Map – Top of Penrose

Penrose Sand Initial Potentials

First 12 Months Oil Production

Penrose Sand Cumulative Production (As of 1/1/02)

EK Penrose Sand Production History

Plan of Development

TABLE I
DETERMINATION OF AVERAGE POROSITY

Penrose Formation

E K QUEEN FIELD

Lea County, New Mexico

Core Data

Operator	Lease and Well Number	Feet Analyzed	Average Porosity Per Cent	Average Permeability Millidarcys	Residual Oil Saturation, Per Cent
Caper Drilling Company	Sively 9	11	12.4	1.4	10.3
Ibex	McElvain Federal 2	7	14.5	32.7	15.5
	McElvain Federal 5	5	11.9	0.9	13.3
Sivley	Federal 2	7	11.3	9.3	6.4
	Federal 3	4	11.5	1.5	13.6
	Federal 4	3	10.5	0.9	10.4

Log Data

Operator	Lease and Well Number	Thickness	Average Porosity Per Cent
Concho Oil & Gas	Citation #1	6	13.0
Seely Oil Co.	McElvain Federal "A" #1	3	12.7
Seely Oil Co.	McElvain Federal #8	3	13.3
Seely Oil Co.	McElvain Federal #10	3	13.3
Seely Oil Co.	Scharbauer #1	3	13.0
Seely Oil Co.	Scharbauer #2	4	13.0
	Average Porosity=		150.4/12= 12.53

Table II
Geologic and Completion Data

									Top of	Perforations					IP	
									Penrose Pay	Below Datum		Subsea				
Completion	Operator	Lease	Well #	Section	Unit	Loc Footage	TD	Datum	Subsea	Perfs ft	to ft	Perfs ft	to ft	Stimulation	Oil / Gas / H2O	Current Status
Sep-57	**Seely Oil Company**	**EK Queen Unit**	22	19-18S-34E	k	1980 FSL & 1897 FWL	4703	3982	-696	4678	4686	-696	-704	Frac- 30k gal lease crude & 37.3k lbs sand	Flowed Gas @ 6mmcfpd	Active Queen Sand WIW
Feb-55	**Seely Oil Company**	**EK Queen Unit**	21	19-18S-34E	l	1980 FSL & 660 FWL	4473		NDE	4390	4445			Frac- 10k gal lease crude & 15k lbs sand		Producing
Dec-57	**Seely Oil Company**	**EK Queen Unit**	24	19-18S-34E	m	330 FSL & 762 FWL	4718	4710	-735	4429	4698	281	12		47 / ? / 0	Active Queen Sand WIW
Jan-56	**Mobil Oil Corp.**	**T.J. Silvey Federal**	3	19-18S-34E	n	2310 FWL & 343 FSL	4735	3956	752	4708	4718	-752	-762		115 / ? / 0	P & A
Jan-56	**Hanson Oil**	**Penzoil Federal**	1	19-18S-34E	o	330 FSL & 2310 FEL	4800	3960	-760	4723	4736	-763	-776	Acid- 1k gal, Frac- 20k gal KCl & 23k lbs sar	75 / ? / 0	P & A
Jul-81	**Seely Oil Company**	**C. S. Federal**	1	19-18S-34E	o	660 FSL & 1980 FEL	4784	3983	-733	4720	4730	-737	-747	Acid- 500 gal, Frac 40k gal & 42.5k lbs sand	30 / 18 / 0	Producing
Sep-99	**Seely Oil Company**	**Scharbauer**	1	20-18S-34E	m	330 FSL & FWL	4840	4014	-760	4777	4784	-763	-770	Acid- 1k gal 15%, Frac- 18k gal	10 / 6 / 0	Producing
														gelled KCl w/ 21k lbs sand		
Feb-00	**Seely Oil Company**	**Scharbauer**	2	20-18S-34E	n	330 FSL & 1650 FWL	4820	3983	-759	4746	4764	-763	-781	Acid- 1k gal KCl & 18k lbs sand	15 / 40 / 1	Producing
Feb-57	**Seely Oil Company**	**EK Queen Unit**	19	24-18S-33E	j	1980 FSL & 1650 FEL	4650		-677	4625	4650(OH)			Acid- 500 gal, Frac- 10k gal & 10k lbs. sand	Didn't Recover Load	Producing
														& 10k lbs. sand		
Jun-66	**Seely Oil Company**	**EK Queen Unit**	27	24-18S-33E	o	990 FSL & 1980 FEL	4657		-702	4628	4634			Acid- 500 gal. 15% NE	Flowed Gas @ 2mmcfpd	Active WIW
Jun-57	**Chiles Drilling Co.**	**Gulf Federal**	1	25-18S-33E	a	660 FNL & 660FEL	4720	3929	-756	4687	4702	-758	-773		47 / ? / 0	P & A
Aug-55	**Seely Oil Company**	**McElvain Federal**	1	25-18S-33E	b	660 FNL & 1980 FEL	4657	3904	-733	4637	4657(OH)	-733	-753	Frac- 10k gal. & 10k lbs. sand	284 / ? / 0	Producing
	Seely Oil Company	**McElvain Federal**	4	25-18S-33E	c	660 FNL & 1980 FWL	5998		-729				0			P & A
Jan-91	**Seely Oil Company**	**McElvain Federal**	6	25-18S-33E	g	1650 FNL & 1650 FEL	4975	3898	-770	4673	4683	-775	-785	Acid- 1k gal NeFe, Frac- 20k gal gel	1 / 0 / 0	Producing
														& 40k lbs 20/40 sand		
Dec-01	**Seely Oil Company**	**McElvain Federal**	10	29-18S-34E	e	1650' FNL & 1980' FWL	6050			4778	4785			1000 gal MCA, Frac- 18,000 gal KCL		Producing
														w/ 41,000 lbs. 16/30 sand		
Nov-55	**Seely Oil Company**	**McElvain Federal**	2	30-18S-34E	b	.5 FNL & 1980 FEL	5401	3966	-764	4732	4742	-766	-776	Frac- 6k gal refined oil w/ 9k lbs sand	211 / ? / 0	Producing
Jun-57	**Seely Oil Company**	**McElvain Federal**	5	30-18S-34E	c	660 FNL & 3300 FEL	4751	3949	-762	4716	4730	-767	-781	Acid- 1k gal Frac- 16.8k frac oil	55 / ? / 0	Producing
														& 16k lbs sand		
Aug-57	**Chiles Drilling Co.**	**Gulf Federal**	2	30-18S-34E	d	560 FNL & 1618 FWL	4728	3936	-752	4690	4708	-754	-772	Acid- 500 gal Frac- 19.3k gal lease crude	80 / ? / 0	P & A
														w/ 14k lbs sand		
Feb-58	**Owen C. Finch**	**Gulf Federal**	1	30-18S-34E	e	1650 FNL & 907 FWL	4732	3921	-770	4697	4709	-776	-788	Acid- unknown Frac- 20k gal lease crude	8 / ? / 0	P & A
														& 17.5 k lbs sand		
Apr-56	**Seely Oil Company**	**McElvain Federal**	3	30-18S-34E	f	2310 FNL & 2290 FWL	4900	3910	-765	4670	4710	-760	-800	Frac- 10k gal & 15k lbs sand	22 / ? / 0	Producing
Apr-82	**Yate Petroleum**	**Howe "TG" Federal**	1	30-18S-34E	k	1980 FSL & 1830 FWL	10512		-786	9519	9541			Acid- 2k gal 15% Ne Acid.		Producing
														Frac- 1k gal rog. Acid, 30k lbs sand		
Jan-86	**Yate Petroleum**	**Howe "TG" Federal**	2	30-18S-34E	n	810 FSL & 1830 FWL	9714		-791	9495	9541			Acid- 3k gal. Frac- 60k gal KCl water,		Producing

Table III
EK Penrose Sand Unit

Tract #	Operator / Well Name	Well #	Location 18S-33E,34E	Unit	Sec	Acreage	100% Acreage	20% Acreage	Total Cum Oil Prod (as of 1-1-02)	Percent of Cum Oil Prod (as of 1-1-02)	Est Total Reserves	Estimated Total Primary (as of 6-1-02)	# Usable Wells	Usable Well Credit (UWC)	Total Primary Prod plus UWC	Total Primary Prod plus by tract	100% Cum Prod + UWC	80% Cum Prod + UWC	Tract Factor
	Seely Oil Co																		
1	EK Queen Tract 2	4	SW, SW	M	19	274.69	18.688302%	3.737660%	6718	1.70%		6,718			6,718	53,248	8.648508%	6.918807%	**0.10656467**
	EK Queen Tract 2-2	2-2	NE, SW	K	19							0	1	10000	10,000				
	EK Queen Tract 2-7	2-7	SW, SE	O	24							0	1	10000	10,000				
	EK Queen Tract 1		NW, SE	J	24														
	Federal "19" (LC-065394)	3	SE, SW	N	19				26,530	6.71%		26,530			26,530				
	U.S. LC-063645		NW,SE	J	19														
2A	McElvain Fed	2	NW, NE	B	30	120	8.164098%	1.632820%	100,015	25.30%		61,751	1	10000	71,751	145,675	23.660446%	18.928357%	**0.20561177**
		3	SE, NW	F	30				24,782	6.27%		24,782	1	10000	34,782				
		5	NE, NW	C	30				29,142	7.37%		29,142	1	10000	39,142				
		8	SE,NW,NE	B	30				0	0.00%		0			0				
2B	McElvain Fed	1	NW, NE	B	25	40	2.721366%	0.544273%	53,002	13.41%		53,002	1	10000	63,002	63,002	10.232747%	8.186198%	**0.08730471**
2C	McElvain Fed	6	SW, NE	G	25	40	2.721366%	0.544273%	3,389	0.86%		3,389	1	10000	13,389	13,389	2.174633%	1.739707%	**0.02283980**
2D	McElvain Fed	"A" 1	NE, NE	A	30	200	13.606831%	2.721366%	0	0.00%									**0.02721366**
			N/2,SE		30														
2E	McElvain Fed	10	SE, NW	F	29	240	16.328197%	3.265640%			25,000	25,000	1	10000	35,000	35,000	5.684679%	4.547743%	**0.07813383**
			N/2, SW		29														
3	EK Queen Tract 6		E/2, SE	I,P	24	160	10.885465%	2.177093%											**0.02177093**
			E/2, SE		19														
5	Federal CS		SW, SE	O	19	40	2.721366%	0.544273%	18,292	4.63%		56,556	1	10000	66,556	71,752	11.653917%	9.323133%	**0.09867406**
	U.S. NM-04591	1	E/2, SE	O	19				5,196	1.31%		5,196			5,196				
6	EK-A, 8701 JU-P		E/2,NE	A,H	25	80	5.442732%	1.088547%	15,949	4.04%		15,949			15,949	15,949	2.590427%	2.072342%	**0.03160889**
7	EK-B, 8701 JU-P		W/2, NW	D,E	30	75.16	5.113447%	1.022689%	25,289	6.40%		25,289			25,289	25,289	4.107424%	3.285939%	**0.04308628**
8	Scharbauer	1&2	S/2, SW	M,N	20	80	5.442732%	1.088547%	77,386	19.58%		77,386	1	10000	87,386	87,386	14.193182%	11.354545%	**0.12443092**
9	Citation	1	NW, SW	L	20	**40**	**2.721366%**	**0.544273%**	**9,562**	**2.42%**	**20,438**	**30,000**	**1**	10000	**40,000**	**40,000**	**6.496776%**	5.197420%	**0.05741693**
	Total Seely Oil Company					**1389.85**	**94.557268%**	**18.911454%**	**395252**	**100.00%**	**45,438**	**440,690**	**11**	**110,000**	**550,690**	**550,690**	**89.442739%**	**71.554191%**	**0.90465645**
4	**Yates Petroleum Corp**		E1/2,SW	K,N	30	**80**	**5.442732%**	**1.088546%**	**0**	**0.00%**	**55,000**	**55,000**	**1**	**10,000**	**65,000**	**65,000**	**10.557261%**	**8.445809%**	**0.09534355**
	TOTALS					**1,470**	**100.000000%**	**20.000000%**	**395,252**	**100.00%**	**100,438**	**495,690**	**12**	**120,000**	**615,690**	**615,690**	**100.000000%**	**80.000000%**	**1.00000000** *

*Secondary participation factors based on 20% acreage and 80% cumulative oil production. Cumulative oil production was adjusted by a usable well credit of 10,000 bbls. and for two recent wells with primary reserves.

TABLE IV
SUMMARY OF BASIC DATA
PENROSE SAND FORMATION
E K PENROSE SAND UNIT
E K-YATES-SR-QUEEN FIELD
Lea County, New Mexico

Oil Production for Proposed Project Area	
Cumulative Oil Production in unit area 1/1/02	395,252
Estimated Remaining Primary as of 1/1/02	39,273
Total Estimated Primary Production	434,525
Fluid and Rock Characteristics	
Average Porosity (From Core Data) – Percent	12.53
Average Permeability (From Core Data) – Millidarcys	8.7
Connate Water Saturation – Percent	30.0
Formation Volume Factor – Barrels Reservoir Space/ Stock Tank Barrel	1.27
Original Solution Gas Oil Ration – Cubic Feet per Barrel	575.0
Reservoir Temperature - °F	103.0
Original Reservoir Pressure – psig @ 730'	1499 psi
Residual Oil Saturation – Sor – Percent	18.0
Reservoir Volume for Project Area	
Total Reservoir Volume Including Gas Cap Acre – Feet	4819
Oil Productive Reservoir Volume In Project Area – Acre – Feet	3692
Total Oil Productive Area – Acres	919
Average Thickness of Oil Productive Reservoir – Feet	4'
Area of Effective Oil Reservoir (Floodable) Acres	786
Volume of Effective Oil Reservoir – Acre – Feet	3194
Volume of Effective Reservoir Above Gas Oil Contact – Acre – Feet	436
Stock Tank Oil in Place	
Productive Reservoir Volume – Barrels/Acre – Foot	536
Barrels	2,000,000
Oil Recovery for Oil Productive Reservoir	
Primary Oil Production	434,525
Barrels/Acre – Foot (Total Area of Productive Reservoir)	90
Barrels/Acre – Foot (Oil Reservoir Only)	117
Percent N- OOIP (Total Productive Reservoir)	21.9
Secondary Recovery Barrels	460,000
Barrels Per Floodable Acre – Foot	144
Percent N – OOIP	23.2
Ultimate Recovery – Primary & Secondary – Barrels	894,461
Barrels Per Oil Productive Acre – Foot	261
Percent N – OOIP	45.2

TABLE V

SAMPLE CALCULATIONS
EK PENROSE UNIT
EK-YATES-SR-QUEEN FIELD

Lea County, New Mexico

1. Estimated N (original oil in place)

$$N = \frac{7758(\emptyset)\,(1\text{-}SW)}{Bo_i}$$

$$= \frac{7758\,(.1253)(1\text{-}.3)}{1.27}$$

$$= 536 \text{ B/A-F}$$

Where:

$\emptyset$ is weighted average porosity from core and log analysis in unit Area.

SW is average interstitial water saturation based on log calculations from Seely Oil Company's Scharbauer No.2 well.

Bo_i is original formation volume factor based on initial solution GOR of 575/1 BHT of 103° F, gas gravity of .98, and oil gravity of 35.9° API.

2. Calculation of Secondary Reserves

$$Np\ Sec = \frac{E}{Bo_2} \{7758(\emptyset)(1-SW)-Np(Bo_1)\} \frac{Bo_2}{Bo_1} - 7758(\emptyset)(Sor)$$

$$Np\ Sec = \frac{.57}{1.06} \{7758(.1252)(1-.3)-117(1.27)\} \frac{1.06}{1.27} - 7758(.1252)(.18)$$

$$= .538 \{679.9 - 148.6\}.8346 - 174.8$$

$$= .538\ (443.4 - 174.8)$$

$$= .538\ (268.6)$$

$$= 144\ B/A\text{-}F$$

Where:

Np Sec = Estimated Secondary Recovery, B/A-F
E = Overall Flooding Efficiency, %
Horizontal 80%, Vertical .71% => .57
$\emptyset$ = Average Porosity, %
Sw = Average water saturation % pore space
Np = Primary Recovery, B/A-F
Bo_1 = Original Formation Volume Factor, reservoir bbl/stock tank bbl
Bo_2 = Present Formation Volume Factor, reservoir bbl/stock tank bbl