

Water Analyses

San Andres-Grayburg



Pe ma Basl A ea Labo atory
2101 SM rk t St t
Bldg B

R p rt D te 3/24/2015

Complete Water Analysis Report ssp .8

Customer	APACHE CORPORATION	Sample P i t N me	NMGSAU 433
D struct	N w M lco	Sampl ID	201501009803
S les R p	Fra k L G rd	Sample Date	3/19/2015
Le se	MONUMENT	Log Out Dat	3/24/2015
S te Type	W ll St	Analyst	Sam IN w m
S mpl P i t D c riptl	WELL HEAD		

APACHE CORPORATION MONUMENT NMGSAU 433

Field Data		Analysis of Sample					
		Anion	mg/L	m q/L	Cations	mg/L	meq/L
Initial Temp rat e (F)	250	Chlo ide (Cl)	5089 0	143 6	Sodium (Na)	3298 8	143 6
Fl IT mp t e (F)	80	S lfate (SO)	882.4	18 4	Potassi m (K)	115 6	3.0
I tial P ess re (psi)	100	Bo ate (H BO ₃)	9 7	0 2	Magne i m (Mg ²⁺)	276 0	22 7
Fl al P ess e (psi)	15	Fl ide (F)	ND		Calci m (Ca ⁺)	688 3	34.3
		B omide (B)	ND		Stro tr m (S ⁺)	17.5	0.4
		N t t (NO ⁻)	ND		Ba i m (B)	0 0	0 0
pH		N t ate (NO ⁻)	ND		l o (Fe)	0 0	0 0
pH at t me of sampl g	6.8	Ph phate (PO ³⁻)	ND		Ma ga ese (M)	0 0	0 0
		Silica (SiO ₂)	ND		Le d (Pb ⁺)	ND	
					Zi c (Zn)	0.0	0 0
					Al mi m (Al ³⁺)	ND	
					Ch m m (Cr ³)	ND	
					C b lt (C)	ND	
					Copp (C)	ND	
					M lybden m (Mo)	ND	
					Ni k l (N)	ND	
					TI (S)	ND	
					T ta m (T ⁺)	ND	
					Vanad m (V ²)	ND	
					Z co i m (Zr ⁺)	ND	
					T t l H d ess	2878	N/A
Alk li ty by Titratio		Organic Acids	mg/L	meq/L			
Bica bo te (HCO ⁻)	1098 0	For mic Acid	ND				
Ca b te (CO ⁻)	ND	A etic Acid	ND				
Hyd ide (OH ⁻)	ND	P pi ic Acid	ND				
		B tyric Acid	ND				
aq eo s CO ₂ (ppm)	100 0	Vale ic Ac d	ND				
q H S (ppm)	391 0						
aq eo s O ₂ (ppb)	ND						
Calcul t d TDS (mg/L)	11475						
Density/Specf c G avity (g/cm ³)	1.0056						
M d d ty/Specific Gra ty	1.0092						
C d ctity (mmh ⁻¹)	ND						
R l st lity	59 64 hm-cm @72.3 F						
MCF/D	No Data						
BOPD	No Data						
BWPD	No Data						
		Anio /Catio Ratio		0.88		ND Not Determi d	

Co d tions		Ba te (BaSO)		Calc te (CaCO)		Gyps m (CaSO 2H O)		Anhyd ite (CaSO)	
T mp	P ess.	I dex	Amt (ptb)	I dex	Amt (ptb)	I dex	Amt (ptb)	I dex	Amt (ptb)
80 F	15 p		0 000	0 60	126 541	-0 42	0 000	-0 67	0 000
99 F	24 p		0 000	0 61	127 447	-0 42	0 000	-0 59	0 000
118 F	34 p i		0 000	0 64	132 792	0 41	0 000	-0 49	0 000
137 F	43 p		0 000	0 69	139 899	-0 39	0 000	-0 39	0 000
156 F	53 p i		0 000	0 76	147 986	-0 37	0 000	-0 27	0 000
174 F	62 p i		0 000	0 83	156 768	-0 33	0 000	-0 14	0 000
193 F	72 p i		0 000	0 91	166 262	-0 30	0 000	0 00	1 189
212 F	81 p i		0 000	1 01	176 655	0 25	0 000	0 15	87 030
231 F	91 p i		0 000	1 12	187 277	-0 21	0 000	0 29	160 266
250 F	100 p i		0 000	1 23	198 063	-0 17	0 000	0 44	221 338

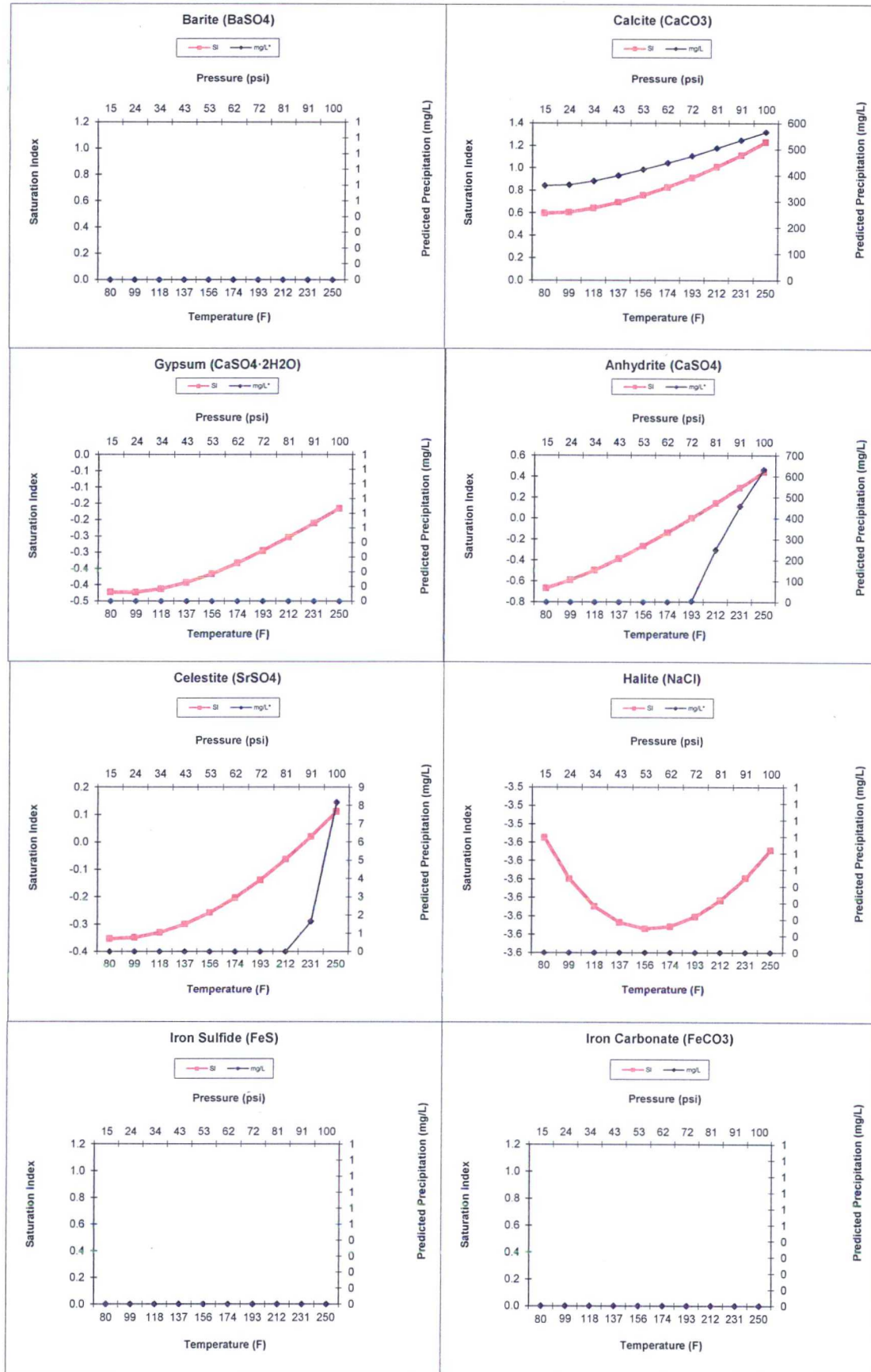
Co diti ns		Celestite (SrSO)		Hal te (N Cl)		l on S lfide (FeS)		l on Ca b te (FeCO)	
Temp	P ess.	I dex	Amt (ptb)	I dex	Amt (ptb)	I dex	Amt (ptb)	I dex	Amt (ptb)
80 F	15 p i		0 35	3 55	0 000	0	0 000		0 000
99 F	24 p i		-0 35	3 57	0 000	0	0 000		0 000
118 F	34 p i		-0 33	3 58	0 000	0	0 000		0 000
137 F	43 p i		-0 30	3 59	0 000	0	0 000		0 000
156 F	53 p i		-0 26	3 60	0 000	0	0 000		0 000
174 F	62 p		0 20	3 60	0 000	0	0 000		0 000
193 F	72 p i		-0 14	3 59	0 000	0	0 000		0 000
212 F	81 p i		-0 06	3 58	0 000	0	0 000		0 000
231 F	91 p		0 02	3 57	0 000	0	0 000		0 000
250 F	100 p		0 11	3 55	0 000	0	0 000		0 000

ote: When assessing the severity of the scale, the total hardness (S) and amount of scale to be considered.
ote 2: Precipitation of each scale considered separately. Total scale will be less than the sum of the amounts of the () scale.
Note 3: Scale ratio index predicts the sheet use and alkalinity %CO no included the calculations.



Seal SoftPitz
SSP2010

Comments



Complete Water Analysis Report

Customer	APACHE CORPORATION	Sample Point Name	NMGSAU 440
District	Northwest	Sample ID	201501009805
Site	Franklin	Sample Date	3/19/2015
Lease	MONUMENT	Log On Date	3/24/2015
Site Type	Well Site	Analyst	Samuel N. Williams
Sample Point Description	WELL HEAD		

APACHE CORPORATION MONUMENT NMGSAU 440

Field Data			Analysis of Sample						
			Ani	mg/L	meq/L	Catio	mg/L	meq/L	
Initial Temperature (F)	250	Chloride (Cl ⁻)		11086.5	312.7	Sulfate (SO ₄ ²⁻)	7734.3	336.0	
Final Temperature (F)	80	Sulfate (SO ₄ ²⁻)		1646.7	34.3	Potassium (K ⁺)	206.2	5.1	
Initial Pressure (psi)	100	Borate (H ₂ BO ₃)		16.4	0.3	Magnesium (Mg ²⁺)	332.0	27.3	
Final Pressure (psi)	15	Fluoride (F ⁻)		ND		Calcium (Ca ²⁺)	910.0	45.5	
			Bromide (Br ⁻)	ND		Strontium (Sr ²⁺)	21.4	0.5	
			Nitrate (NO ₃ ⁻)	ND		Barium (Ba ²⁺)	0.0	0.0	
pH			Nitrite (NO ₂ ⁻)	ND		Iron (Fe ²⁺)	0.0	0.0	
pH at time of sampling			6.2			Manganese (Mn ²⁺)	0.0	0.0	
			Phosphate (PO ₄ ³⁻)	ND		Lead (Pb ²⁺)	ND	ND	
			Silica (SiO ₂)	ND		Zinc (Zn ²⁺)	0.0	0.0	
Alkalinity by Titration			mg/L	meq/L					
Bicarbonate (HCO ₃ ⁻)			1012.0	16.6	Aluminum (Al ³⁺)				ND
Carbonate (CO ₃ ²⁻)			ND		Chromium (Cr ³⁺)				ND
Hydroxide (OH ⁻)			ND		Cobalt (Co ²⁺)				ND
					Copper (Cu ²⁺)				ND
					Molybdenum (Mo ⁶⁺)				ND
					Nickel (Ni ²⁺)				ND
					Tin (Sn ²⁺)				ND
					Titanium (Ti ²⁺)				ND
					Vanadium (V ²⁺)				ND
					Zinc (Zn ²⁺)				ND
					Total Hardness				3667
									N/A

Conditio s		Ba ite (BaSO ₄)		C lcite (CaCO ₃)		Gyp m (CaSO ₄ 2H ₂ O)		Anhyd ite (CaSO ₄)	
Temp	P ess	I dex	Amt (ptb)	I dex	Amt (ptb)	I dex	Amt (ptb)	I dex	Amt (ptb)
80 F	15 p i		0 000	0 13	32 322	-0 29	0 000	0 52	0 000
99 F	24 p		0 000	0 15	38 511	-0 28	0 000	0 44	0 000
118 F	34 p i		0 000	0 21	52 540	-0 27	0 000	0 35	0 000
137 F	43 p		0 000	0 29	68 484	0 26	0 000	0 24	0 000
156°F	53 p i		0 000	0 37	84 681	-0 23	0 000	0 13	0 000
174 F	62 p <i>i</i>		0 000	0 46	101 362	-0 21	0 000	0 00	0 000
193 F	72 p i		0 000	0 56	118 169	-0 18	0 000	0 13	126 382
212 F	81 p i		0 000	0 66	134 133	-0 14	0 000	0 26	242 151
231 F	91 p i		0 000	0 77	149 375	-0 11	0 000	0 40	342 965
250 F	100 p i		0 000	0 88	163 941	-0 07	0 000	0 54	429 356

Co dit		Celestst (SrSO ₄)		Halite (N Cl)		I S lf'de (FeS)		I Ca bo ate (FeCO ₃)	
T mp	P ess	I dex	Amt (ptb)	I dex	Amt (ptb)	I dex	Amt (ptb)	I dex	Amt (ptb)
80 F	15 p l	-0.25	0.000	2.88	0.000	0	0.000		0.000
99 F	24 p l	-0.24	0.000	2.91	0.000	0	0.000		0.000
118 F	34 p l	-0.23	0.000	2.92	0.000	0	0.000		0.000
137°F	43 p l	-0.20	0.000	2.93	0.000	0	0.000		0.000
156°F	53 p l	-0.17	0.000	2.93	0.000	0	0.000		0.000
174 F	62 p l	-0.12	0.000	2.93	0.000	0	0.000		0.000
193 F	72 p	-0.07	0.000	2.93	0.000	0	0.000		0.000
212 F	81 p l	0.00	0.000	2.92	0.000	0	0.000		0.000
231 F	91 p l	0.07	2.243	2.91	0.000	0	0.000		0.000
250 F	100 p l	0.15	4.435	2.90	0.000	0	0.000		0.000

N When assessing the severity of the scale, both the saturation index (S) and unit of calculation should be considered.

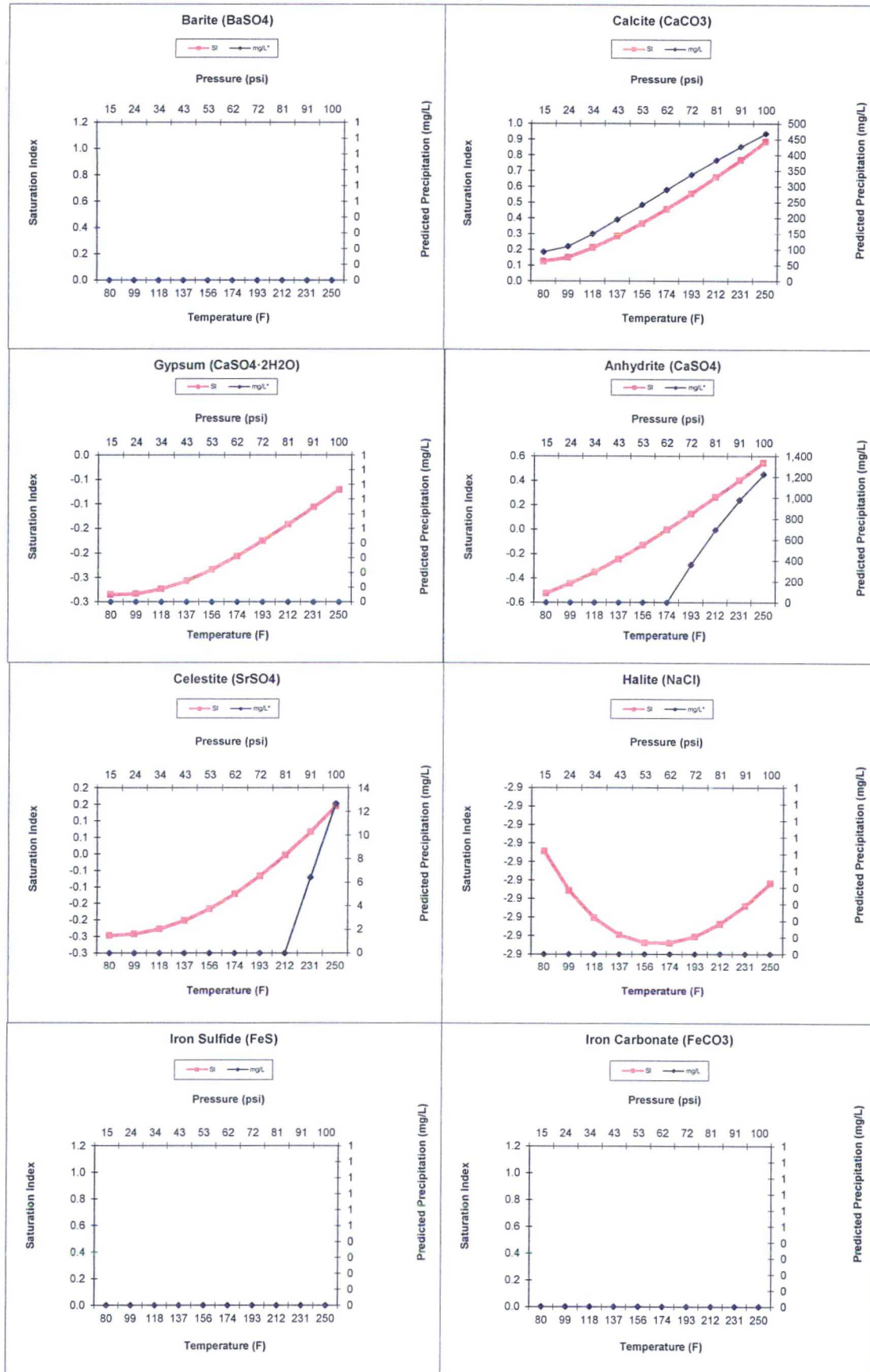
2. Pre-its of chasca considered as a T-sca will be that the sum of the units of the (8) sca

Note 3 Saturation Ind pre ns this she use p d ka inity %CO no includ he ca uta ns



Sc 1 SoftPlt TM
SSP2010

C mm ts



GROUND WATER REPORT 6

Geology and Ground-Water Conditions in Southern Lea County, New Mexico

by ALEXANDER NICHOLSON, Jr
and ALFRED CLEBSCH, JR

UNITED STATES GEOLOGICAL SURVEY

STATE BUREAU OF MINES AND MINERAL RESOURCES
NEW MEXICO INSTITUTE OF MINING & TECHNOLOGY
CAMPUS STATION SOCORRO, NEW MEXICO

TABLE 9. CHEMICAL ANALYSES OF OIL-FIELD WATERS IN SOUTHERN LEA COUNTY, N. MEX. (continued)

PART B. ANALYSES REPORTED IN ROSWELL GEOL. SOC. (1956)*

(Chemical constituents are in parts per million and equivalents per million [underscored].)

Sample No.	Pool name	Location†	Pay zone†	Calcium (Ca)	Magnesium (Mg)	Sodium plus potassium (Na+K)	Iron (Fe)	Bicarbonate (HCO ₃)	Carbon-dioxide (CO ₂)	Sulfate (SO ₄)	Chloride (Cl)	Hydroxyl (OH)	Hydrogen sulfide (H ₂ S)	Dissolved solids	Resistivity	
															Ohm-meters	Degrees (°F)
82	Langlie-Mattix	T. 22 thru 26 S., R. 36, 37 E.	Yates, Seven Rivers Queen	214 <u>10.68</u>	233 <u>19.16</u>	922 <u>40.09</u>	—	1,364 <u>22.36</u>	—	29 <u>.603</u>	1,663 <u>46.9</u>	—	—	4,425	—	—
83	Littman	T. 21 S., R. 38 E.	San Andres	5,240 <u>261.47</u>	2,527 <u>207.8</u>	30,900 <u>1,343.53</u>	0	—	0	2,080 <u>43.3</u>	62,000 <u>1,748.4</u>	—	T	93,400	1.07	79
84	Maljamar	T. 17 S., R. 31, 32, 33 E., T. 18 S., R. 32 E.	Grayburg-San Andres	2,480 <u>123.7</u>	1,370 <u>112.7</u>	—	T	710 <u>11.64</u>	—	H	127,300 <u>3,589.9</u>	—	—	—	—	—
85	Maljamar (Devonian)	T. 17 S., R. 32 E.	Devonian	920 <u>45.9</u>	305 <u>25.08</u>	8,450 <u>367.41</u>	—	807 <u>13.23</u>	—	1.63 <u>.034</u>	14,000 <u>394.8</u>	—	—	25,000	—	—
86	Mason, North	T. 26 S., R. 31, 32 E.	Delaware	2,480 <u>123.7</u>	170 <u>13.98</u>	61,000 <u>2,652.28</u>	—	2,890 <u>47.37</u>	—	4,000 <u>83.3</u>	94,800 <u>2,673.4</u>	—	—	165,340	.06	65
87	Pearsall	T. 17, 18 S., R. 32 E.	Queen	6,500 <u>324.4</u>	4,530 <u>372.5</u>	—	—	95 <u>1.56</u>	—	M	123,000 <u>3,468.6</u>	—	—	—	—	—
88	San Simon	T. 21, 22 S., R. 35 E.	Yates	1,990 <u>99.3</u>	1,700 <u>139.81</u>	17,400 <u>756.55</u>	0	443 <u>7.26</u>	0	0	34,900 <u>984.2</u>	0	—	[56,208]	—	—
89	Skaggs	T. 20 S., R. 37, 38 E.	Queen-Grayburg	300 <u>14.97</u>	N	10,000 <u>434.80</u>	100	710 <u>11.64</u>	180	3,200 <u>66.6</u>	12,000 <u>338.4</u>	N	3	37,000	—	—
90	Skaggs (Drinkard)	T. 20 S., R. 37 E.	Drinkard	5,330 <u>265.97</u>	1,830 <u>150.49</u>	43,700 <u>1,900.68</u>	113	428 <u>7.01</u>	—	2,250 <u>46.84</u>	82,300 <u>2,320.9</u>	—	—	141,300	.052	76
91	Vacuum	T. 17, 18 S., R. 33, 34, 35 E.	Grayburg-San Andres	3,195 <u>159.43</u>	796 <u>65.46</u>	57,900 <u>2,517.49</u>	112	700 <u>11.47</u>	—	2,470 <u>51.43</u>	94,221 <u>2,657.0</u>	—	—	160,000	—	—
92	Wantz	T. 21 S., R. 37, 38 E.	Abo	3,375 <u>168.4</u>	0	19,500 <u>847.86</u>	10	744 <u>12.19</u>	103	1,689 <u>35.16</u>	44,325 <u>1,249.9</u>	N	175	81,208	0.08-0.106	—
93	Warren	sec. 27 and 28, T. 20 S., R. 38 E.	Drinkard	7,000 <u>349.3</u>	0	47,500 <u>2,065.30</u>	75	496 <u>8.13</u>	0	1,402 <u>29.19</u>	103,898 <u>2,929.9</u>	N	N	[166,800]	.080	60

* Analyses are quoted verbatim except for calculated values, which are enclosed in brackets or underscored; N, none or nil; 2, trace; M, medium; H, heavy.

† Location: The water analyses listed in the source reference are headed "Nature of producing zone water." The wells from which the samples were taken are listed in the source reference.

Water Sample Analysis

Pool	Location		Range	Chlorides
	Section	Township		
North Justis Montoya	2	25S	37E	45440
North Justis McKee	2	25S	37E	58220
North Justis Fusselman	2	25S	37E	88533
North Justis Ellenburger	2	25S	37E	34151
Fowler Blinbry	22	24S	37E	116085
Skaggs Grayburg	18	20S	38E	84845
Warren McKee	18	20S	38E	85910
Warren Abo	19	20S	39E	91600
DK Drinkard	30	20S	39E	108855
Littman San Andres	8	21S	38E	38695
East Hobbs grayburg	29	18S	39E	8461
Halfway Yates	18	20S	32E	14768
Arkansas Junction San Andres	12	18S	38E	7171
Pearl Queen	28	19S	35E	114310
Midway Abo	17	17S	37E	38494
Lovinton Abo	31	16S	37E	22933
Lovington San Andres	3	16S	37E	4899
Lovington Paddock	31	16S	37E	93720
Mesa Queen	17	16S	32E	172530
Kemnitz Wolfcamp	27	16S	34E	49345
Hume Queen	9	16S	34E	124980
Anderson Ranch Wolfcamp	2	16S	32E	11040
Anderson Ranch Devonian	11	16S	32E	25702
Anderson Ranch Unit	11	16S	32E	23788
Caudill Devonian	9	15S	38E	20874
Townsend Wolfcamp	6	16S	38E	38695
Dean Pemo Perin	5	16S	37E	44730
Dean Devonian	35	15S	38E	19525
South Denton Wolfcamp	26	15S	37E	54315
South Denton Devonian	36	15S	37E	34080
Medicine Rock Devonian	15	15S	38E	39760
Little Lucky Lake Devonian	29	15S	30E	23288
Wantz Abo	26	21S	37E	132770
Crosby Devonian	18	25S	37E	58220
Scarborough Yates Seven Rivers	7	26S	37E	3443(Reef)
Teague Simpson	34	23S	37E	114685
Teague Ellenburger	34	23S	37E	120345
Rhodes Yates 7 Rivers	27	26S	37E	144485
House SA	11	20S	38E	93385
House Drinkard	12	20S	38E	49700
South Leonard Queen	24	26S	37E	115375
Elliot Abo	2	21S	38E	55380
Scharb Bone Springs	5	19S	35E	30801
EK Queen	13	18S	34E	41890
East EK Queen	22	18S	34E	179630
Maljamar Grayburg SA	22	17S	32E	46079
Maljamar Paddock	27	17S	32E	115375
Maljamar Devonian	22	17S	32E	25418

Information from O.C.D. Hobbs

Wall #440
Unit G 32-19-37

Wall #433
Unit C - 20-19-37

Oasis was sent 17-20-37

