



DANIEL B. STEPHENS & ASSOCIATES, INC.

CONSULTANTS IN GROUND-WATER HYDROLOGY

SOCORRO, NEW MEXICO

UPDATE ON HYDROGEOLOGIC
CONDITIONS NEAR LAGUNA PLATA,
LEA COUNTY, NEW MEXICO,
FOR
PETRO - THERMO CORPORATION

SEPTEMBER 1986

BEFORE THE	
OIL CONSERVATION COMMISSION	
Socorro Co., New Mexico	
Case No. <u>8781</u>	Exhibit No. <u>3</u>
Submitted by <u>Petro Thermo</u>	
Hearing Date _____	



DANIEL B. STEPHENS & ASSOCIATES, INC.
CONSULTANTS IN GROUND-WATER HYDROLOGY

• GROUND-WATER CONTAMINATION • UNSATURATED ZONE INVESTIGATIONS • WATER SUPPLY DEVELOPMENT •

UPDATE ON HYDROGEOLOGIC
CONDITIONS NEAR LAGUNA PLATA, LEA COUNTY,
NEW MEXICO, FOR
PETRO-THERMO CORPORATION

PREPARED BY

DANIEL B. STEPHENS & ASSOCIATES, INC.
P. O. BOX 740
SOCORRO, N.M. 87801

SEPTEMBER 1986

TABLE OF CONTENTS

	Page
Figure 1. Structure Contour Map: Top of Triassic	1
Figure 2. Water Level Elevations	2
Figure 3. Map Showing Cross-Section Locations	3
Figure 4. Cross-Section B-B'	4
Figure 5. Cross-Section E-E'	5
Figure 6. Ground Water Flow Towards Clayton Basin	6

APPENDICES

Appendix 1. Well Log	8
Appendix 2. Water Chemistry of Springs & Seeps	10



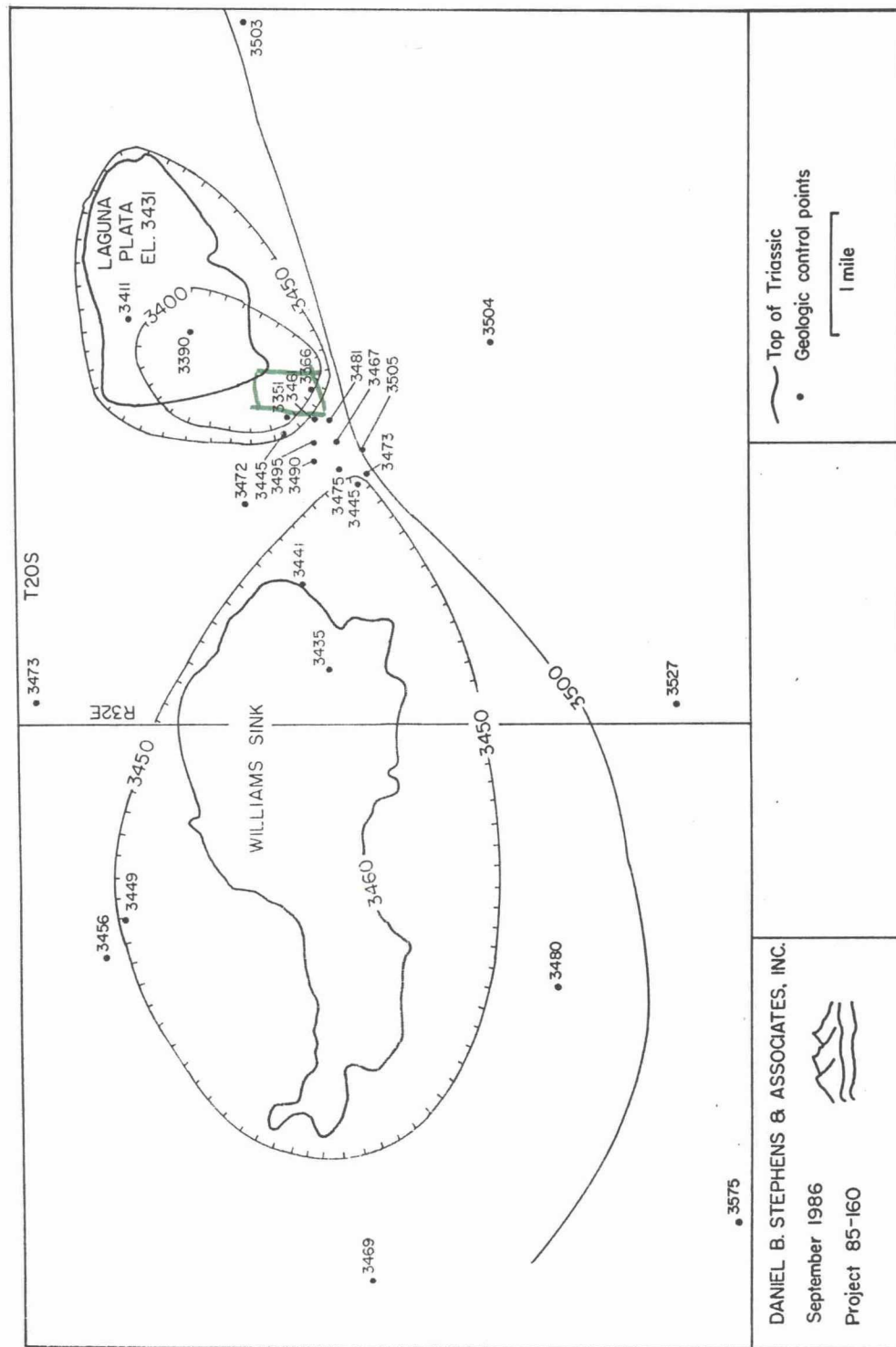


Figure 1. Structure Contour Map: Top of Triassic



DANIEL B. STEPHENS & ASSOCIATES, INC.

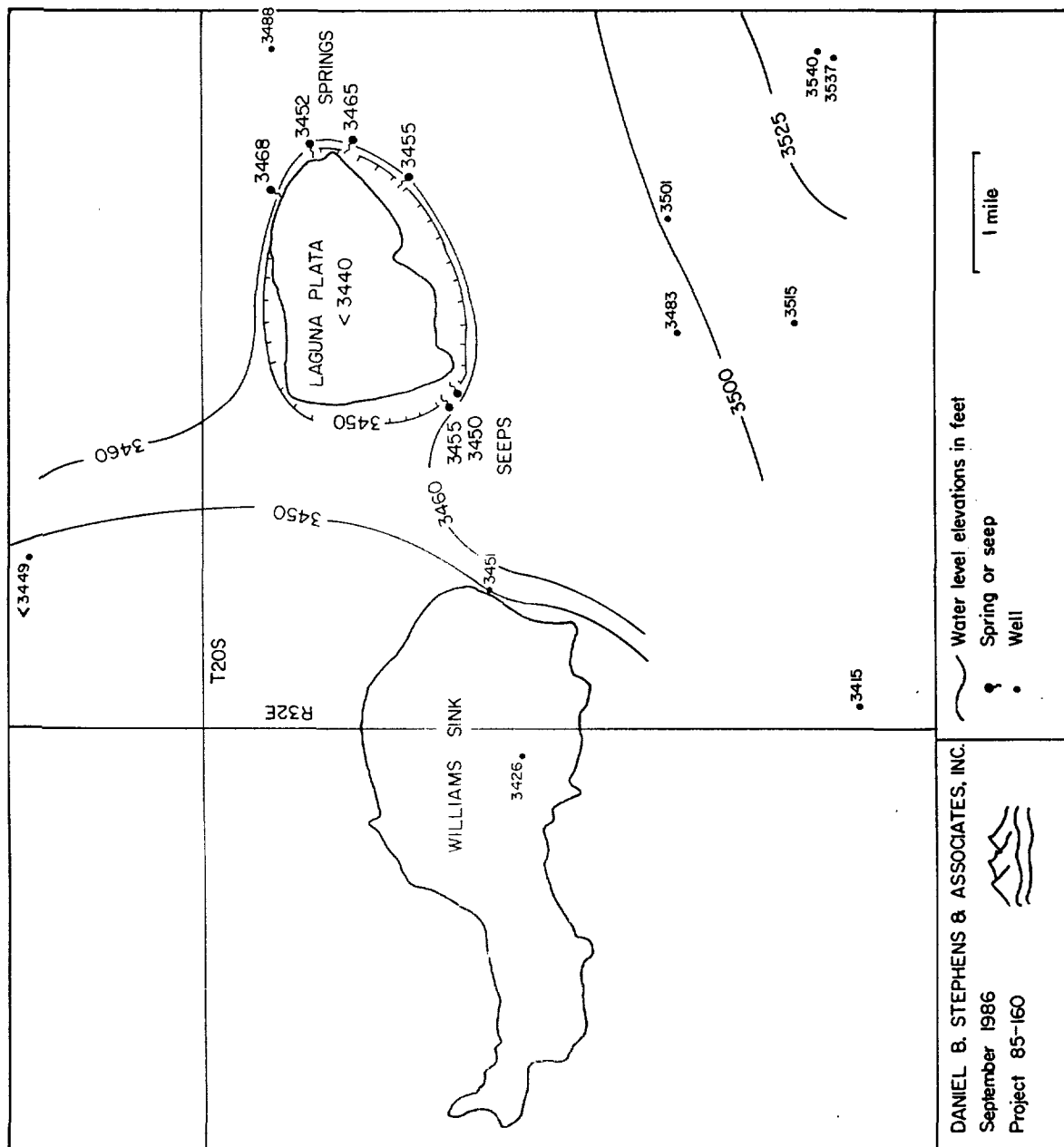


Figure 2. Water Level Elevations



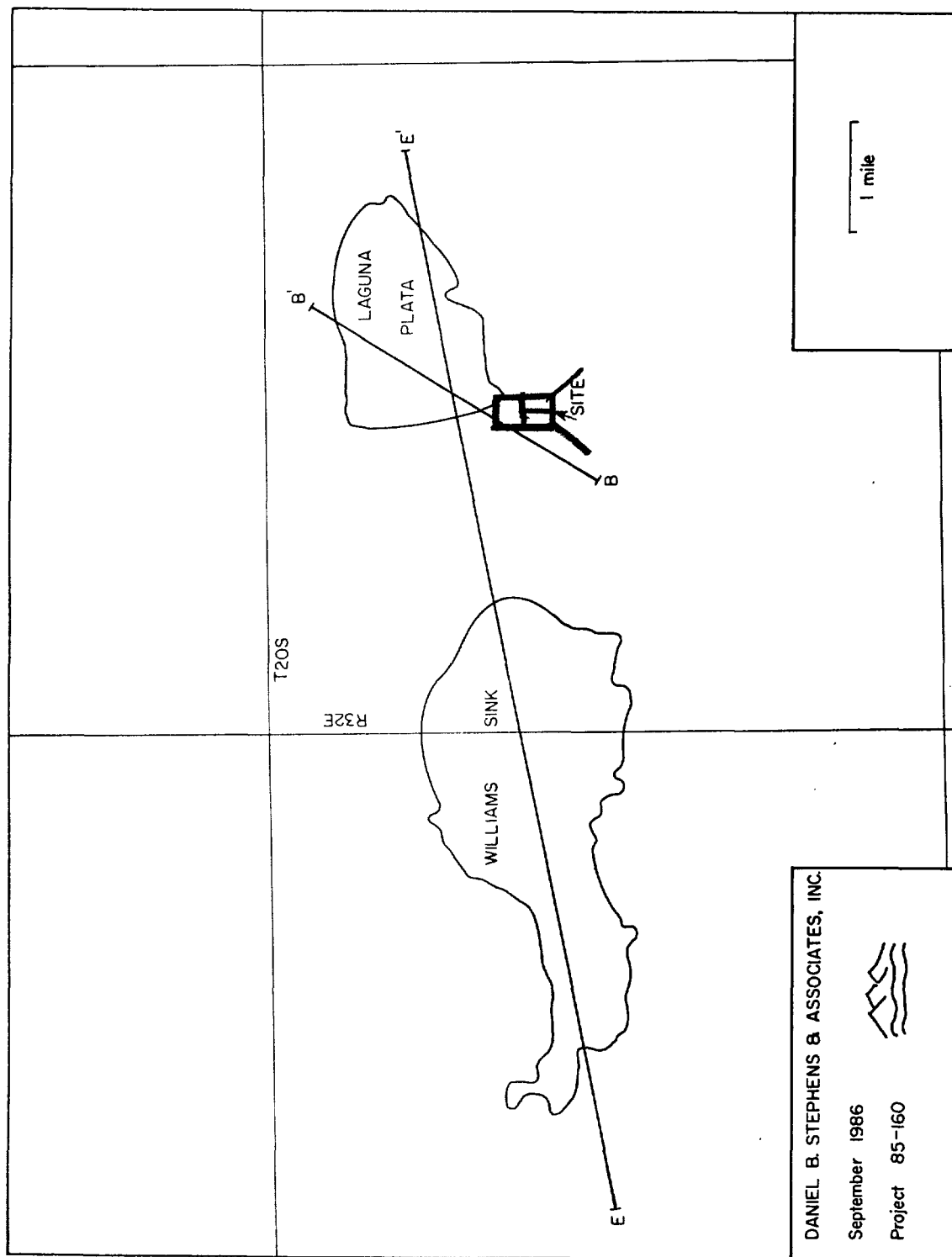


Figure 3. Map Showing Cross-Section Locations



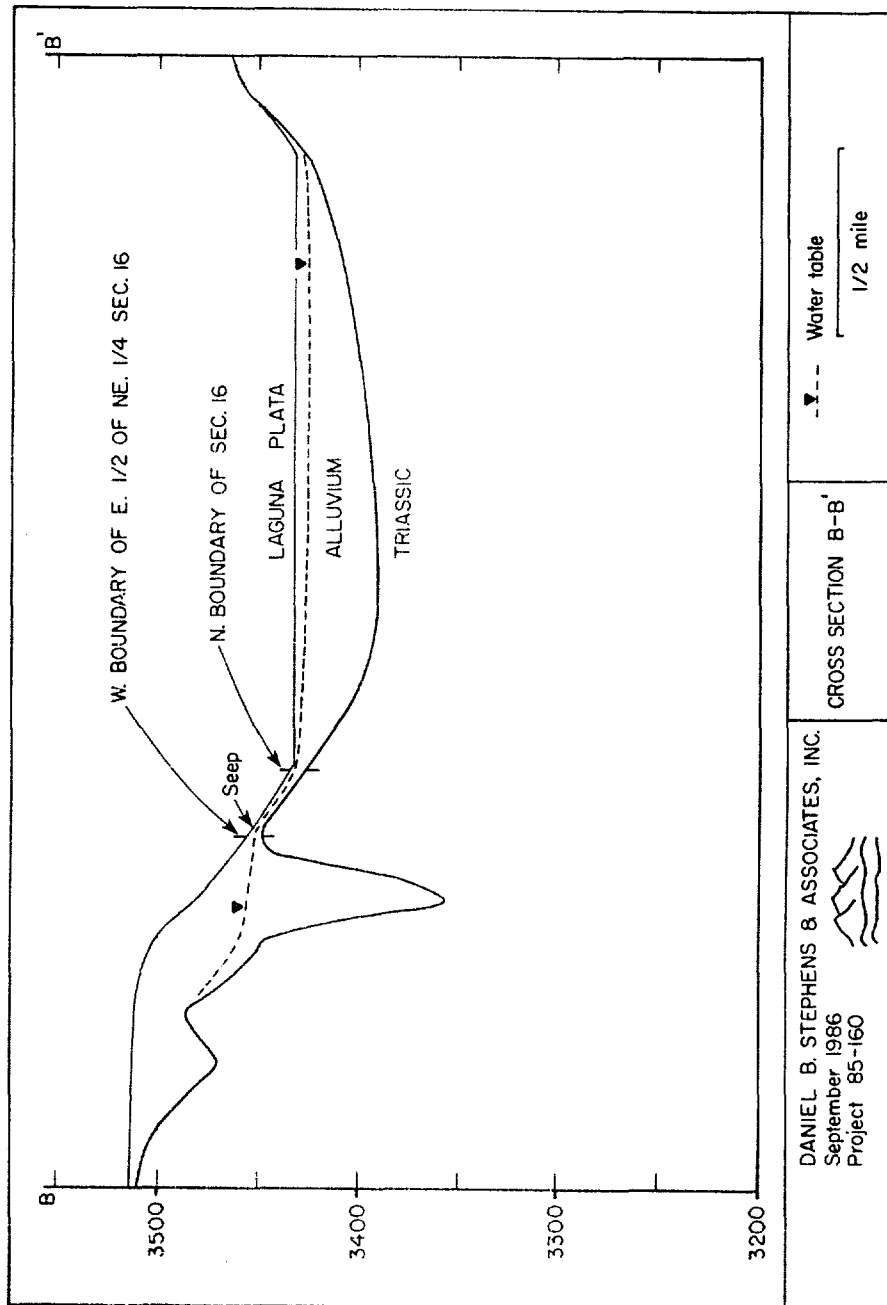


Figure 4. Cross-Section B-B'



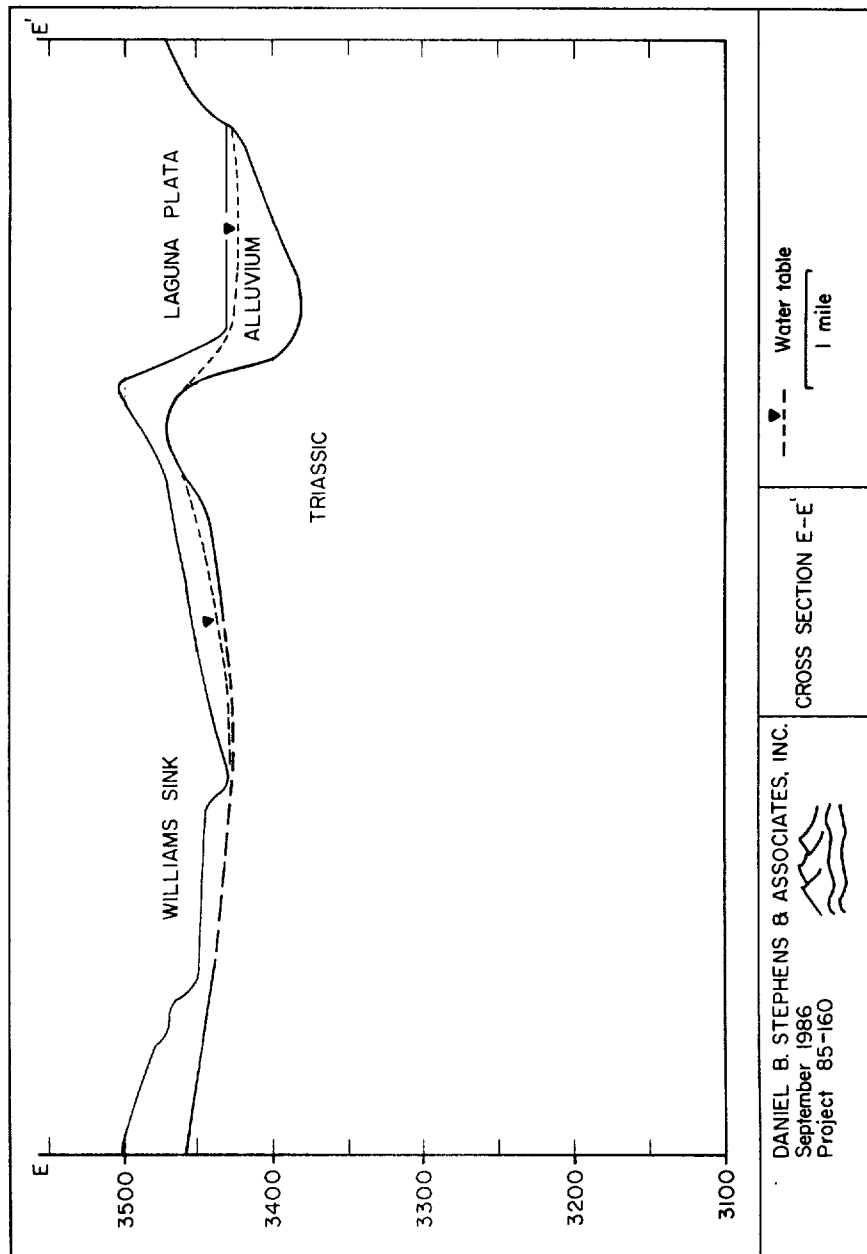


Figure 5. Cross-Section E-E'



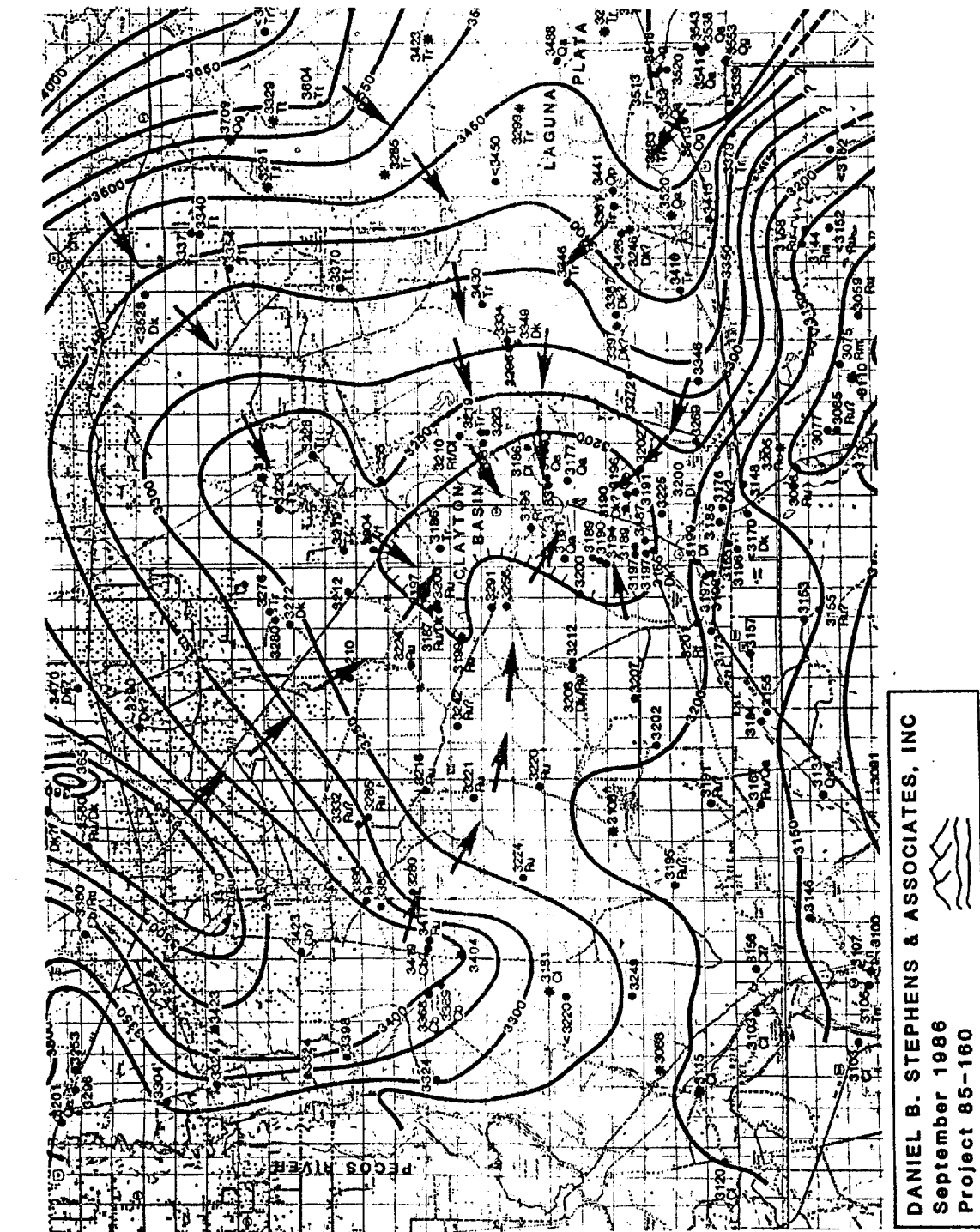


Figure 6. Ground Water Flow Towards Clayton Basin



APPENDIX 1 - WELL LOG



NEW MEXICO SCHOOL OF MINES
STATE BUREAU OF MINES AND MINERAL RESOURCES
SOCORRO, NEW MEXICO

WELL LOG DIVISION

COUNTY Eddy
FIELD Wildcat
COMPANY Culbertson & Irwin, Inc.
LEASE State L Well No. 1
LOCATION (1/4) SW/4
SEC. 2 T. 20S R. 31E
1650 feet from South line and
330 feet from West line of Section
COMMENCED 5-12-47
COMPLETED 6-12-47
ABANDONED
REMARKS:

CASING RECORD		ELEVATION	FEET
Diam., in	Bottom		
		3481	
INITIAL DAILY PRODUCTION:			
	Open		bbls. Oil
	Open		cu. ft. Gas
	Thg.		bbls. Oil
	Thg.		cu. ft. Gas

FORMATION	BOTTOM, FEET	FORMATION	BOTTOM, FEET
Sand	25	Lime and sand	2270
Sandy red shale	75	Lime	2315
Red sand & lime shells	105	Sand	2325
Sandy red shale	115	Lime	2365
Red sand & lime shells	135	Lime and sand	2385
Red sand, water @140-160	165	Lime	2420
Red Rock	280	Lime and sand	2440
Red sand	315	Lime	2450
Red sand & red shale	420	Lime and sand	2460
Red rock	550	Lime	2488
Red rock and gypsum	560	Porous lime 1/4 bailer water pr.hr. 2492 T.D. (S.L.M. 2492)	
Red rock	665		
Red sand & red shale	745		
Red rock	786		
Anhydrite	805		
Red sand & anhydrite	840		
Lime and anhydrite	875		
Anhydrite	925		
Lime	950		
Anhydrite	970		
Anhydrite & red sand	980		
Red sand	1035		
Salt and red sand	1070		
Salt	1175		
Anhydrite	1190		
Salt	1275		
Salt and anhydrite	1315		
Salt	1365		
Salt and Potash	1395		
Salt	1540		
Salt & Potash	1550		
Salt	1660		
Salt and Potash	1685		
Salt	1865		
Salt & potash	1900		
Salt	1925		
Anhydrite	1950		
Salt	2025		
Salt & anhydrite	2070		
Anhydrite	2105		
Lime	2160		
Lime and anhydrite	2210		
Brown lime	2220		

APPENDIX 2 - WATER CHEMISTRY



DANIEL B. STEPHENS & ASSOCIATES, INC.



700 Camino de Salud NE
Albuquerque, NM 87106 — (505) 841-2555

NN

GENERAL WATER CHEMISTRY
and NITROGEN ANALYSIS

DATE RECEIVED **2/10/86** LAB NO. **WC 567**

Collection DATE **6/10/84**

Collection TIME **1200**

Collected by — Person/Agency **Boyer/ACB**

USER CODE ☐ 59300 ☐ 59600 ☒ OTHER: **82235**

Sample location **Lacuna Plato**

Collection site description **E side of Salt Lake at salt mine**

Dipped from W side of level

ENVIRONMENTAL BUREAU
NM OIL CONSERVATION DIVISION
State Land Office Bldg, PO Box 2088
Santa Fe, NM 87501

Attn: David Boyer

Station/
well code

Owner

SAMPLING CONDITIONS

☒ Bailed	☐ Pump	Water level	Discharge	Sample type Gravel
☒ Dipped	☐ Tap			
(00400)		Conductivity (Uncorrected) μ mho	Water Temp. (00010) $^{\circ}$ C	Conductivity at 25 $^{\circ}$ C (00094) μ mho

Field comments **Salt Lake is near saturation - High in TDS**

SAMPLE FIELD TREATMENT — Check proper boxes

No. of samples submitted **1**

☒ NF: Whole sample (Non-filtered) ☐ F: Filtered in field with 0.45 μ m membrane filter ☐ A: 2 ml H₂SO₄/L added

☒ NA: No acid added ☐ Other-specify:

ANALYTICAL RESULTS from SAMPLES

NF, NA	Units	Date analyzed	F, NA	Units	Date analyzed
Conductivity (Corrected) 25 $^{\circ}$ C (00095)	μ mho		☒ Calcium (00915)	68.8 mg/l	2/10
			☒ Magnesium (00925)	821.8 mg/l	
			☒ Sodium (00930)	165600.0 mg/l	
Total non-filterable residue (suspended) (00530)	mg/l		☒ Potassium (00935)	40677.0 mg/l	
☐ Other:			☒ Bicarbonate (00440)	117.6 mg/l	2/18
☐ Other:			☒ Chloride (00940)	174263 mg/l	2/20
☐ Other:			☒ Sulfate (00945)	15989 mg/l	2/18
			☒ Total filterable residue (dissolved) (70300)	225,430 ma/l	3/13
			☐ Other:		

NF, A-H ₂ SO ₄	Units	Date analyzed	F, A-H ₂ SO ₄	Units	Date analyzed
☐ Nitrate-N +, Nitrate-N total (00630)	mg/l		☐ Nitrate-N +, Nitrate-N dissolved (00631)	mg/l	
☐ Ammonia-N total (00610)	mg/l		☐ Ammonia-N dissolved (00608)	mg/l	
☐ Total Kjeldahl-N ()	mg/l		☐ Total Kjeldahl-N ()	mg/l	
☐ Chemical oxygen demand (00340)	mg/l		☐ Other:		
☐ Total organic carbon ()	mg/l				
☐ Other:					
☐ Other:					

Analyst

Date Reported **3/26/86**

Reviewed by *[Signature]*

Laboratory remarks

DATE RECEIVED 2/10/86	LAB NO. WC 566	USER CODE ☐ 59300 ☐ 59600 ☒ OTHER: 82235
Collection DATE 2/6/86	SITE INFORMATION	Sample location South Seep
Collection TIME 11:10		Collection site description Sample from South Seep in NE 1/4 of NE 1/4 Sec 16 T20S, R35E in Grant Co
Collected by — Person/Agency BOYER/DB		

ENVIRONMENTAL BUREAU
NM OIL CONSERVATION DIVISION
State Land Office Bldg, PO Box 2088
Santa Fe, NM 87501

SEND FINAL REPORT TO
Attn: David Boyer

SAMPLING CONDITIONS

☐ Bailed	☐ Pump	Water level	D. discharge	Sample type Grab
☒ Dipped	☐ Tap			
pH (00400)	Conductivity (Uncorrected) μ mho	Water Temp. (00010) $^{\circ}$ C	Conductivity at 25 $^{\circ}$ C (00094) μ mho	
Field comments Water seep from small pond/puddle at base of eroded cut. Water seeping from then Sandstone layer				

SAMPLE FIELD TREATMENT — Check proper boxes

No. of samples submitted 1	☒ NF: Whole sample (Non-filtered)	☐ F: Filtered in field with 0.45 μ m membrane filter	☐ A: 2 ml H ₂ SO ₄ /L added
☒ NA: No acid added ☐ Other-specify:			

ANALYTICAL RESULTS from SAMPLES

NF, NA	Units	Date analyzed	F, NA	Units	Date analyzed
☐ Conductivity (Corrected) 25 $^{\circ}$ C (00095)	μ mho		☒ Calcium (00915)	776.0 mg/l	2/10
☐ Total non-filterable residue (suspended) (00530)	mg/l		☒ Magnesium (00925)	15.07 mg/l	
☐ Other:			☒ Sodium (00930)	1196.0 mg/l	
☐ Other:			☒ Potassium (00935)	206.7 mg/l	
☐ Other:			☒ Bicarbonate (00440)	423.8 mg/l	2/13
☐ Other:			☒ Chloride (00940)	1527.6 mg/l	2/10
			☒ Sulfate (00945)	1165.7 mg/l	2/18
			☒ Total filterable residue (dissolved) (70300)	3642.8 mg/l	3/13
			☐ Other:		
NF, A-H ₂ SO ₄			F, A-H ₂ SO ₄		
☐ Nitrate-N +, Nitrate-N total (00630)	mg/l		☐ Nitrate-N +, Nitrate-N dissolved (00631)	mg/l	
☐ Ammonia-N total (00610)	mg/l		☐ Ammonia-N dissolved (00608)	mg/l	
☐ Total Kjeldahl-N ()	mg/l		☐ Total Kjeldahl-N ()	mg/l	
☐ Chemical oxygen demand (00340)	mg/l		☐ Other:		
☐ Total organic carbon ()	mg/l				
☐ Other:			Analyst	Date Reported 3/24/86	Reviewed by Allen
☐ Other:			Laboratory remarks		

Lab Number: HM 1141
Date Submitted: 6/20/86
By: Earp

Sample Code: Laguna Plata Seep
Date Analyzed: 6/30/86
Reviewed By: Jim Ashby
Date Reported: 8/11/86

Element	ICAP VALUE (MG/L)	AA VALUE (MG/L)
Aluminum	<u>0.4</u>	<u> </u>
Barium	<u>0.2</u>	<u> </u>
Beryllium	<u><0.1</u>	<u> </u>
Boron	<u>2.1</u>	<u> </u>
Cadmium	<u><0.1</u>	<u> </u>
Calcium	<u>890.</u>	<u> </u>
Chromium	<u><0.1</u>	<u> </u>
Cobalt	<u><0.1</u>	<u> </u>
Copper	<u><0.1</u>	<u> </u>
Iron	<u>0.3</u>	<u> </u>
Lead	<u><0.1</u>	<u> </u>
Magnesium	<u>870.</u>	<u> </u>
Manganese	<u>0.31</u>	<u> </u>
Molybdenum	<u><0.1</u>	<u> </u>
Nickel	<u><0.1</u>	<u> </u>
Silicon	<u>4.5</u>	<u> </u>
Silver	<u><0.1</u>	<u> </u>
Strontium	<u>16.</u>	<u> </u>
Tin	<u><0.1</u>	<u> </u>
Vanadium	<u><0.1</u>	<u> </u>
Zinc	<u><0.1</u>	<u> </u>
Arsenic		<u>0.095</u>
Selenium		<u> </u>
Mercury		<u><0.0005</u>

DATE RECEIVED	2/17/86	LAB NO.	411-112	USER CODE	88800 2 8 0000	OTHER: 82235
Collection DATE	2/17/86	SITE INFORMATION		Sample Location	LAGUNA PLATA SEEP	
Collection TIME	1230			ON CONSERVATION DIVISION		
Collected by -- Person/Agency	ARILEY/SEAF/OCD			Collection site description	SANTA FE SPRING IN ARROYO ON	

ENVIRONMENTAL BUREAU
NM OIL CONSERVATION DIVISION
State Land Office Bldg, PO Box 2088
Santa Fe, NM 87504-2088

SEND
FINAL
REPORT
TO

Attn: David Boyer

Phone: 827-5812

SW CORNER OF
LAGUNA

Station/
well code
Owner

SAMPLING CONDITIONS

☐ Bailed	☐ Pump	Water level	Discharge	Sample type	GRAB
☒ Dipped	☐ Tap				
pH (00400)	Conductivity (Uncorrected)	Water Temp. (00010)	Conductivity at 25°C (00094)		
	50,700 μ mho	29 °C	μ mho		
Field comments					

SAMPLE FIELD TREATMENT -- Check proper boxes

No. of samples submitted	1	☒ NF: Whole sample (Non-filtered)	☐ F: Filtered in field with 0.45 μ m membrane filter	☐ A: 2 ml H ₂ SO ₄ /L added
☐ NA: No acid added		☐ Other-specify:		☐ A: 5ml conc. HNO ₃ added
				☒ A: 4ml fuming HNO ₃ added

ANALYTICAL RESULTS from SAMPLES

NF, NA	Units	Date analyzed	F, NA	Units	Date analyzed
☐ Conductivity (Corrected) 25°C (00095)	μ mho		☐ Calcium (00915)	mg/l	
☐ Total non-filterable residue (suspended) (00530)	mg/l		☐ Magnesium (00925)	mg/l	
☒ Other: 1000			☐ Sodium (00930)	mg/l	
☒ Other: AS			☐ Potassium (00935)	mg/l	
☒ Other: H ₂			☐ Bicarbonate (00440)	mg/l	
NF, A-H ₂ SO ₄			☐ Chloride (00940)	mg/l	
☐ Nitrate-N +, Nitrate-N total (00630)	mg/l		☐ Sulfate (00945)	mg/l	
☐ Ammonia-N total (00610)	mg/l		☐ Total filterable residue (dissolved) (70300)	mg/l	
☐ Total Kjeldahl-N ()	mg/l		☐ Other:		
☐ Chemical oxygen demand (00340)	mg/l		F, A-H ₂ SO ₄		
☐ Total organic carbon ()	mg/l		☐ Nitrate-N +, Nitrate-N dissolved (00631)	mg/l	
☐ Other:			☐ Ammonia-N dissolved (00608)	mg/l	
☐ Other:			☐ Total Kjeldahl-N ()	mg/l	
			☐ Other:		

Laboratory remarks: *Digested.*
Delayed due to matrix interference on AS.

FOR OCD USE -- Date Owner Notified _____ Phone or Letter? _____ Initials _____



New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106 — (505) 841-2555

GENERAL WATER CHEMISTRY
and NITROGEN ANALYSIS

DATE RECEIVED	LAB NO.	USER CODE	59300	59600	OTHER: 82235
Collection DATE 6/17/86	SITE INFORMATION	Sample location LAGUNA PLATA SEEP			
Collection TIME 1230		Collection site description SPRING IN ARROYO ON SW CORNER OF LAGUNA			
Collected by — Person/Agency BAILEY/SEAY 10CD					

SEND
FINAL
REPORT
TO

ENVIRONMENTAL BUREAU
NM OIL CONSERVATION DIVISION
State Land Office Bldg, PO Box 2088
Santa Fe, NM 87504-2088

Attn: David Boyer

Phone: 827-5812

SAMPLING CONDITIONS

☐ Bailed	☐ Pump	Water level	Discharge	Sample type GRAB
☒ Dipped	☐ Tap			
pH (00400)	Conductivity (Uncorrected) 50,000 μ mho	Water Temp. (00010) 29 °C	Conductivity at 25 °C (00094) μ mho	
Field comments UP ARROYO FR. PREVIOUSLY SAMPLED SEEP				

SAMPLE FIELD TREATMENT — Check proper boxes

No. of samples submitted 1	☒ NF: Whole sample (Non-filtered)	☐ F: Filtered in field with 0.45 μ membrane filter	☐ A: 2 ml H ₂ SO ₄ /L added
☒ NA: No acid added		☐ Other-specify:	☐ A: 5ml conc. HNO ₃ added ☐ A: 4ml fuming HNO ₃ added

ANALYTICAL RESULTS from SAMPLES

NF, NA	Units	Date analyzed	F, NA	Units	Date analyzed
☐ Conductivity (Corrected) 25 °C (00095)	μ mho		☒ Calcium (00915)	972.0 mg/l	6/28
☐ Total non-filterable residue (suspended) (00530)	mg/l		☒ Magnesium (00925)	96 mg/l	"
☐ Other:			☒ Sodium (00930)	3550 mg/l	"
☐ Other:			☒ Potassium (00935)	203 mg/l	"
☐ Other:			☒ Bicarbonate (00440)	115 mg/l	"
			☒ Chloride (00940)	25344 mg/l	7/11
			☒ Sulfate (00945)	239 mg/l	7/15
			☒ Total filterable residue (dissolved) (70300)	49,648 mg/l	6/30
NF, A-H ₂ SO ₄			☒ Other: CO ₃		
☐ Nitrate-N +, Nitrate-N total (00630)	mg/l		F, A-H ₂ SO ₄		
☐ Ammonia-N total (00610)	mg/l		☐ Nitrate-N +, Nitrate-N dissolved (00631)	mg/l	
☐ Total Kjeldahl-N ()	mg/l		☐ Ammonia-N dissolved (00608)	mg/l	
☐ Chemical oxygen demand (00340)	mg/l		☐ Total Kjeldahl-N ()	mg/l	
☐ Total organic carbon ()	mg/l		☐ Other:		
☐ Other:			Analyst	Date Reported	Reviewed by
☐ Other:				7/6/86	CS

Laboratory remarks

FOR OCD USE -- Date Owner Notified _____ Phone or Letter? _____ Initials _____