ABOVE THIS LINE FOR DIVISION USE ONLY

NEW MEXICO OIL CONSERVATION DIVISION

- Engineering Bureau -

1220 South St. Francis Drive, Santa Fe, NM 87505



martha_howard@swn.com

e-mail Address

ADMINISTRATIVE APPLICATION CHECKLIST

Print o	r Type Name	Signature Title	Date
	rtha Howard	Signature Regulatory Analyst Title	2/08/2007
	Note	: Statement must be completed by an individual with managerial and/or supervisory capaci	ty.
[4] approv applic	val is accurate a	TION: I hereby certify that the information submitted with this application found complete to the best of my knowledge. I also understand that no action we equired information and notifications are submitted to the Division.	r administrative ill be taken on this
[3]		CURATE AND COMPLETE INFORMATION REQUIRED TO PROCI ATION INDICATED ABOVE.	ESS THE TYPE
	[F]	Waivers are Attached	
	[E]	For all of the above, Proof of Notification or Publication is Attached, a	nd/or,
	[D]	Notification and/or Concurrent Approval by BLM or SLO U.S. Bureau of Land Management - Commissioner of Public Lands, State Land Office	
	[C]	Application is One Which Requires Published Legal Notice	
	[B]	☐ Offset Operators, Leaseholders or Surface Owner	10
[2]	[A]	TION REQUIRED TO: - Check Those Which Apply, or □ Does Not Apply Working, Royalty or Overriding Royalty Interest Owners	9
r21			AM
	[D]	Other: Specify	တ
	[C]	Injection - Disposal - Pressure Increase - Enhanced Oil Recovery WFX PMX SWD IPI EOR PPR	7 FEB
	Check [B]	Cone Only for [B] or [C] Commingling - Storage - Measurement DHC CTB PLC PC OLS OLM	2007
[1]	TYPE OF AI [A]	PPLICATION - Check Those Which Apply for [A] Location - Spacing Unit - Simultaneous Dedication NSL NSP SD	
	DHC-Dow PC-Pd	rnhole Commingling] [CTB-Lease Commingling] [PLC-Pool/Lease Commool Commingling] [OLS - Off-Lease Storage] [OLM-Off-Lease Measurem [WFX-Waterflood Expansion] [PMX-Pressure Maintenance Expansion] [SWD-Salt Water Disposal] [IPI-Injection Pressure Increase] Increase Infied Enhanced Oil Recovery Certification] Increase Incre	ningling] ent]
Applic	ation Acronym INSL-Non-Sta		dication]
TH	HIS CHECKLIST IS M	IANDATORY FOR ALL ADMINISTRATIVE APPLICATIONS FOR EXCEPTIONS TO DIVISION RULES A WHICH REQUIRE PROCESSING AT THE DIVISION LEVEL IN SANTA FE	ND REGULATIONS
		7.5 III. 1.5 - 1.	

STATE OF NEW MEXICO ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

Oil Conservation Division 1220 South St. Francis Dr. Santa Fe, New Mexico 87505

FORM C-108 Revised June 10, 2003

APPLICATION FOR AUTHORIZATION TO INJECT

I.	PURPOSE: Secondary Recovery Pressure Maintenance XX Disposal Storage Application qualifies for administrative approval? XX Yes No
II.	OPERATOR: Southwestern Energy Production Company
	ADDRESS: 2350 N. Sam Houston Parkway East, Suite 190 Houston, Texas 77032
	CONTACT PARTY: Martha Howard PHONE: (281) 618-4887
III.	WELL DATA: Complete the data required on the reverse side of this form for each well proposed for injection. Additional sheets may be attached if necessary.
IV.	Is this an expansion of an existing project? Yes XX No If yes, give the Division order number authorizing the project:
V.	Attach a map that identifies all wells and leases within two miles of any proposed injection well with a one-half mile radius circle drawn around each proposed injection well. This circle identifies the well's area of review.
VI.	Attach a tabulation of data on all wells of public record within the area of review which penetrate the proposed injection zone. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of completion, and a schematic of any plugged well illustrating all plugging detail.
VII.	Attach data on the proposed operation, including:
	 Proposed average and maximum daily rate and volume of fluids to be injected; Whether the system is open or closed; Proposed average and maximum injection pressure; Sources and an appropriate analysis of injection fluid and compatibility with the receiving formation if other than reinjected produced water; and, If injection is for disposal purposes into a zone not productive of oil or gas at or within one mile of the proposed well, attach a chemical analysis of the disposal zone formation water (may be measured or inferred from existing literature, studies, nearby wells, etc.).
*VIII	Attach appropriate geologic data on the injection zone including appropriate lithologic detail, geologic name, thickness, and depth. Give the geologic name, and depth to bottom of all underground sources of drinking water (aquifers containing waters with total dissolved solids concentrations of 10,000 mg/l or less) overlying the proposed injection zone as well as any such sources known to be immediately underlying the injection interval.
IX.	Describe the proposed stimulation program, if any.
*X.	Attach appropriate logging and test data on the well. (If well logs have been filed with the Division, they need not be resubmitted)
*XI.	Attach a chemical analysis of fresh water from two or more fresh water wells (if available and producing) within one mile of any injection or disposal well showing location of wells and dates samples were taken.
XII.	Applicants for disposal wells must make an affirmative statement that they have examined available geologic and engineering data and find no evidence of open faults or any other hydrologic connection between the disposal zone and any underground sources of drinking water.
XIII.	Applicants must complete the "Proof of Notice" section on the reverse side of this form.
XIV.	Certification: I hereby certify that the information submitted with this application is true and correct to the best of my knowledge and belief.
	NAME: Martha Howard TITLE: Regulatory Analyst
	SIGNATURE: DATE: 2/8/2007
*	E-MAIL ADDRESS: <u>martha_howard@swn.com</u> If the information required under Sections VI, VIII, X, and XI above has been previously submitted, it need not be resubmitted. Please show the date and circumstances of the earlier submittal:
DIST	RIBUTION: Original and one copy to Santa Fe with one copy to the appropriate District Office

III. WELL DATA

- A. The following well data must be submitted for each injection well covered by this application. The data must be both in tabular and schematic form and shall include:
 - (1) Lease name; Well No.; Location by Section, Township and Range; and footage location within the section.
 - (2) Each casing string used with its size, setting depth, sacks of cement used, hole size, top of cement, and how such top was determined.
 - (3) A description of the tubing to be used including its size, lining material, and setting depth.
 - (4) The name, model, and setting depth of the packer used or a description of any other seal system or assembly used.

Division District Offices have supplies of Well Data Sheets which may be used or which may be used as models for this purpose. Applicants for several identical wells may submit a "typical data sheet" rather than submitting the data for each well.

- B. The following must be submitted for each injection well covered by this application. All items must be addressed for the initial well. Responses for additional wells need be shown only when different. Information shown on schematics need not be repeated.
 - (1) The name of the injection formation and, if applicable, the field or pool name.
 - (2) The injection interval and whether it is perforated or open-hole.
 - (3) State if the well was drilled for injection or, if not, the original purpose of the well.
 - (4) Give the depths of any other perforated intervals and detail on the sacks of cement or bridge plugs used to seal off such perforations.
 - (5) Give the depth to and the name of the next higher and next lower oil or gas zone in the area of the well, if any.

XIV. PROOF OF NOTICE

All applicants must furnish proof that a copy of the application has been furnished, by certified or registered mail, to the owner of the surface of the land on which the well is to be located and to each leasehold operator within one-half mile of the well location.

Where an application is subject to administrative approval, a proof of publication must be submitted. Such proof shall consist of a copy of the legal advertisement which was published in the county in which the well is located. The contents of such advertisement must include:

- (1) The name, address, phone number, and contact party for the applicant;
- (2) The intended purpose of the injection well; with the exact location of single wells or the Section, Township, and Range location of multiple wells;
- (3) The formation name and depth with expected maximum injection rates and pressures; and,
- (4) A notation that interested parties must file objections or requests for hearing with the Oil Conservation Division, 1220 South St. Francis Dr., Santa Fe, New Mexico 87505, within 15 days.

NO ACTION WILL BE TAKEN ON THE APPLICATION UNTIL PROPER PROOF OF NOTICE HAS BEEN SUBMITTED.

NOTICE: Surface owners or offset operators must file any objections or requests for hearing of administrative applications within 15 days from the date this application was mailed to them.

C-108 Application for Authority to Inject Southwestern Energy Production Company Karlsbad Corral SWD No. 1 API # 30-015-35341 Eddy County, New Mexico

I. The purpose is to drill and complete a salt water disposal well for produced Delaware, Bone Springs, and other source water into the Delaware Sand formation.

Southwestern Energy Production Company plans to drill a new well into the Delaware Sand for the purpose of water disposal.

II. Operator:

Southwestern Energy Production Company

2350 N. Sam Houston Parkway East

Suite 190

Houston, Texas 77032

Attn: Martha Howard (281-618-4887)

III. Well Data:

See Attachment A

- IV. This is not an expansion of an existing project
- V. There are no active wells within the ½ mile area of review that penetrate the proposed injection zone. (See Attachment B)

Southwestern Energy Production Company operates three (3) horizontal wells that are producing form the Cherry Canyon 4 Sand of the Delaware Formation Series. The horizontal laterals produce at depth of 5,300' TVD.

- VI. Attachment C is a tabulation of well data and wellbore schematics for all wells that fall within the ½ mile area of review.
- VII. 1. Proposed average daily injection volume is approximately 2,000 BWPD. Maximum daily injection volume is approximately 5,000 BWPD
 - 2. This will be a closed system
 - 3. Proposed Average Injection Pressure unknown Proposed maximum injection pressure 1526 psig
 - 4. Sources of injected water would be produced water from the Delaware, Bone Springs, and other sources (Attachment D)
 - 5. There are no productive oil or gas wells in the Bell Canyon formation within 1 mile of the proposed injection well.

- VIII. The proposed injection interval is the portion of the Delaware Sand formation consisting of porous sandstone from estimated depths of 3,200' 4,000' (TD of proposed new well).
 - IX. The proposed disposal interval may be acidized with 10% HCL acid or proppant fracture.
 - X. Logs will be filed after the well is drilled.
 - XI. There are no windmills within a one mile radius of the well location.
- XII. Southwestern Energy Production Company has examined geological and engineering data and has found no evidence of faulting in the proposed interval. (Attachment E).

XIII. Proof of notice

- A. Certified letters sent to the surface owner and offset operators attached (Attachment F)
- B. Copy of legal advertisement attached (Attachment G)

XIV. Certification is signed

Side 1

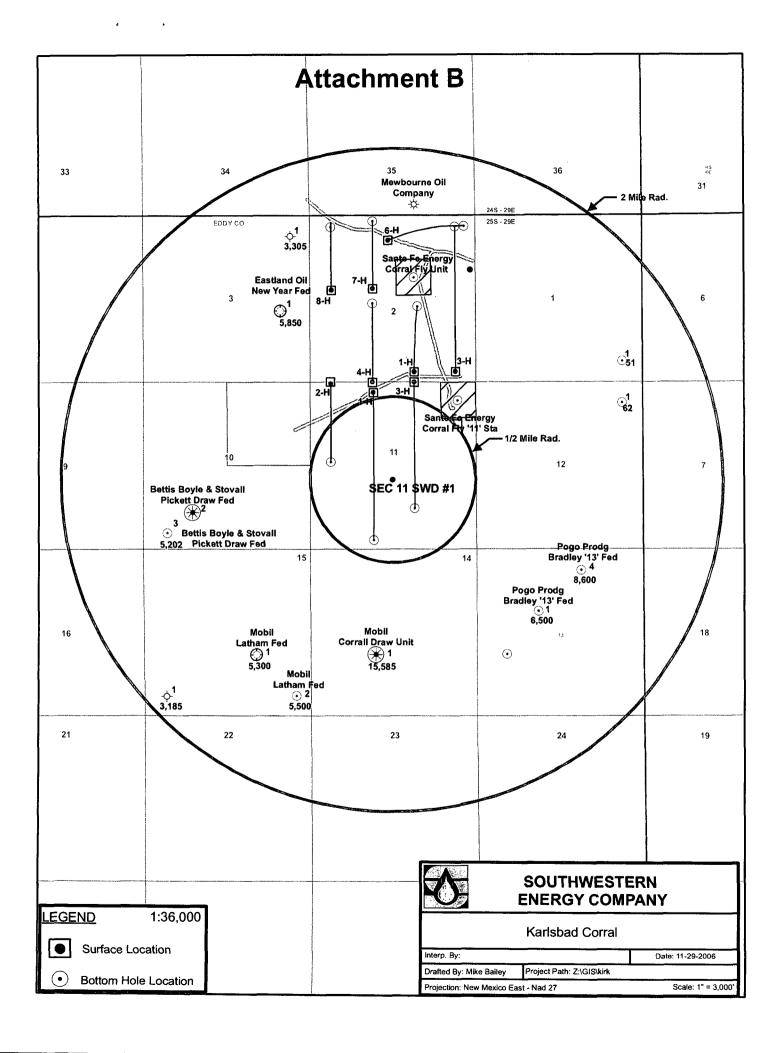
INJECTION WELL DATA SHEET

OPERATOR: Southwestern E	nergy Production Comp	oany		
WELL NAME & NUMBER:	Karlsbad Corral SWD	No. 1	~	
WELL LOCATION: <u>2,222' FSL & 2,640' :</u> FOOTAGE LOCATIO	FEL ON UNIT LETTER	11 SECTION		
WELLBORE SCHEMATIC		WELL CO	NSTRUCTION DA	1 <i>TA</i>
Southwestern Energy Production Company Proposed Wellbore Diagram Karlsbad Corral SWD No. 1, Eddy County, New Mexico		<u>Surf</u>	ace Casing	
71111	Hole Size:	12-1/4"	Casing Size:	9-5/8"
	Cemented with	n:305s	x. or	412 ft
	Top of Cemen	t: Surface	Method Deterr	mined: Circulation
		<u>Interm</u>	ediate Casing	
9 5/8", 24#, K-55, @	Hole Size:		_ Casing Size:_	
	Cemented with	ı:s	sx. <i>or</i>	ft
	Top of Cemen	t:	_ Method Deterr	mined:
2 7/8", 6.50 #, N-80, coated	tubing	Produ	ction Casing	
	Hole Size:	7-7/8"	Casing Size:	5-1/2"
	Cemented with	n:641s	sx. <i>or</i> 1	134 ft
	Top of Cemen	t: Surface	Method Deterr	mined: Circulation
Baker, 5 1/2", Loc-Set @	^{2 3,175'} Depth: <u>400</u>	00'		
Perforations (3,200' -	4,000')	<u>Injec</u>	tion Interval	
		3,200' fe	eet to <u>4,000'</u>	
5 1/2", 17#, N-80, @ 4,0	00'	(Pe	erforated)	

INJECTION WELL DATA SHEET

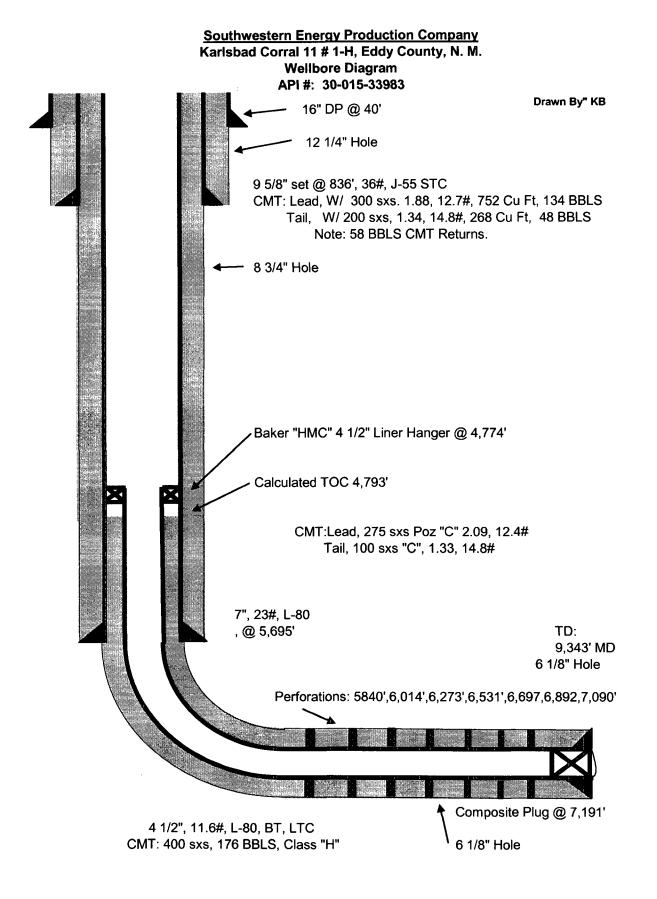
Tubing Size:	2-7/8" Lining Material: Plastic Coated
Гуре of Packer	r: Baker 5-1/2" Loc-Set, internally plastic coated
Packer Setting	g Depth: 3,175' MD
Other Type of	Tubing/Casing Seal (if applicable):
	Additional Data
1.	Is this a new well drilled for injection? XX Yes No
	If no, for what purpose was the well originally drilled?
2.	Name of the Injection Formation: Delaware (Bell Canyon)
3.	Name of Field or Pool (if applicable):
4.	Has the well ever been perforated in any other zone(s)? List all such perforated intervals and give plugging detail, i.e. sacks of cement or plug(s) used. New Drill
	No other perforated intervals
5.	Give the name and depths of any oil or gas zones underlying or overlying the proposed njection zone in this area:
	Higher: Delaware (Lamar)
	Lower: Delaware (Cherry Canyon)
	Lower. Delaware (Cherry Carryon)
6.	The proposed well is not located in either a Potash area or WIPP site area.
7.	Estimated Formation Tops: Rustler 553' Salado 1,683' Base of Salado 2,903' Lamar 3,183' Bell Canyon 3,208'

8. Production casing will be cemented to surface to isolate the salt section of the well from the injection interval. A cement bond log will be run to verify cement placement.

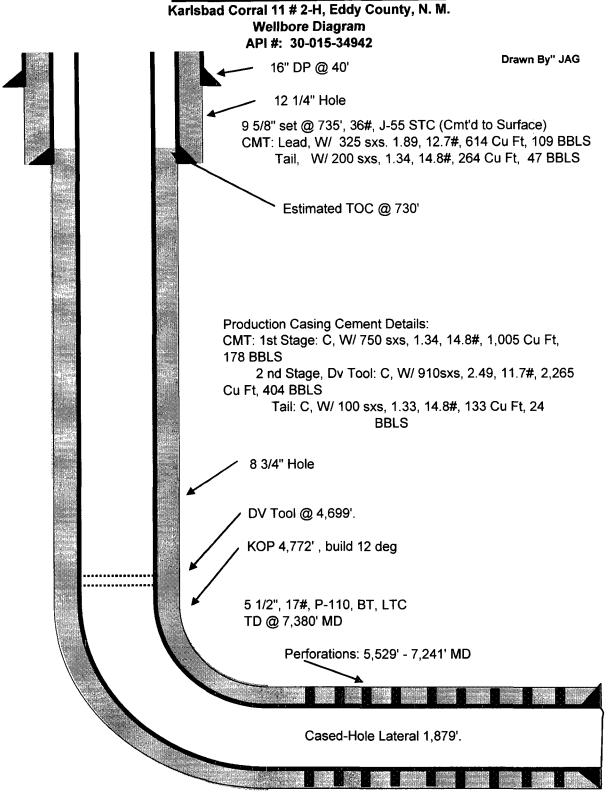


The following is a tabulation on all wells of public record within the area of review. None of these wells penetrate the proposed injection formation within the area of review.

Well Name	Operator	API#	Type Well / Location	Date	Completion	Schematic
	_			Drilled	Date	Attached
Karlsbad Corral 11 State 1-H	Southwestern Energy Production Company	30-015-33983	Horizontal Well Surface Location: 330' FNL & 1980' FWL Bottom Hole Location:	5/6/2005 (TD Reached)	5/15/2005	Yes
Karlsbad Corral 11 State 2-H	Southwestern Energy Production Company	30-015-34942	Horizontal Well Surface Location: 65' FNL & 660' FWL Bottom Hole Location: 2563' FNL & 660' FWL	9/8/2006 (TD Reached)	10/3/2006	Yes
Karlsbad Corral 11 State 3-H	Southwestern Energy Production Company	30-015-34449	Horizontal Well Surface Location: 10' FNL & 1980' FEL Bottom Hole Location: 3,598' FNL & 1,968' FEL	3/9/2006 (TD Reached)	4/11/2006	Yes

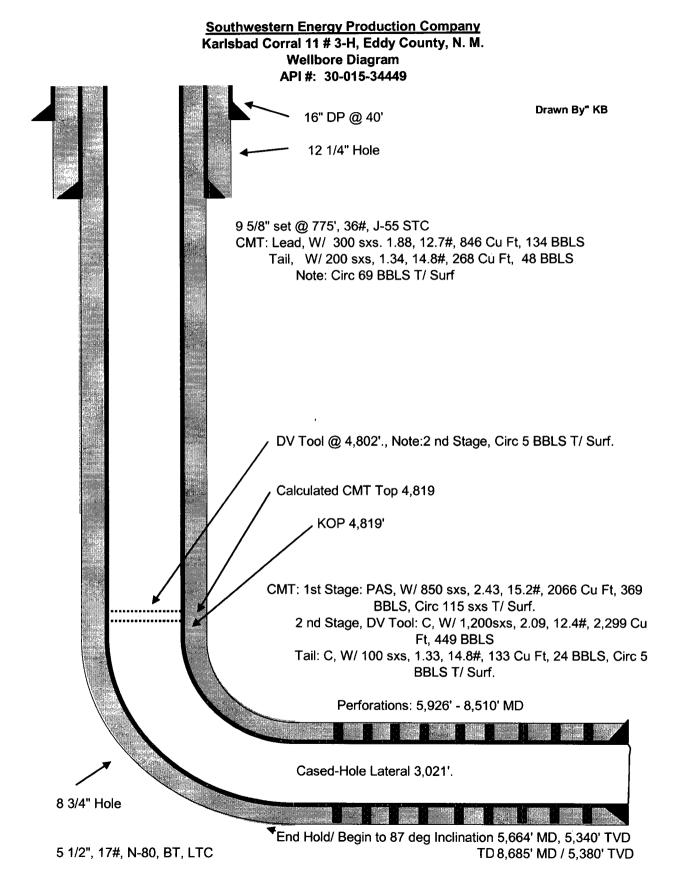


Southwestern Energy Production Company



End Hold/ Begin to 90 deg Inclination 5,518' MD, 5,259' TVD

TD: 7,400' MD / 5,301' TVD



WATER ANALYSIS REPORT

SA	M	PL	E

Oil Co.: Southwestern Energy Co.

Lease: Karlsbad Corral 11-ST.

Well No.: 1-H

Location: Cherry CANYON 4

Attention:

Date Sampled: 30-November-2006 Date Analyzed: 01-December-2006 Lab ID Number: Dec0106.001- 2

EQ. WT.

1 00 4 -

Salesperson:

00 004

Requested By: Pro-Kem, Inc.*

File Name: Dec0106.001

ANALYSIS

6.170 1. Ph 1.208 2 Specific Gravity 60/60 F.

3.205 Severe **CACO3 Saturation Index** @ 80F 3. 3.205 Severe @140F

MG/L **Dissolved Gasses** Hydrogen Sulfide 4.

Not Determined Carbon Dioxide 5. Dissolved Oxygen **Not Determined** 6.

Cations

1.	Calcium	(Ca++)		32,064	/ 20.1 =	1,595.22
8.	Magnesium	(Mg++)		4,741	/ 12.2 =	388.61
9.	Sodium	(Na+)	(Calculated)	74,969	/ 23.0 =	3,259.52
10.	Barium	(Ba++)	,	20	/ 68.7 =	0.29
-	Anions					
11 -	Hydroxyd	(UHT)		0	/ 17 0 =	0.00

A	<u>lnions</u>				
11.	Hydroxyl	(OH+)	0	/ 17.0 =	0.00
12.	Carbonate	(CO3=)	0	/ 30.0 =	0.00
13.	Bicarbonate	(HCO3-)	73	/ 61.1 =	1.19
14.	Sulfate	(SO4=)	220	/ 48.8 =	4.51
15.	Chloride	(CI-)	185,958	/ 35.5 =	5,238.25
16.	Total Dissolved	Solids	298,045		
17.	Total Iron	(Fe)	33.00	/ 18.2 =	1.81

18. **Not Determined** Manganese (Mn++)99,589

19. Total Hardness as CaCO3

20. Resistivity @ 75 F. (Calculated)

PROBABLE MINERAL COMPOSITION

0.001 Ohm · meters

*MEQ/L

		~~~	<u> </u>	111007
= mg/l	EQ. WT.	X	*meq/L	COMPOUND
97	81.04		1.19	Ca(HCO3)2
287	68.07		4.22	CaSO4
88,235	55.50		1,589.81	CaCl2
0	73.17		0.00	Mg(HCO3)2
0	60.19		0.00	MgSO4
18,505	47.62		388.61	MgCl2
0	84.00		0.00	NaHCO3
0	71.03		0.00	NaSO4
190,570	58.46		3,259.83	NaCl
	nor Litor	onte i	millioquival	*

millieguivalents per Liter

### LOGARITHMIC WATER PATTERN

				*meq	/ L.				
Na		-	<del>                                     </del>		1 111111				CI
Са	<b> </b>				<b>TIME</b>	11111	+ + + + + + + + + + + + + + + + + + + +	-++	HC03
Mg		- M-L				-+++	+++	-++++	SO4
Fe	100000	1000 1	₩ ∞	10	1 10	1111111	<del>-            </del>  -   1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1		CO3

### Calcium Sulfate Solubility Profile

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## WATER ANALYSIS REPORT

	SA	M	PL	E.
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Oil Co.: Southwestern Energy Co.

Lease : Karlsbad Corral 11-ST.

Well No.: 2-H,

Location: Change Cangon 4

Attention: **ANALYSIS** 

Date Sampled: 30-November-2006 Date Analyzed: 01-December-2006 Lab ID Number: Dec0106.001- 3

Salesperson:

98,338

Requested By: Pro-Kem, Inc.*

File Name: Dec0106.001

1. Ph 6.320 1.206 2. Specific Gravity 60/60 F.

**CACO3 Saturation Index** @ 80F Severe 3.353

3.353 Severe @140F MG/L EQ. WT. **Dissolved Gasses** 

Hydrogen Sulfide 0 4. Carbon Dioxide **Not Determined** 

Dissolved Oxygen **Not Determined** 6.

Cations

7.	Calcium	(Ca++)		31,864	/ 20.1 =	1,585.27
8.	Magnesium	(Mg++)		4,559	/ 12.2 =	373.69
9.	Sodium	(Na+)	(Calculated)	74,853	/ 23.0 =	3,254.48
10.	Barium	(Ba++)		Below 10		
	Anions					

11.	Hydroxyl	(OH+)	0	/ 17.0 =	0.00
12.	Carbonate	(CO3=)	0	/ 30.0 =	0.00
13.	Bicarbonate	(HCO3-)	73	/ 61.1 =	1.19
14.	Sulfate	(SO4=)	135	/ 48.8 =	2.77
15.	Chloride	(Cl-)	184,958	/ 35.5 =	5,210.08
16	Total Dissalved	Solide	206 442		

Total Dissolved Solids

16. 296,442 2.53 / 18.2 = 17. Total Iron (Fe) 46.00 Manganese 18. (Mn++)Not Determined

19. Total Hardness as CaCO3

20. Resistivity @ 75 F. (Calculated)

### PROBABLE MINERAL COMPOSITION

0.001 Ohm · meters

*MEQ/L

PRODA	DFE MIMEN	~L \	CIVIE COLL	1014						
COMPOUND	*meq/L	Χ	EQ. WT.	= mg/L						
Ca(HCO3)2	1.19		81.04	97						
CaSO4	2.77		68.07	188						
CaCl2	1,581.31		55.50	87,763						
Mg(HCO3)2	0.00		73.17	0						
MgSO4	0.00		60.19	0						
MgCl2	373.69		47.62	17,795						
NaHCO3	0.00		84.00	0						
NaSO4	0.00		71.03	0						
NaCl	3,255.08		58.46	190,292						
* milliequivalents per Liter										

LOGARITHMIC WATER PATTERN *mea/I

meq/L.										
Na	1111111		-	<del>                                     </del>	1 11111		++++		CI	
	1								•	
Ca	<b>******</b>		<del>- <b>1</b>11111111</del>		<b>HIII</b>	+++	++++		HC03	
		X			<b>\</b>		, , , , , ,	11111		
Mg		-	<del>-                                      </del>	111111	<b>)</b>	<del>-++++   </del>		-	SO4	
9	,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			<b>/</b>		1 1111111		004	
Fe	<b>IIIII 1</b>	-	11111		<b>Z</b> +++++++	++++	++++		CO3	
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### **Calcium Sulfate Solubility Profile**

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	350							
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m	328		_					
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	Temp °F	. 50	70	90	110	130	150	170

Rebecca Rodriguez, Analys

## WATER ANALYSIS REPORT

S	Δ	ħ	Λ	P	ı	F
v		v k	FB		_	_

Oil Co.: Southwestern Energy Co.

Lease: Karlsbad Corral 11

Well No.: 3-H

Location: Cheary CAnyon 4

Attention:

Date Sampled: 30-November-2006
Date Analyzed: 01-December-2006
Lab ID Number: Dec0106.001-1

EQ. WT.

Salesperson:

MG/L

Requested By: Pro-Kem, Inc.*

File Name: Dec0106.001

### **ANALYSIS**

1. Ph **6.190**2. Specific Gravity 60/60 F. **1.213** 

3. CACO3 Saturation Index @ 80F **3.297 Severe** @ 140F **3.298 Severe** 

**Dissolved Gasses** 

4. Hydrogen Sulfide5. Carbon DioxideNot Determined

6. Dissolved Oxygen Not Determined

### **Cations**

1.	Calcium	(Ca++)		35,4/1	/ 20.1 =	1,704.73
8.	Magnesium	(Mg++)		3,890	/ 12.2 =	318.85
9.	Sodium	(Na+)	(Calculated)	70,019	/ 23.0 =	3,044.30
10.	Barium	(Ba++)	•	Below 10		
A	nions					
11.	Hydroxyl	(OH+)		0	/ 17.0 =	0.00

0.00 12. 0 / 30.0 =Carbonate (CO3=) **Bicarbonate** 78 / 61.1 = 1.28 13. (HCO3-) 14. Sulfate (SO4=) 95 / 48.8 = 1.95 Chloride 181.959 / 35.5 = 5,125.61 15. (CI-)

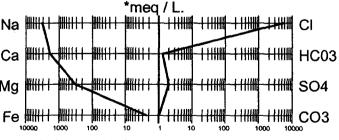
16. Total Dissolved Solids
 17. Total Iron (Fe)
 291,512
 39.50

18. Manganese (Mn++) **Not Determined**19. Total Hardness as CaCO3 **104,593** 

20. Resistivity @ 75 F. (Calculated)

0.001 Ohm · meters

### LOGARITHMIC WATER PATTERN



### **Calcium Sulfate Solubility Profile**

		ai	u		un.	ate o		Dility	1-11	J1111	₹.
	320	$\neg$									_
n	309	ヿ					1				+
"	298	<u>_</u>					_	-			
	287	-+		+-				_+	<b>\</b>		+-
ı	276	+		+-			<del></del>		<del>-\</del> -		+-
	265	+		+-			-		<del></del>		+-
	254	-		-			<u> </u>			<del></del>	4
	243	+					ļ			<del>_</del> _	4
	232	$\perp$					<u> </u>			$\boldsymbol{-}$	
	221	$\bot$					l	[	1_		V
		T							T		Т
	210 Temp	°F.	50	70	9	0 1	10	130	150		170

### PROBABLE MINERAL COMPOSITION

/ 18.2 =

*MEQ/L

2.17

	INCUM	DEF MINATIA	~~ <i>~</i>		. • . •
C	COMPOUND	*meq/L	Χ	EQ. WT.	= mg/l
	Ca(HCO3)2	1.28		81.04	103
	CaSO4	1.95		68.07	133
	CaCl2	1,761.50		55.50	97,763
	Mg(HCO3)2	0.00		73.17	0
	MgSO4	0.00		60.19	0
	MgCl2	318.85		47.62	15,184
	NaHCO3	0.00		84.00	0
	NaSO4	0.00		71.03	0
	NaCl	3,045.25		58.46	178,025
	al.				

* milliequivalents per Liter

Rebecca Rodriguez, Analyst

					<b>,</b>				
		WAT	ER A	NAL	YSIS I	REPORT			
SAMPL	E								
Oil Co	o. : Southwestern e : Karlsbad Cor	Energy			Date Sample	ed : 22-July-2004 ed: 02-August-2004			
	; : Kansbad Coi No.: # 1-H	Idi Z				per: AUG0204.001- 4	<b>,</b>		
Location: Olaco O Advisor 4 Salesperson:									
Attention: Requested By : Pro-Kem, Inc.*									
ANALY	<u>SIS</u>				File Name : A	AUG0204.001			
1.	Ph			6.500					
2.	Specific Gravity			1.128					
3.	CACO3 Saturati	on Index	@ 80F		0.868	Moderate			
_			@140F		2.288	Severe	*MEQ/L		
_	issolved Gasses				MG/L.	EQ. WT.	MIEGYL		
4. 5.	Hydrogen Sulfide Carbon Dioxide	е		Not	Determined				
5. 6.	Dissolved Oxyge	an			Determined				
= :	ations	211		`	J0101111110				
7.	Calcium	(Ca++)			22,846	/ 20.1 =	1,136.62		
8.	Magnesium	(Mg++)			5,349	/ 12.2 =	438.44		
9.	Sodium	(Na+)	(Calculate	ed)	41,763	/ 23.0 =	1,815.78		
10.	Barium	(Ba++)	`		Determined				
A	nions	•							
11.	Hydroxyl	(OH+)			0	/ 17.0 =	0.00		
12.	Carbonate	(CO3=)			0	/ 30.0 =	0.00		

12.	Carbonate	(CO3=)	0	/ 30.0 =	0.00
13.	Bicarbonate	(HCO3-)	73	/ 61.1 =	1.19
14.	Sulfate	(SO4=)	550	/ 48.8 =	11.27
15.	Chloride	(Cl-)	119,973	/ 35.5 =	3,379.52
16.	Total Dissolved	Solids	190,554		

Total Iron 450.00 17. 18. Manganese **Not Determined** (Mn++) 79,071

Total Hardness as CaCO3 19. 20. Resistivity @ 75 F. (Calculated)

0.003 Ohm meters

### **LOGARITHMIC WATER PATTERN**

*meq / L.											
Na					1 11111			<del></del>	CI		
Са	1				<b>₹</b>			-+++	HC03		
Mg					-	111111		-	SO4		
Fe	0000 1	Meeter 1		10		11111111					
Calaium Sulfata Salubility Brafile											

710						
706	$\neg \neg$		$\neg$			_
702						_
698						
694	-					
690 -	$\neg$				<del></del>	_
686						
682			_			
678 -	-+-	-+		-+-		
674						
670 —	<del></del>					_

## PROBABLE MINERAL COMPOSITION

/ 18.2 =

0.00 0.00 1.19 11.27

24.73

. • . •		~~ ·	PAPPE IAITIAPIA	INCUM
= mg/L	EQ. WT.	Χ	*meq/L	COMPOUND
97	81.04		1.19	Ca(HCO3)2
767	68.07		11.27	CaSO4
62,390	55.50		1,124.15	CaCl2
0	73.17		0.00	Mg(HCO3)2
0	60.19		0.00	MgSO4
20,879	47.62		438.44	MgCl2
0	84.00		0.00	NaHCO3
0	71.03		0.00	NaSO4
106,218	58.46		1,816.93	NaCl
	per Liter	ents i	millieguivale	*

		WAT	ER ANA	LYSIS I	REPORT	
Lease	D.: Southwestern  E: Karlsbad Corl  No.: 3-H  ion: Cherry C.  tion:	ral 2-ST.		Date Analyze Lab ID Numb Salesperson	y : Pro-Kem, Inc.*	06
1.	Ph		6.200			
2.	Specific Gravity		1.206			
3.	CACO3 Saturation	on Index	@ 80F	2.628	Severe	
			@140F	3.068	Severe	
<u>D</u>	issolved Gasses			MG/L.	EQ. WT.	*MEQ/L
4.	Hydrogen Sulfide	9		0		
5.	Carbon Dioxide		No	t Determined		
6.	Dissolved Oxyge	en	No	t Determined		
C	ations					
7.	Calcium	(Ca++)		32,264	/ 20.1 =	1,605.17
8.	Magnesium	(Mg++)		4,984	/ 12.2 =	408.52
9.	Sodium	(Na+)	(Calculated)	67,737	/ 23.0 =	2,945.09
10.	Barium	(Ba++)	,	Below 10		
A	<u>nions</u>	•				

10.	Barium	(Ba++)	Below 10		
A	<u>Inions</u>				
11.	Hydroxyl	(OH+)	0	/ 17.0 =	0.00
12.	Carbonate	(CO3=)	0	/ 30.0 =	0.00
13.	Bicarbonate	(HCO3-)	49	/ 61.1 =	0.80
14.	Sulfate	(SO4=)	115	/ 48.8 =	2.36
15.	Chloride	(CI-)	175,960	/ 35.5 =	4,956.62
16.	Total Dissolved	Solids	281,109	•	
17.	Total Iron	(Fe)	33.00	/ 18.2 =	1.81

18. (Mn++) **Not Determined** Manganese 19. Total Hardness as CaCO3 101,090

20. Resistivity @ 75 F. (Calculated)

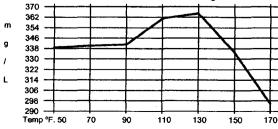
### PROBABLE MINERAL COMPOSITION

( NODA	DEE 1811111E11	~~ ·		1011
COMPOUND	*meg/L	X	EQ. WT.	= mg/L
Ca(HCO3)2	0.80		81.04	65
CaSO4	2.36		68.07	160
CaCl2	1,602.02		55.50	88,912
Mg(HCO3)2	0.00		73.17	0
MgSO4	0.00		60.19	0
MgCl2	408.52		47.62	19,454
NaHCO3	0.00		84.00	0
NaSO4	0.00		71.03	0
NaCl	2,946.08		58.46	172,228
*	milliequivale	ents	per Liter	

### LOGARITHMIC WATER PATTERN

				*meq	/ L.				
Na			<del>         </del>			+++			CI
Са	<b></b>						1111		HC03
Ua	HILLIA	Milli	WINTE T 1	1	\ · · · · · · · · · · · · · · · · · · ·	1 1 1 1 1 1 1 1	1 111100	1 1 1 1 1 1 1 1 1 1	псоз
Mg	<b>*****</b>	- IM-L			<b>)</b>	1111111	1111111	-1111111	SO4
Fe	 	1000 1	<u> </u>    + - ∞	10	+	1111111	 	000 100	соз

### **Calcium Sulfate Solubility Profile**



0.001 Ohm · meters

# Pro-Kem, Inc. WATER ANALYSIS REPORT

	SA	MP	LE
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Oil Co.: Southwestern Energy Co.

Lease : Karlsbad Corral 2

Well No.: 4-H

Location: Cherry CAWYON 4

Attention:

Date Sampled: 30-November-2006 Date Analyzed: 01-December-2006 Lab ID Number: Dec0106.002- 2

EQ. WT.

*MEQ/L

1 395 82

1.81

Salesperson:

28 056

Requested By: Pro-Kem, Inc.*

File Name: Dec0106.002

### **ANALYSIS**

Ph
 Specific Gravity 60/60 F.
 1.205

3. CACO3 Saturation Index @ 80F 2.187 Severe @ 140F 3.107 Severe

@140F 3.107 Sevential Seve

4. Hydrogen Sulfide 0
5. Carbon Dioxide Not Determined

6. Dissolved Oxygen Not Determined

 $(C_0+1)$ 

## Calcium

17.

1.	Calcium	(Carr)		20,000	/ 20.1 -	1,000.02
8.	Magnesium	(Mg++)		5,166	/ 12.2 =	423.44
9.	Sodium	(Na+)	(Calculated)	68,324	/ 23.0 =	2,970.61
10.	Barium	(Ba++)	,	16	/ 68.7 =	0.23
<u> </u>	<u>Anions</u>					
11.	Hydroxyl	(OH+)		0	/ 17.0 =	0.00
				_		

1 12. Carbonate 0 / 30.0 =0.00 (CO3=) 0.80 13. **Bicarbonate** (HCO3-) 49 / 61.1 = 2.05 14. Sulfate (SO4=)100 / 48.8 = / 35.5 = Chloride 4,787.66 15. (CI-) 169,962

15. Chloride (Ci-) 169,962 / 35.5 = 4,767.6

16. Total Dissolved Solids 271.673

18. Manganese (Mn++) Not Determined
19. Total Hardness as CaCO3 91,331

20. Resistivity @ 75 F. (Calculated)

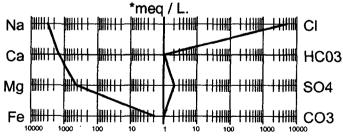
Total Iron

0.001 Ohm meters

33.00

### LOGARITHMIC WATER PATTERN

(Fe)



### **Calcium Sulfate Solubility Profile**

	Ou	1010	1111 0	unate	, 001	awiiity	, , , ,	116
	450	<del> </del>				-+-	-+-	
	445	<del> </del>				<del></del>		
1	440	ـــــ				$\angle\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!$		
	435 —	┖—					$\searrow$	
	430 —							
	425 -							
	420 —							
	415 —			/	-+-			1
	410 —	_			<del></del>			+
	405	<b></b>	_					₩
	400 —	<b> </b>	<b></b>					
	Temp ºF	. 50	70	90	110	130	150	17

### PROBABLE MINERAL COMPOSITION

/ 18.2 =

IUN	COMILOSII	CAL	RE MINER	PRUBA
= mg/L	EQ. WT.	Χ	*meq/L	COMPOUND
65	81.04		0.80	Ca(HCO3)2
124	68.07		1.82	CaSO4
77,323	55.50		1,393.20	CaCl2
0	73.17		0.00	Mg(HCO3)2
0	60.19		0.00	MgSO4
20,164	47.62		423.44	MgCl2
0	84.00		0.00	NaHCO3
0	71.03		0.00	NaSO4
173,686	58.46		2,971.02	NaCl

* milliequivalents per Liter

Rebecca Rodriguez, Analyst

## WATER ANALYSIS REPORT

SA	MP	LE
----	----	----

Oil Co.: Southwestern Energy Co.

Lease: Karlsbad Corral 2

Well No.: 6-H

Location: Chenny (LANYON 4

Attention:

Date Sampled: 30-November-2006 Date Analyzed: 01-December-2006 Lab ID Number: Dec0106.002- 3

Salesperson:

Requested By: Pro-Kem, Inc.*

File Name: Dec0106.002

### **ANALYSIS**

1.	Ph	6.110
2.	Specific Gravity 60/60 F.	1.212

Severe 2.905 **CACO3 Saturation Index** @ 80F

@140F 3.005 Severe EQ. WT. MG/L

### Dissolved Gasses Hydrogen Sulfide

4.	nyarogen Sumae	U
5.	Carbon Dioxide	Not Determined
_		

**Not Determined** 6. Dissolved Oxygen

### **Cations**

7.	Calcium	(Ca++)		31,262	/ 20.1 =	1,555.32
8.	Magnesium	(Mg++)		4,255	/ 12.2 =	348.77
9.	Sodium	(Na+)	(Calculated)	72,852	/ 23.0 =	3,167.48
10	Barium	(Ba++)		Below 10		

### Anions

11.	Hydroxyl	(OH+)	0	/ 17.0 =	0.00
12.	Carbonate	(CO3=)	0	/ 30.0 =	0.00
13.	Bicarbonate	(HCO3-)	54	/ 61.1 =	0.88
14.	Sulfate	(SO4=)	98	/ 48.8 =	2.01
15.	Chloride	(CI-)	179,959	/ 35.5 =	5,069.27
16.	Total Dissolved	Solids	288,480		-

17. Total Iron 89.50 (Fe)

18. Manganese **Not Determined** (Mn++) 19. Total Hardness as CaCO3 95,585

20. Resistivity @ 75 F. (Calculated)

## 0.001 Ohm meters

/ 18.2 =

PROBABLE WINEIVAL COMPONITION									
COMPOUND	*meg/L	X	EQ. WT.	= mg/L					
Ca(HCO3)2	0.88		81.04	72					
CaSO4	2.01		68.07	137					
CaCl2	1,552.43		55.50	86,160					
Mg(HCO3)2	0.00		73.17	0					
MgSO4	0.00		60.19	0					
MgCl2	348.77		47.62	16,608					
NaHCO3	0.00		84.00	0					
NaSO4	0.00		71.03	0					
NaCl	3,168.07		58.46	185,205					

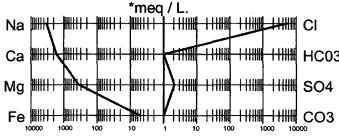
PROBABLE MINERAL COMPOSITION

*MEQ/L

4.92

* milliequivalents per Liter

### LOGARITHMIC WATER PATTERN



### Calcium Sulfate Solubility Profile

360				
336				
324	Ţ		$\rightarrow$	
312			<u>`</u>	<b>\</b>
300	<del> </del>			<del>\</del>
288 -	+ +	— <del> </del> —		+
276	+			+
264	+ +		<del></del>	+
252	+ +		<del></del>	<del>                                     </del>
240	70 90	110	130	150 1

## WATER ANALYSIS REPORT

SAMPL	E
-------	---

Oil Co.: Southwestern Energy Co.

Lease : Karlsbad Corral 2

Well No.: 7-H

Location:

Attention:

Cherry CANYON 4

**ANALYSIS** 1. Ph 6.050 1.208

2. Specific Gravity 60/60 F.

**CACO3 Saturation Index** 

@ 80F

2.304

Severe

Date Sampled: 30-November-2006

Date Analyzed: 01-December-2006

Lab ID Number: Dec0106.002- 4

Requested By: Pro-Kem, Inc.*

File Name: Dec0106.002

@140F

3.004 Severe

Salesperson:

*MEQ/L **Dissolved Gasses** MG/L Hydrogen Sulfide 4. Carbon Dioxide **Not Determined** 5. Dissolved Oxygen **Not Determined Cations** 1,530.40 Calcium 30.761 / 20.1 =7. (Ca++) (Mg++) 4,741 / 12.2 = 388.61 Magnesium 8. 67,331 / 23.0 =2,927.44 9. Sodium (Na+) (Calculated) 10. Barium (Ba++) Below 10 **Anions** 11. Hydroxyl 0 / 17.0 = 0.00 (OH+) 12. Carbonate (CO3=)0 / 30.0 =0.00 / 61.1 = 13. **Bicarbonate** (HCO3-) 63 1.03 / 48.8 = 2.25 14. Sulfate (SO4=) 110 / 35.5 = 15. Chloride 171,961 4,843.97 (CI-) 274.967

16. **Total Dissolved Solids** 

17. Total Iron (Fe) 18. Manganese

19.

(Mn++)

**Not Determined** 

96,336

35.50

/ 18.2 = 1.95

Total Hardness as CaCO3

20. Resistivity @ 75 F. (Calculated)

0.001 Ohm · meters

### LOGARITHMIC WATER PATTERN

				*meq	/ L.				
Na		<del>        </del>		<del>                                     </del>	111111	+++			CI
Са					(11111	111111	1111111	+ + + + + + + + + + + + + + + + + + + +	HC03
Mg		MILL.			<b>)</b>	-	1 1111111	111111	SO4
Fe	0000 1	000 1		10		100	1111111	+++++ 00 1000	CO3

### **Calcium Sulfate Solubility Profile**

	390 -	<del>                                     </del>							-
	381 -	+				_			_
n	372	<del>  </del>							_
	363 -								
ı	354 —		_					$\perp$	_
	345 —	<del></del>							_
	336 —	<u> </u>							_
	327 —								_
	318 -	<u> </u>							_
	309 —		ı					1	_
		T							_
	300 — Temp %	50	70	90	110	130	150	170	_

### PROBABLE MINERAL COMPOSITION

= mg/	EQ. WT.	Χ	*meq/L	COMPOUND
84	81.04		1.03	Ca(HCO3)2
153	68.07		2,25	CaSO4
84,755	55.50		1,527.11	CaCl2
0	73.17		0.00	Mg(HCO3)2
0	60.19		0.00	MgSO4
18,505	47.62		388.61	MgCl2
0	84.00		0.00	NaHCO3
0	71.03		0.00	NaSO4
171,186	58.46		2,928.25	NaCl
	nor Litor	onte	millioguiyak	*

milliequivalents per Liter

Rebecca Rodriguez, Analyst

		,		0-111	5111, 1110		
		WATE	ER A	NAL	YSIS I	REPORT	
Lease Well N Locati Attent ANALY: 1.	D.: Southwestern B.: Karlsbad Corra No.: 8-H ion: Cheney Cr ion: SIS	Energy Co. Il 2 t-Yon 4		6.020	Date Sample Date Analyze Lab ID Numb Salesperson Requested B	d : <b>30-November-2</b> 0 d: <b>01-December-2</b> 0 er: <b>Dec0106.002-</b> 5	006
4. 5. 6.	Specific Gravity 6 CACO3 Saturation  issolved Gasses Hydrogen Sulfide Carbon Dioxide Dissolved Oxygen	n Index	@ 80F @140F		2.229 3.149 <u>MG/L.</u> 0 Determined Determined	Severe Severe EQ. WT.	*MEQ/L
7. 8. 9. 10.	ations Calcium Magnesium Sodium Barium	(Ca++) (Mg++) (Na+) (Ba++)	(Calculat	ted)	27,254 5,166 70,600 Below 10	/ 20.1 = / 12.2 = / 23.0 =	1,355.92 423.44 3,069.57
11. 12. 13.	<u>nions</u> Hydroxyl Carbonate Bicarbonate	(OH+) (CO3=) (HCO3-)			0 0 107	/ 17.0 = / 30.0 = / 61.1 =	0.00 0.00 1.75

12.	Carbonate	(CO3=)	0
13.	Bicarbonate	(HCO3-)	107
14.	Sulfate	(SO4=)	180
15	Chloride	(CI-)	171.961

17. **Total Iron** (Fe) 54.00 **Not Determined** 18. Manganese (Mn++)89,330

19. Total Hardness as CaCO3

**Total Dissolved Solids** 

16.

20. Resistivity @ 75 F. (Calculated)

### PROBABLE MINERAL COMPOSITION

/ 48.8 =

/ 35.5 =

/ 18.2 =

**0.001** Ohm meters

275,268

3.69

2.97

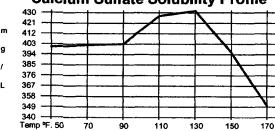
4,843.97

I NODADLE MINILIONE COM COC.									
COMPOUN	ID *meq/L	Χ	EQ. WT.	= mg/L					
Ca(HCO3	)2 1.75		81.04	142					
CaSO4	3.69		68.07	251					
CaCl2	1,350.48		55.50	74,952					
Mg(HCO3	0.00		73.17	0					
MgSO4	0.00		60.19	0					
MgCl2	423.44		47.62	20,164					
NaHCO3	0.00		84.00	0					
NaSO4	0.00		71.03	0					
NaCl	3,070.05		58.46	179,475					
* milliequivalents per Liter									

### LOGARITHMIC WATER PATTERN

*meq / L.										
Na		<del>                                     </del>			++++	<del>-+++++  -</del>		₩IIII CI		
				<u>.</u> i						
Ca			<del>                                     </del>		<b>\</b>	<del>-                 </del>	<del>                                     </del>	HC03		
			MILLS 1 1 1	MH+1.1.1	1	1.1111				
Mg						<del>-1111111 </del>	<del>                                      </del>	HIIII SO4		
Fe		 			Z	1111111		<del>IIII</del> соз		
		) 	) 	10  uuiiii		111111111	1000			

### **Calcium Sulfate Solubility Profile**



## WATED ANALYSIS DEDOOT

		WAII	EK A	NAL	. Y 515 I	KEP	JKI	i			
SAMPL	<u>E</u>						,				
Oil Co	o. : Southwestern	Energy Co.			Date Sample						
	: Karlsbad Corr	al Section 2	2		Date Analyze						
	No.: Heater	( )			Lab ID Numb		106.00	1-5			
Locat	ion: TANK PATTER	4 DAMPR	\		Salesperson		om In	· *			
Attent	( mi Uni	enny CAny.	ous 4)		Requested B File Name : I			C.			
ANALY	<u> </u>	, ,			i ne ivalite . L	JCCO 100.	٠,				
1.	Ph			6.160							
2.	Specific Gravity 6			1.203		_					
3.	CACO3 Saturatio	n Index		@ 80F <b>3.237</b>			Severe				
			@140F		3.238	Severe	<b>~</b> \		E0.11		
	issolved Gasses				MG/L.	E	Q. WT	<u>. "M</u>	EQ/L		
4.	Hydrogen Sulfide			5.1.4	0						
5.	Carbon Dioxide				Determined						
6.	Dissolved Oxyger	1		Not	Determined						
	ations										
7.	Calcium	(Ca++)			33,166		20.1				
8.	Magnesium	(Mg++)			4,133	•	12.2		8.77		
9.	Sodium	(Na+)	(Calculat	ted)	73,529	1	23.0	= 3,19	6.91		
10.	Barium	(Ba++)			Below 10						
	<u>nions</u>										
11.	Hydroxyl	(OH+)			0		17.0		0.00		
12.	Carbonate	(CO3=)			0		30.0		0.00		
13.	Bicarbonate	(HCO3-)			78		61.1		1.28		
14.	Sulfate	(SO4=)			155		48.8		3.18		
15.	Chloride	(CI-)			183,959	1	35.5	= 5,18	1.94		
16.	Total Dissolved S	olids			295,020						
17.	Total Iron	(Fe)			54.5	iO /	18.2	=	2.99		
18.	Manganese	(Mn++)		Not	Determined						
19.	Total Hardness as				99,839						
20.	Resistivity @ 75 F	F. (Calculate	ed)		0.0	<b>001</b> Ohm	· mete	ers			
	LOGARITHMIC	WATER PA	ATTERN		PRO	BABLE	MINEF	RAL COMPO	OSITIC		

# *meq / L. HC03

	n Suitate Soi	lubility Profile
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### ION

PRUDA	DFC MINEL	AL (	POINILOSI I	ION
COMPOUND	*meq/L	Χ	EQ. WT.	= mg/L
Ca(HCO3)2	1.28		81.04	103
CaSO4	3.18		68.07	216
CaCl2	1,645.60		55.50	91,331
Mg(HCO3)2	0.00		73.17	0
MgSO4	0.00		60.19	0
MgCl2	338.77		47.62	16,132
NaHCO3	0.00		84.00	0
NaSO4	0.00		71.03	0
NaCl	3,197.58		58.46	186,930
	****			

* milliequivalents per Liter

Date Sampled: 30-November-2006

Date Analyzed: 01-December-2006

Severe

EQ. WT.

*MEQ/L

2.58

Lab ID Number: Dec0106.002- 1

Requested By: Pro-Kem, Inc.* File Name: Dec0106.002

Salesperson:

## WATER ANALYSIS REPORT

SAMPLE	Ξ	Е
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Oil Co.: Southwestern Energy Co. Lease : Karlsbad Corral Section 11

Well No.: Heater Location: TANK BATTERY SAMP(E Attention: (Ain Chevry CHUYON 4)

### **ANALYSIS**

6.130 1. 1.203 2. Specific Gravity 60/60 F.

**CACO3 Saturation Index** 2.245 @ 80F

@140F 2.945 Severe MG/L **Dissolved Gasses** 

Hydrogen Sulfide 4. 5. Carbon Dioxide **Not Determined** 

**Dissolved Oxygen Not Determined** 

### **Cations**

7.	Calcium	(Ca++)		28,557	/ 20.1 =	1,420.75
8.	Magnesium	(Mg++)		5,227	/ 12.2 =	428.44
9.	Sodium	(Na+)	(Calculated)	70,245	/ 23.0 =	3,054.13

Below 10 10. Barium (Ba++)

### **Anions**

11.	Hydroxyl	(OH+)	0	/ 17.0 =	0.00
12.	Carbonate	(CO3=)	0	/ 30.0 =	0.00
13.	Bicarbonate	(HCO3-)	49	/ 61.1 =	0.80
14.	Sulfate	(SO4=)	138	/ 48.8 =	2.83
15.	Chloride	(CI-)	173,961	/ 35.5 =	4,900.31
16.	Total Dissolved	Solids	278,177		

17. Total Iron 47.00

18. Manganese **Not Determined** (Mn++)19. Total Hardness as CaCO3 92,833

20. Resistivity @ 75 F. (Calculated)

> LOGARITHMIC WATER PATTERN *meq / L.

### PROBABLE MINERAL COMPOSITION

/ 18.2 =

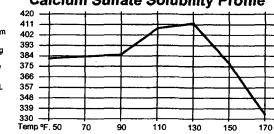
0.001 Ohm meters

IUN	COMPOSIT	CAL (	DLE MINEL	PRUBAI
= mg/l	EQ. WT.	X	*meq/L	COMPOUND
65	81.04		0.80	Ca(HCO3)2
192	68.07		2.83	CaSO4
78,650	55.50		1,417.12	CaCl2
0	73.17		0.00	Mg(HCO3)2
0	60.19		0.00	MgSO4
20,402	47.62		428.44	MgCl2
0	84.00		0.00	NaHCO3
0	71.03		0.00	NaSO4
178,581	58.46		3,054.75	NaCl

* milliequivalents per Liter

Ca	1		<del>                                     </del>		( <del>111111)</del>	+++	++++	+++	HC03
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### **Calcium Sulfate Solubility Profile**



Karlsbad Corral SWD No. 1 API # 30-015-35341 Section 11, T25S R29E 2,222' FSL & 2,640' FEL Eddy County, New Mexico

Available engineering and geological data have been examined and no evidence of open faults of hydrologic connection between the disposal zone and underground sources of drinking water have been found.

Al Gomez Geologist

Southwestern Energy Production Company

Toni Showan

Engineer

Southwestern Energy Production Company

2/8/202

Karlsbad Corral SWD No. 1 API # 30-015-35341 Section 11, T25S R29E 2222' FSL & 2,640' FEL Eddy County, New Mexico

### Offset Operators

EOG Resources P.O. Box 2267 Midland, Texas 79702 OXY USA WTP Limited Partnership P.O. Box 50250 Midland, Texas 79710

Yates Petroleum Corporation 105 South 4th Street Artesia, New Mexico 88210

### Surface/Mineral Owner and Lessees

New Mexico State Land Office Oil, Gas and Minerals Division P.O. Box 1148 Santa Fe, NM 87504-1148

Russler Breaks Ranch Attn: Mr. Tran King 64 North 5050 East Ririe, Idaho 83443

JR Engineering and Construction Co. P.O. Box 487 Carlsbad, New Mexico 88220 Bureau of Land Management Carlsbad Field Office 620 E. Greene Street Carlsbad, NM 88220



February 8, 2007

EOG Resources P. O. Box 2267 Midland, Texas 79702 <u>via Certified Mail</u> Receipt # 7006 2150 0002 1398 0534

Re:

Karlsbad Corral SWD No. 1

API # 30-015-35341 Section 11, T25S R29E 2,222' FSL & 2,640' FEL

### Dear Sir:

Southwestern Energy Production Company is making an application to amend the perforation interval approved by Administrative Order SWD-1062 for the Karlsbad Corral SWD No. 1 well for disposal of produced Delaware Formation water from our Karlsbad Corral lease. In accordance with regulation 701.B (2), as an offset operator, a copy of the disposal application is being furnished to you.

If you have no objections to this operation, kindly execute the attached waiver of protest and return to Southwestern Energy in the enclosed stamped and addressed envelope.

Thank you for your cooperation of this application. If you have any questions, I can be reached at 281-618-4887.

Very truly yours,

Martha Howard

Regulatory Analyst

Attachments

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February 8, 2007

Bureau of Land Management Carlsbad Field Office 620 E. Greene Street Carlsbad, New Mexico 88220 <u>via Certified Mail</u> Receipt # 7006 2150 0002 1398 0541

Re:

Karlsbad Corral SWD No. 1 API # 30-015-35341 Section 11, T25S R29E 2,222' FSL & 2,640' FEL

Dear Sir:

Southwestern Energy Production Company is making an application to amend the perforation interval approved by Administrative Order SWD-1062 for the Karlsbad Corral SWD No. 1 well for disposal of produced Delaware Formation water from our Karlsbad Corral lease. In accordance with regulation 701.B (2), as an offset operator, a copy of the disposal application is being furnished to you.

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Thank you for your cooperation of this application. If you have any questions, I can be reached at 281-618-4887.

Very truly yours,

Martha Howard
Regulatory Analyst

Attachments

Attachments

Attachments

1547	U.S. Postal Service T. CERTIFIED MAIL RECEIPT (Domestic Mail Only; No Insurance Coverage Provided)
1398	For delivery information visit our website at www.usps.com,  OFFICIALUS  Postage \$
2000	Certified Fee  Return Receipt Fee (Endorsement Required)  Restricted Delivery Fee
2150	Total Postage & Fees \$
7006	Street, Apt. No., or PO Box No. 620 E. Green St.  City, State, ZIP+4 Carlsbad, NM 8820 PS Form 3800, August 2006
	7006 2150 0002 1398 05



February 8, 2007

Mr. Robert H. Bullock Yates Petroleum Corporation 105 South 4th Street Artesia, New Mexico 88210-2177 <u>via Certified Mail</u> Receipt # 7006 2150 0002 1398 0558

Re:

Karlsbad Corral SWD No. 1 API # 30-015-35341 Section 11, T25S R29E 2,222' FSL & 2,640' FEL

Dear Mr. Bullock:

Southwestern Energy Production Company is making an application to amend the perforation interval approved by Administrative Order SWD-1062 for the Karlsbad Corral SWD No. 1 well for disposal of produced Delaware Formation water from our Karlsbad Corral lease. In accordance with regulation 701.B (2), as an offset operator, a copy of the disposal application is being furnished to you.

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Thank you for your cooperation of this application. If you have any questions, I can be reached at 281-618-4887.

Very truly yours,

Martha Howard Regulatory Analyst

Attachments

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February 8, 2007

Mr. David Evans OXY USA WTP Limited Partnership P.O. Box 50250 Midland, Texas 79710 <u>via Certified Mail</u> Receipt # 7006 2150 0002 1398 0565

Re:

Karlsbad Corral SWD No. 1

API # 30-015-35341 Section 11, T25S R29E 2,222' FSL & 2,640' FEL

Dear Mr. Evans:

Southwestern Energy Production Company is making an application to amend the perforation interval approved by Administrative Order SWD-1062 for the Karlsbad Corral SWD No. 1 well for disposal of produced Delaware Formation water from our Karlsbad Corral lease. In accordance with regulation 701.B (2), as an offset operator, a copy of the disposal application is being furnished to you.

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Very truly yours,

Martha Howard Regulatory Analyst

Attachments

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February 8, 2007

New Mexico State Land Office Oil, Gas, and Mineral Division P.O. Box 1148 Santa Fe, New Mexico 87504-1148 <u>via Certified Mail</u> Receipt # 7006 2150 0002 1398 0572

Re:

Karlsbad Corral SWD No. 1

API # 30-015-35341 Section 11, T25S R29E 2,222' FSL & 2,640' FEL

Dear Sir:

Southwestern Energy Production Company is making an application to amend the perforation interval approved by Administrative Order SWD-1062 for the Karlsbad Corral SWD No. 1 well for disposal of produced Delaware Formation water from our Karlsbad Corral lease. In accordance with regulation 701.B (2), as an offset operator, a copy of the disposal application is being furnished to you.

If you have no objections to this operation, kindly execute the attached waiver of protest and return to Southwestern Energy in the enclosed stamped and addressed envelope.

Thank you for your cooperation of this application. If you have any questions, I can be reached at 281-618-4887.

Very truly yours,

Martha Howard Regulatory Analyst

Attachments

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February 8, 2007

Jim Richardson
JR Engineering and Construction Co.
P.O. Box 487.
Carlsbad, New Mexico 88220

<u>via Certified Mail</u> Receipt # 7006 2150 0002 1398 0589

Re:

Karlsbad Corral SWD No. 1 API # 30-015-35341 Section 11, T25S R29E

2,222' FSL & 2,640' FEL

Dear Mr. Richardson:

Southwestern Energy Production Company is making an application to amend the perforation interval approved by Administrative Order SWD-1062 for the Karlsbad Corral SWD No. 1 well for disposal of produced Delaware Formation water from our Karlsbad Corral lease. In accordance with regulation 701.B (2), as an offset operator, a copy of the disposal application is being furnished to you.

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Thank you for your cooperation of this application. If you have any questions, I can be reached at 281-618-4887.

Howas

0589

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Very truly yours,

Martha Howard Regulatory Analyst

Attachments





February 8, 2007

Mr. Tran King Russler Breaks Ranch 64 North 5050 East. Ririe, Idaho 83443 <u>via Certified Mail</u> Receipt # 7006 2150 0002 1398 0596

Re:

Karlsbad Corral SWD No. 1 API # 30-015-35341 Section 11, T25S R29E 2,222' FSL & 2,640' FEL

Dear Mr. King:

Southwestern Energy Production Company is making an application to amend the perforation interval approved by Administrative Order SWD-1062 for the Karlsbad Corral SWD No. 1 well for disposal of produced Delaware Formation water from our Karlsbad Corral lease. In accordance with regulation 701.B (2), as an offset operator, a copy of the disposal application is being furnished to you.

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Thank you for your cooperation of this application. If you have any questions, I can be reached at 281-618-4887.

Very truly yours,

Martha Howard
Regulatory Analyst

Attachments

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Attachments

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Suite 300 Houston, Texas 77032 (281) 618-4700 FAX: (281) 618-4818

2350 N. Sam Houston Parkway East

February 8, 2007

2007 FEB 9 AM 9 04

Mr. William Jones Oil Conservation Division 1220 South St. Francis Drive Santa Fe, New Mexico 87505

Re: Karlsbad Corral SWD No. 1 API # 30-015-35341 Section 11, T25S R29E 2,222' FSL & 2,640' FEL

Dear Mr. Jones:

Southwestern Energy Production Company is requesting to amend the perforation interval approved by Administrative Order SWD-1062 for the Karlsbad Corral SWD No. 1 well. Enclosed please find the following information in support of this application:

- 1. Form C-108
- 2. Map identifying all wells within two (2) miles with a on-half (½) radius circle around proposed injection well
- 3. Table of wells within a one-half (½) mile radius of subject well.
- 4. Injection well data sheet
- 5. Wellbore diagrams for all wells within a on-half (½) mile radius
- 6. Water Analysis Report
- 7. Affidavit of publication and newspaper clipping to be emailed upon receipt Published 2-8-07
- 8. Administrative Application Checklist

narthal doward

9. Letter attesting to the notification of the affected parties.

Thank you for your timely approval of this application. If you have any questions, I can be reached at 281-618-4887.

Very truly yours,

Martha Howard Regulatory Analyst

Attachments CC: District 2

### Jones, William V., EMNRD

From:

Martha Howard [Martha_Howard@SWN.COM]

Sent:

Monday, February 12, 2007 11:01 AM

To:

Jones, William V., EMNRD

Subject:

Southwestern - Karlsbad Corral SWD 1

Attachments: Affidavit of Publication - TD to 4000'.pdf

Will,

The attached is the Affidavit of Publication for the second request to amend the approved Administrative Order SWD-1062 that was mailed to you on February 8, 2007. The engineers assure me that they will not be changing their plans again.

On behalf of Southwestern, I apologize for all of the additional work that Southwestern has generated due to these numerous requests to amend the existing approved order.

Martha C. Howard Staff Regulatory Analyst 281-618-4887 direct 281-618-4758 fax Martha_Howard@SWN.com

Notice: This e-mail may contain privileged and/or confidential information and is intended only for the addressee. If you are not the addressee or the person responsible for delivering it to the addressee, you may not copy or distribute this communication to anyone else. If you received this communication in error, please notify us immediately by telephone or return e-mail and promptly delete the original message from your system.

### Affidavit of Publication

State of New Mexico, County of Eddy, ss.

April Hernandez, being first duly sworn, on oath says:

That she is HR/Administrative Assistant of the Carisbad Current-Argus, a newspaper published daily at the City of Carlsbad, in said county of Eddy, state of New Mexico and of general paid circulation in said county; that the same is a duly qualified newspaper under the laws of the State wherein legal notices advertisements and published; that the printed notice attached hereto was published in the regular and entire edition of said newspaper and not in supplement thereof on the date as follows, to wit

### February 8

2007

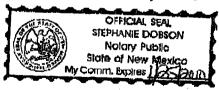
That the cost of publication is \$60.35 and that Payment Thereof has been made and will be assessed as court costs.

Cipile Hesmande

Subscribed and swom to before me this

My commission Expires on

**Notary Public** 



#### February 8, 2007

Southwestern Energy Production Company TAG N. Sam Hou House Eas form C cation for on to inje me New Mexic Conservation sion, seeking adm nistrative opproval lo

formation,

All interested parties opposing the afore mentioned must file objections of requests by contacting C. Howard at

Published by the Carlshad Current Ar gus, Carlsbad February 8, 2007

Legal Natice Number

January 26, 2007

### Affidavit of Publication

State of New Mexico, County of Eddy, ss.

April Hernandez, being first duly sworn, on oath says:

That she is HR/Administrative Assistant of the Carlsbad Current-Argus, a newspaper published daily at the City of Carlsbad, in said county of Eddy, state of New Mexico and of general paid circulation in said county; that the same is a duly qualified newspaper under the laws of the State wherein legal notices and advertisements may be published; that the printed notice attached hereto was published in the regular and entire edition of said newspaper and not in supplement thereof on the date as follows, to wit:

January 26

2007

That the cost of publication is \$59.69 and that Payment Thereof has been made and will be assessed as court costs.

CETULIS COMMUNICAÇÃO

·Subscribed and sworn to before me this

26 day of

2007

My commission Expires on

25/ 2010

**Notary Public** 

OFFICIAL SEAL
STEPHANIE DOBSON
Notary Public
State of New Mexico
My Comm. Expires 1.351

Southwestern Energy Production Company, 2350 N. Sam Houston Parkway East, Suite 125, Houston, Texas, 77032 has filled form: C-108 A polication for Authorization to Inject), with the New Mexico Oil Conservation well, son, seeking administrative approved by Administrative approved to a injection well. This application wesapproved by Administrative or Desember 23, 2006 Administrative or Desember 23, 2007 Administrative or Desember 23, 2007 Administrative or Desember 23, 2007 Administrative or Disposal permit. The proposed well, the pro

All interested parties opposing the afore mentioned must file polyacions of reguest for a hearing with the Oil Conservation D vision, 1220 South Francis Drive Saint Francis Drive Saint Francis Drive Saint Francis Drive Mex Co. 87505-5472 within 15 days. Additional information contacting Muritia Drive obtained by cortecting Muritia Chine 487

Published by the Corkbad Current A gus, Carlebad N.M. January 26, 2007.

Logal Notice Number