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REPORTS

DATE:

12/95

RITTER ENVIRONMENTAL & GEOTECHNICAL SERVICES
2900 N. Big Spring, Midland, Texas 79705
Bus: (915) 682-7404 • Metro: (915) 570-6007 • Fax: (915) 682-7440

FINAL CLOSURE REPORT

UNLINED SURFACE IMPOUNDMENT CLOSURE

PHILLIPS PETROLEUM COMPANY

SOUTH FOUR LAKES FIELD IMPOUNDMENT
SECTION 2
TOWNSHIP 12 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

RECEIVED
FEB 0 1 1996
Environmental Bureau
Oil Conservation Division

DECEMBER 1995

PREPARED BY:

RITTER ENVIRONMENTAL & GEOTECHNICAL SERVICES

SOUTH FOUR LAKES BATTERY
LOOKING NORTH

SOUTH FOUR LAKES BATTERY

I. INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

Ritter Environmental & Geotechnical Services (REGS) was contracted by Phillips Petroleum Company to properly address the closure of an unlined surface impoundment located on Phillips operated leases in Lea County, New Mexico. This impoundment was located in Section 2, Township 12 South, Range 34 East of the South Four Lakes Unit, currently operated by Phillips Petroleum Company.

It was the desire of Phillips Petroleum Company to achieve permanent closure of the subject impoundment while adhering to the published guidelines for impoundment closure put forth by the New Mexico Oil Conservation Division in February 1993. This report will document the events and the results of the remedial efforts achieved in the process of permanent closure of the above impoundment. The accompanying analytical documentation will provide substantiated evidence that the recommended levels of remediation put forth in the guidance document have been successfully achieved by Phillips Petroleum Company.

1.2 BACKGROUND

The impoundment has been in use by previous operators, possibly since the late 1950's. The impoundment was established and utilized by previous oil operators who owned and operated a gas processing plant at this location. The impoundment was discovered by Phillips Petroleum personnel subsequent to acquiring the field.

The impoundment's condition varied somewhat; however, it contained residual tars, asphaltines, waxes and aged crude oil primarily from what appeared to be excess crude and tank bottom residuals left in the impoundment when leases were abandoned by the previous operators. **The impoundment appeared not to have received any wastes**

other than produced crude oil and/or tank bottoms. No evidence of chemical dumping or other regulated wastes were found in the impoundment. All materials appeared to be RCRA exempt materials.

Preliminary bench tests were run on the material from the monitor well placed directly in the center of impoundment. These tests indicated the impoundment materials were well suited to the process of solidification as a means of site remediation. Phillips chose solidification as a means of permanently addressing the impoundment contents in lieu of disposal in landfills which only transfers the problem to another location.

1.3 HYDROGEOLOGY & SURFACE CONDITIONS

The South Four Lakes Unit is located on the Llano Estacado of the High Plains which is an isolated mesa covering a large part of eastern New Mexico and western Texas. The Llano Estacado, locally called the Caprock, is a depositional surface of low relief which slopes southeastward. It is comprised of a thick layer of resistant caliche (limestone). The High Plains surface is almost uniformly flat. Most rainfall runoff is trapped in shallow surface depressions, locally called "buffalo wallows", where evaporation and downward percolation occur.

The primary source of drinking water in the area is the Ogallala formation. The Ogallala ranges in thickness from 100 to 250 feet. Recharge of the aquifer is exclusively from precipitation and subsequent downward percolation, primarily from the buffalo wallows. Depth to water ranges from 25 to 50 feet in the general vicinity of the impoundment. The Ogallala is the sole source aquifer in the area. The nearest use of the groundwater in the area of the impoundment is that of a windmill located approximately one half mile east-northeast of the facility. Since groundwater gradient has been established to be southeast, this well should not be affected. The well is utilized for the watering of livestock.

Near surface geological site conditions varied somewhat over the site. Generally, a moderately dense but well consolidated sandy, caliche lime layer underlay most the location from a depth of ten to twenty foot. The moderately dense caliche was intermittently overlain by a hard dense layer of limestone. The location was overlain by a layer of soil made up of silty to sandy clay that ranged in depth from a few inches to four feet. Most of the clayey soil was medium to dark brown.

The surface vegetation primarily consists of native prairie grasses such as blue gramma, side oats gramma and black gramma. Occasional mesquite and cactus also are found.

The excavation of the soil and the impoundment contents was completed at a depth of approximately 23 feet from the surface. The grossly stained soil and pit contents were removed until visual clearance could be ascertained. The majority of the affected soils were removed for treatment by solidification. Due to the depth limitations of the excavation equipment, twenty three feet was the maximum depth the soils were removed. No significant amounts of visual staining were identified in the bottom of the excavation; however, any residual soil contaminants not herein addressed by the solidification process is to be addressed by Phillips in a groundwater remediation project.

1.4 TREATMENT METHODOLOGY

Solidification refers to a treatment system which is designed to improve the handling and physical characteristics of wastes, to decrease the surface area across which the transfer or loss of waste characteristics can occur and to limit the solubility of those waste characteristics. This process effectively limits the leachate process and prevents the material from entering the subsurface soils and groundwater. Solidification is achieved by the addition of proprietary mixtures of cementious pozzolan materials to the waste to form a monolithic block of "concrete" like material. Solidification occurs through a process that includes micro-encapsulation of the waste material. It was the desire of Phillips Petroleum

to achieve the recommended level of remediation by using an onsite process wherein Phillips would retain control of the waste after remediation through the solidification process.

II. SCOPE OF WORK

The scope of work for the South Four Lakes project included the necessary operations to address the remediation by solidification of an unlined surface impoundment and the oily wastes contained in the impoundment. Both olfactory and visual means were utilized to identify the limits of affected soils.

2.1 IMPOUNDMENT CLOSURE

The impoundment was located to the north of the tank battery of the South Four Lakes Unit. (See Site Plan Map in the Appendix of this report). The impoundment was an earthen containment and was essentially level with the ground surface. At the time of this closure, no berm was associated with the impoundment. (Please refer to the photographic documentation found in the appendix of this report). The surface dimensions of the impoundment were approximately 60 feet by 50 feet. Impoundment contents included weathered heavy asphaltines, tars, waxes and weathered crude oil. Several years of weathering had obscured portions of the impoundment by covering with air borne sand and soil. It appeared a previous operator had attempted closure of the impoundment by covering with native soils and rock. The only visual evidence of the location of the impoundment was that of the disturbed bedrock lying on the surface.

The remedial operations began on November 27, 1995. The initial operations consisted of the placement of one trench running in a north/south orientation. This trench was utilized to provide the mixing cell for the blending of the solidification materials with the contents of the impoundment. Two additional trenches were located to the north of the

impoundment. These trenches were located in an east/west parallel alignment. All trenches were excavated to a depth of 10 to 12 feet from the ground surface.

Reagent chemical was placed into the cells prior to mixing with the impoundment contents and the affected soils. The sludge materials and the affected soils were physically mixed with fresh water and the solidification reagent to accomplish the reaction in which the solidification process occurs.

Each cell was sampled to assure thorough mixing had taken place. Proper sampling techniques and protocol were utilized in the acquisition, handling and transport of all samples. Representative samples were submitted for analyses to determine the degree of effectiveness of the process. Analytical results are presented in the appendix of this report.

3.0 FINAL CLOSURE AND COVER

The solidified impoundment and treatment cells were allowed two to three weeks time to cure prior to covering. Each treatment cell was constructed such that a two to three foot freeboard was allowed for the placement of top soil over the cell area. Clean topsoil from the excavated cells was used to cover the excavated impoundment. A two to three foot layer of top soil was placed over the top of the closed impoundment and solidified cells. The topsoil was contoured to match the surrounding terrain with a gentle slope away from the center of the treatment area to prevent ponding and accumulation of rainwater over the treatment area.

III. ANALYTICAL

Analyses of the solidified masses were conducted to determine the effectiveness of the treatment. Each impoundment was sampled immediately after treatment. Samples were

taken such as to represent a general cross section of that particular impoundment's representative levels of constituents to be analyzed. Sample protocol adhered to U S EPA recommended methodology. Samples were collected by a clean stainless steel sampling device and were placed in laboratory cleaned glass sample container and sealed with a lid containing a Teflon lined septum. After collection, each sample was placed on ice and chilled to approximately 4°C until delivered to the lab for analyses. Proper chain of custody documentation is provided in the appendix of this report. Lab QA/QC data is provided along with the formal signed lab reports in the appendix. The core samples were analyzed by EPA approved methodologies according to SW 846 published methods. The samples were analyzed for Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethyl Benzene and Xylene (BTEX). The analytical results were as follows:

TCLP ANALYSES						
Sample Number & Location	TPH mg/kg	BTEX mg/l	Benzene mg/l	Toluene mg/l	Ethyl Benzene mg/l	Xylene mg/l
112895-1 Cell #1	1.3	0.131	<0.004	0.013	0.006	0.112
112895-2 Cell #1	1.1	0.201	<0.004	0.019	0.011	0.171
113095-3 Cell#2	1.6	0.289	<0.004	0.020	0.024	0.245
113095-4 Cell #2	1.2	0.330	<0.004	0.034	0.026	0.270
12195-5 Cell #3	1.0	0.437	<0.004	0.033	0.033	0.404
12195-6 Cell #3	1.3	0.682	<0.004	0.056	0.043	0.583

IV. CONCLUSIONS

Evaluation of the above analytical results verifies that remediation of the impoundment found in the South Four Lakes field of Lea County, New Mexico has been successfully completed. Review of the data supports the use of solidification as an environmentally safe and sound technology to control and remediate the sludges and affected soils found

in the impoundment. The encapsulation/solidification process effectively limits the leachability of the hydrocarbons previously left in the impoundment and allows the land surface to return to a productive state. Locking up the hydrocarbons by solidification prevents downward migration and the potential adverse effects on the groundwater supply in the vicinity of the impoundment, allows the surface to blend in with natural surroundings and allows for grazing of livestock to reestablish itself without fear of animal mortality or endangerment.

The surface impoundment has been properly addressed in accordance with the NMOCD published guidelines for "Unlined Surface Impoundment Closure" dated February 1993. Clearance sampling for the excavation was not conducted. It is anticipated that some residual affected soils remain at the site. Phillips has chosen to address the remediation of these soils with a groundwater remediation project to be conducted at a future date.

RITTER ENVIRONMENTAL & GEOTECHNICAL SERVICES

Mitchell R. Ritter, Managing Partner

1-1. Constructions of Cells Battery

1-2. Location of Unlined Surface Impoundment

1-3. Removal of Contents of Impoundment

2-1. Pumping Reagent into Cell

2-2. Pumping Reagent

2-3. Placement of Contents of Impoundment in Cells

3-1. Premixing

3-2. Excavation of Soils From Impoundment

3-3. Affected Soils

Prepared by:
Ritter Environmental & Geotechnical Services
Midland, Texas

4-1. Location of Impoundment

4-2. Cell #2 on Right (South Cell)
Cell #3 on Left (North Cell)

4-3. Mixing in Cell #3

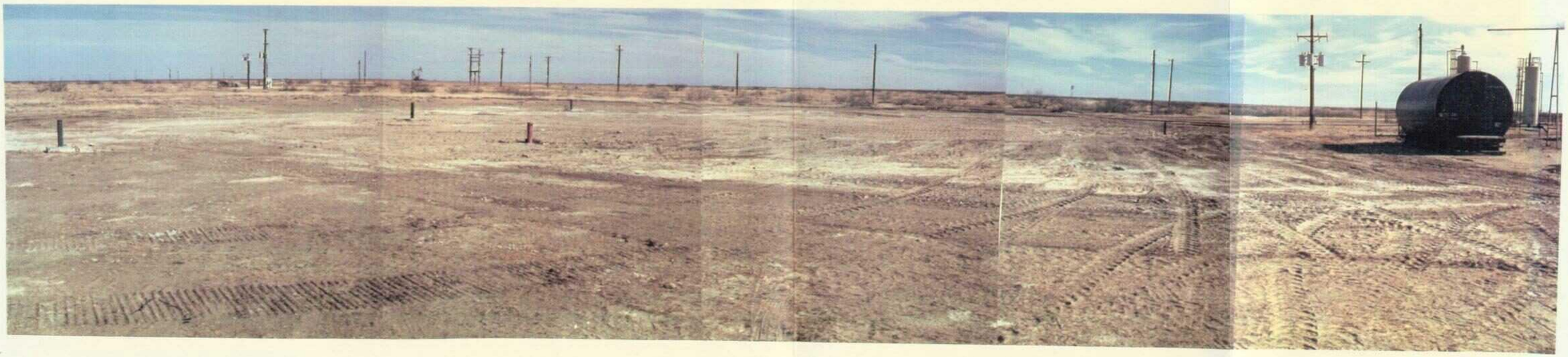
5-1. Excavation South Wall

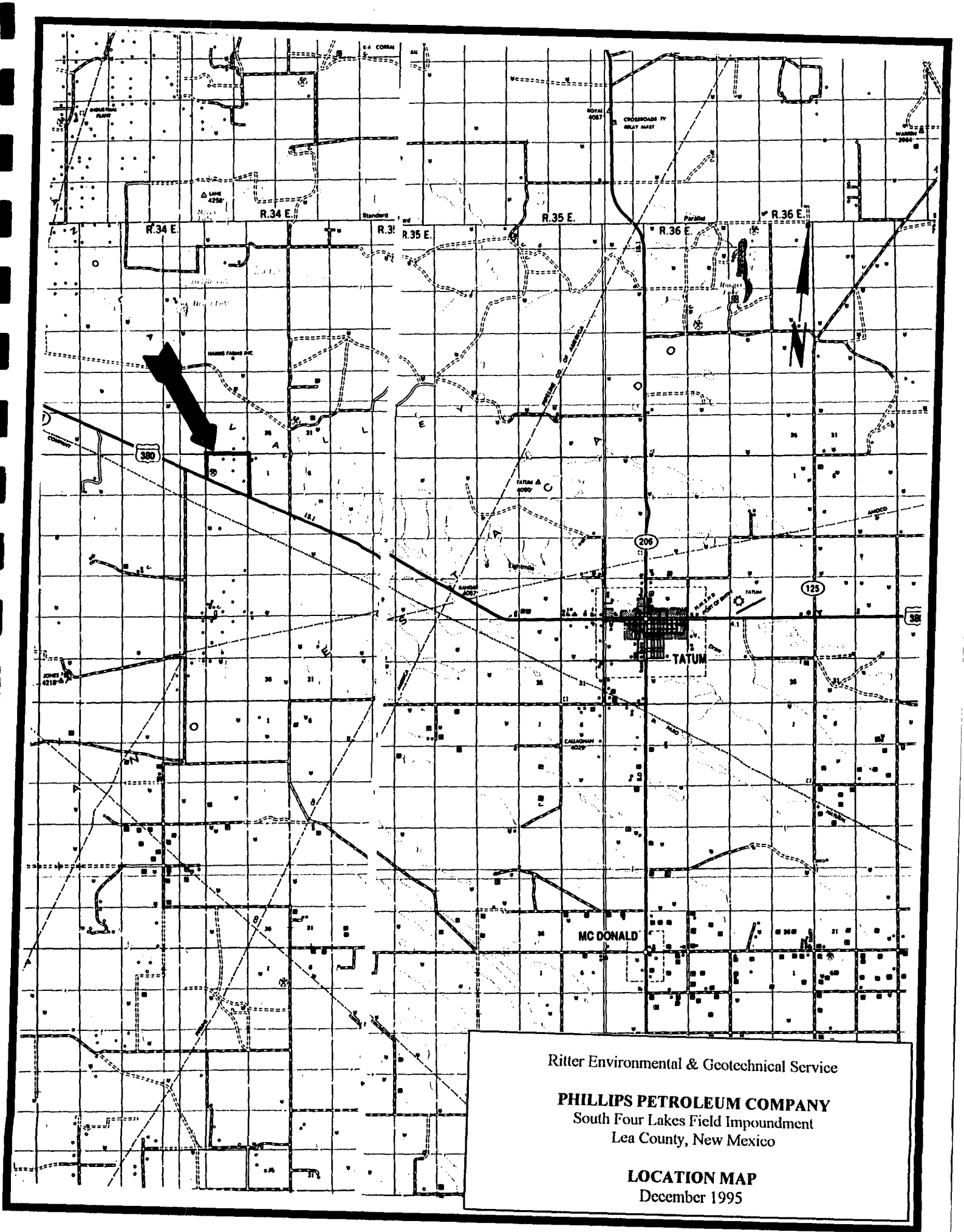
5-2. Excavation West Wall

5-3. Excavation North Wall

6-1. Final Closure Looking West

Prepared by:
Ritter Environmental & Geotechnical Services
Midland, Texas





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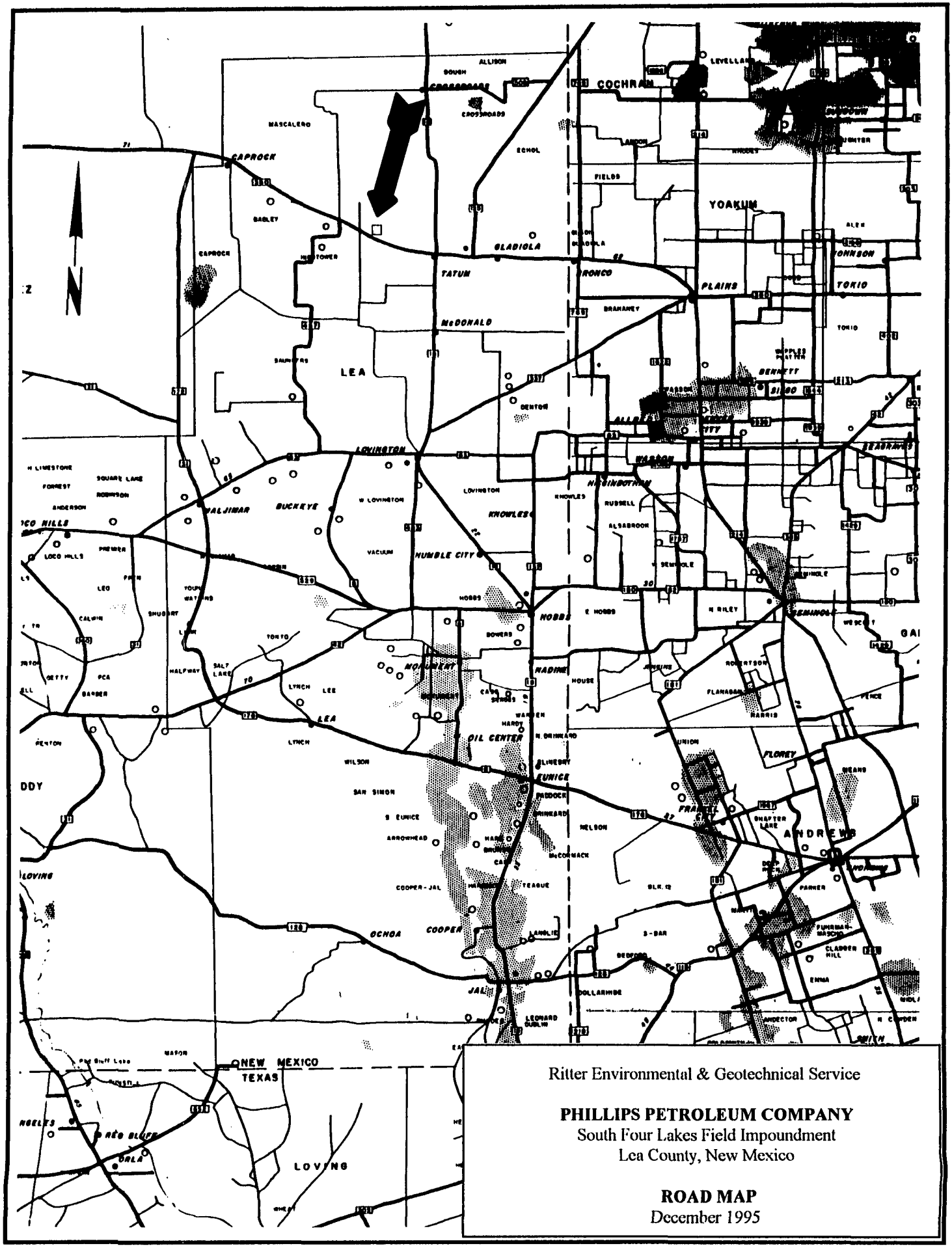
PHILLIPS PETROLEUM COMPANY
South Four Lakes Field Impoundment
Lea County, New Mexico

LOCATION MAP
December 1995



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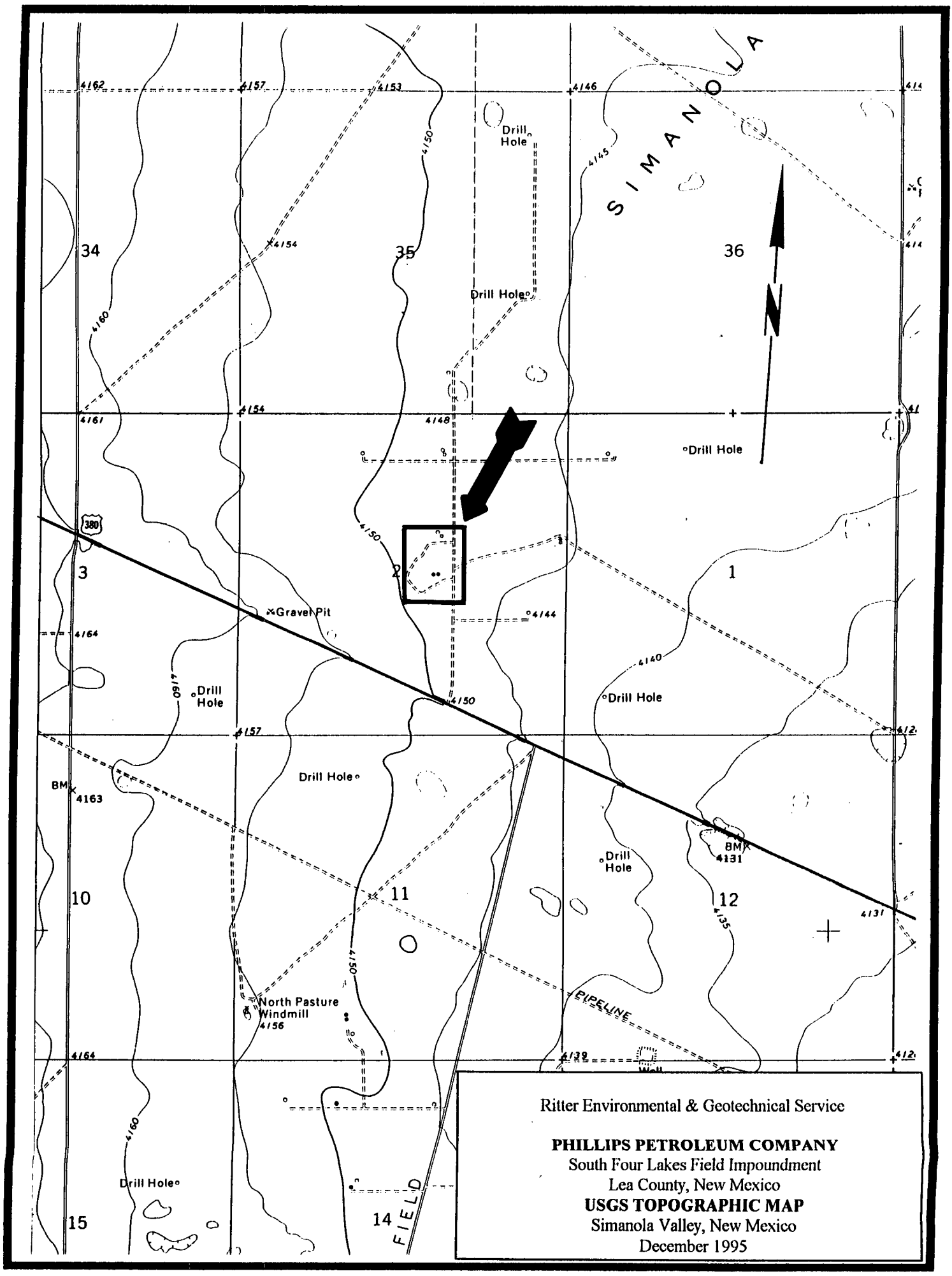
PHILLIPS PETROLEUM COMPANY

South Four Lakes Field Impoundment

Lea County, New Mexico

ROAD MAP

December 1995


SIMANOLA
Drill Hole
Drill Hole
Drill Hole
Gravel Pit
Drill Hole
Drill Hole
Drill Hole
Drill Hole
BM 4163
BM 4131
North Pasture Windmill 4156
PIPELINE
FIELD
34
35
36
3
2
1
10
11
12
15
14
380
4162
4157
4153
4146
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4139
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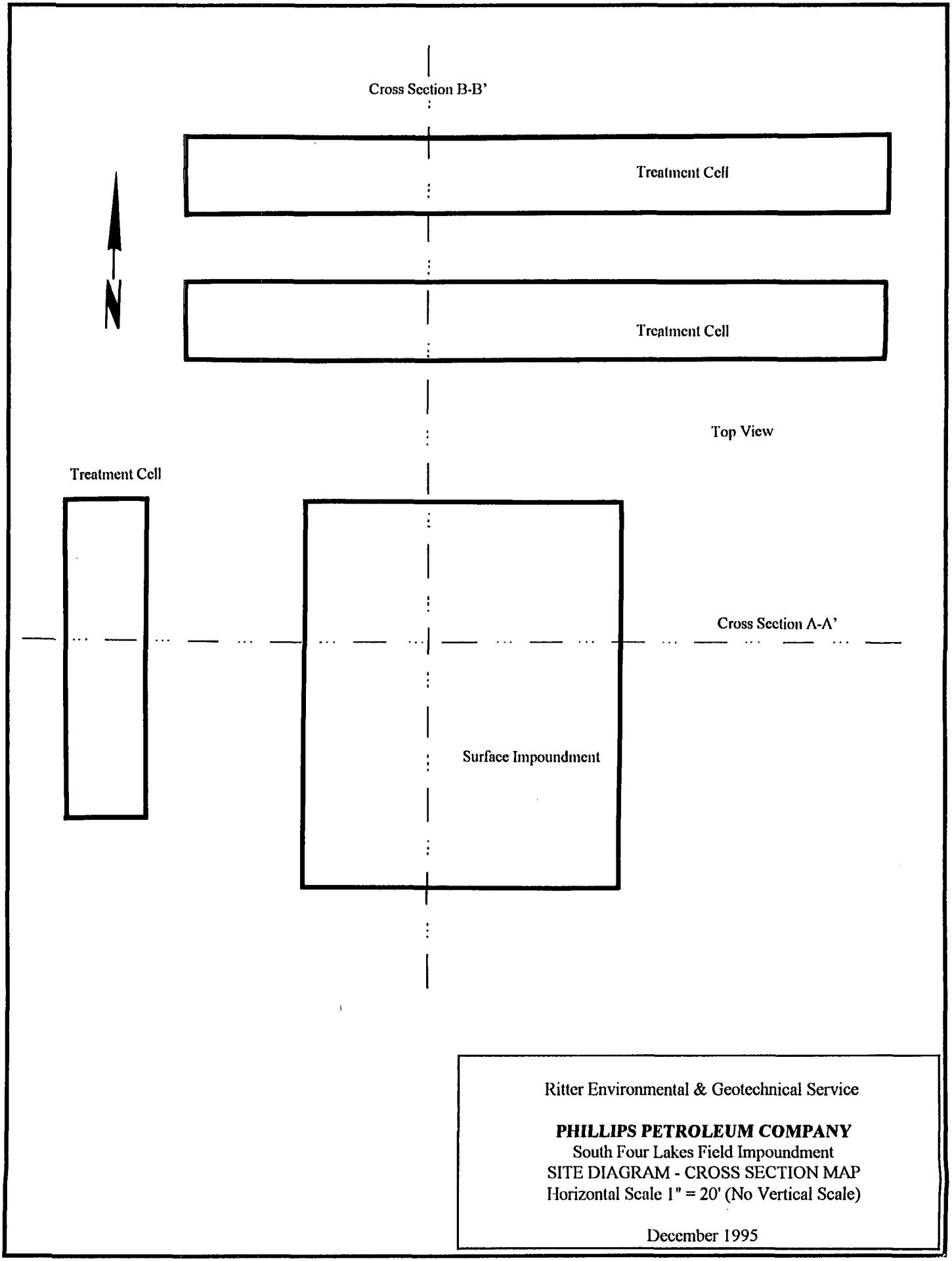
PHILLIPS PETROLEUM COMPANY
South Four Lakes Field Impoundment
Lea County, New Mexico
USGS TOPOGRAPHIC MAP
Simanola Valley, New Mexico
December 1995



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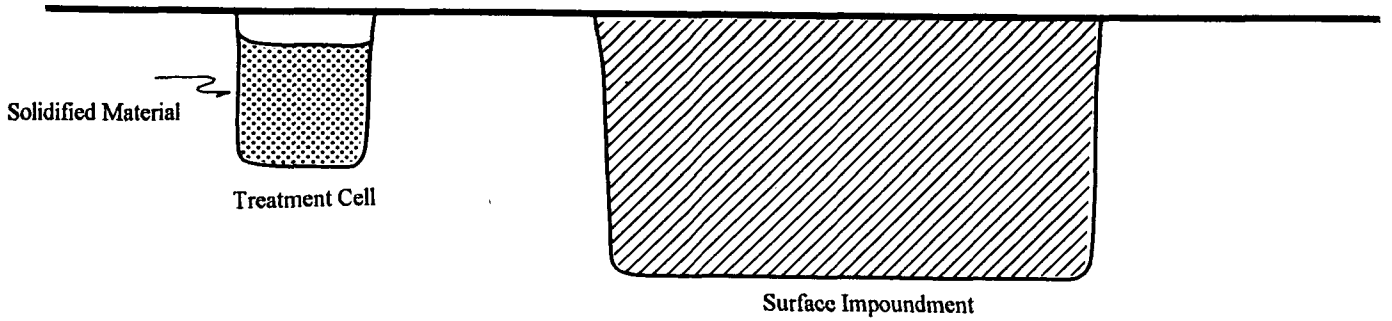
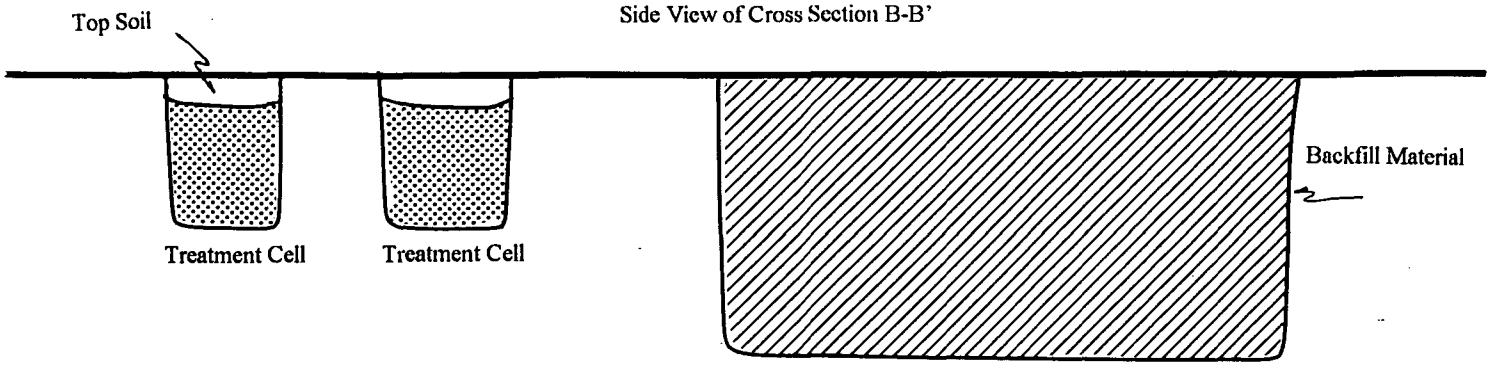
PHILLIPS PETROLEUM COMPANY
South Four Lakes Field Impoundment
SITE DIAGRAM - CROSS SECTION MAP
Horizontal Scale 1" = 20' (No Vertical Scale)

December 1995

Side View of Cross Section A-A'



Side View of Cross Section B-B'



Ritter Environmental & Geotechnical Service

PHILLIPS PETROLEUM COMPANY
South Four Lakes Field Impoundment
SITE DIAGRAM - CROSS SECTION MAP
Horizontal Scale 1" = 20' (No Vertical Scale)

December 1995

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November 13, 1995

Certified Return Receipt

Mr. William C. Olsen
Environmental Bureau
New Mexico Oil Conservation Division
Energy, Minerals and Natural Resources Department
2040 S. Pacheco St.
Santa Fe, New Mexico 87505

Re: Phillips Petroleum Company - South Four Lakes Remediation Project-
Section 2, T-12-S, R-34-E, Lea County, New Mexico

Dear Mr. Olsen:

This letter will serve as notification to the NMOCD of the implementation of the Remedial Action Plan and Unlined Surface Impoundment Closure of the South Four Lakes project. The remediation project will follow the previously filed plan which was submitted to the NMOCD in July of 1995.

We anticipate start of this project on the 27th of November 1995. The project will run approximately one to two weeks in duration, weather permitting. The NMOCD is welcome to visit the project and witness any phase that may take place.

Thank you for your time and assistance on this project.

Sincerely,

Mitchell Ritter

cc: Jerry Sexton - NMOCD - Hobbs

Sam Christie - Phillips Petroleum - Odessa

SOULSTAR.LTR

MAXIM
TECHNOLOGIES INC

1703 West Industrial P.O. Box 2150 * Midland, Texas 79701 * 915/683-3349 FAX 915/686-0492

Client Mitch Ritter
REGS
2900 N. Big Spring
Midland, TX 79705

Client No. 6750100
Report No. M5-12-030
Report Date 12/12/95 16:35

Project Phillips - South Four Lakes

Phone: 915-682-7404 Fax: 915-682-7440

Date Sampled 11/28/95 12/01/95

Sampled By Client

Sample Type Solids

Transported by Mitch Ritter

P.O. # _____

Date Received 12/08/95

Lab No.	Sample Identification
M5-12-030-01	112895-1, Cell #1, South
M5-12-030-02	112895-2, Cell #1, North
M5-12-030-03	113095-3, Cell #2, West
M5-12-030-04	113095-4, Cell #2, East
M5-12-030-05	12195-5, Cell #3, West
M5-12-030-06	12195-6, Cell #3, East

Reviewed By

MAXIM

ALLAN B. JOHNSTON

TEST RESULTS BY SAMPLE

Sample: 01A 112895-1, Cell #1, South Collected: 11/28/95 Category: S

Test Name	Method	Result	Units	Detection Limit	Date Started	Analyst
TCLP PREPARATION - SOLIDS	SW-846, 1311	12/10/95	DATE		12/10/95	WCR
TCLP TPH	EPA 418.1	1.3	mg/L	0.50	12/11/95	SLS

Sample: 02A 112895-2, Cell #1, North Collected: 11/28/95 Category: S

Test Name	Method	Result	Units	Detection Limit	Date Started	Analyst
TCLP PREPARATION - SOLIDS	SW-846, 1311	12/10/95	DATE		12/10/95	WCR
TCLP TPH	EPA 418.1	1.1	mg/L	0.50	12/11/95	SLS

Sample: 03A 113095-3, Cell #2, West Collected: 11/30/95 Category: S

Test Name	Method	Result	Units	Detection Limit	Date Started	Analyst
TCLP PREPARATION - SOLIDS	SW-846, 1311	12/10/95	DATE		12/10/95	WCR
TCLP TPH	EPA 418.1	1.6	mg/L	0.50	12/11/95	SLS

Sample: 04A 113095-4, Cell #2, East Collected: 11/30/95 Category: S

Test Name	Method	Result	Units	Detection Limit	Date Started	Analyst
TCLP PREPARATION - SOLIDS	SW-846, 1311	12/10/95	DATE		12/10/95	WCR
TCLP TPH	EPA 418.1	1.2	mg/L	0.50	12/15/95	SLS

Sample: 05A 12195-5, Cell #3, West Collected: 11/30/95 Category: S

Test Name	Method	Result	Units	Detection Limit	Date Started	Analyst
TCLP PREPARATION - SOLIDS	SW-846, 1311	12/10/95	DATE		12/10/95	WCR
TCLP TPH	EPA 418.1	1.0	mg/L	0.50	12/11/95	SLS

TEST RESULTS BY SAMPLE

Sample: 06A 12195-6, Cell #3, East Collected: 12/01/95 Category: S

Test Name	Method	Result	Units	Detection Limit	Date Started	Analyst
TCLP PREPARATION - SOLIDS	SW-846, 1311	12/10/95	DATE		12/10/95	WCR
TCLP TPH	EPA 418.1	1.3	mg/L	0.50	12/11/95	SLS

TEST RESULTS BY SAMPLE

Sample Description: 112895-1, Cell #1, South Lab No: 01A
Test Description: TCLP BTEX Method: SW-846, 8020 Test Code: BTX_TC
Collected: 11/28/95 Category: S

Date Started	12/11/95	Analyst	ABJ
Detection Limit	0.004	Units	mg/L
Method	SW-846, 8020		

Compound	Results
BENZENE	< 0.004
TOLUENE	0.013
ETHYLBENZENE	0.006
XYLENE	0.112

TEST RESULTS BY SAMPLE

Sample Description: 112895-2, Cell #1, North Lab No: 02A
Test Description: TCLP BTEX Method: SW-846, 8020 Test Code: BTX_TC
Collected: 11/28/95 Category: S

Date Started	12/11/95	Analyst	ABJ
Detection Limit	0.004	Units	mg/L
Method	SW-846, 8020		

Compound	Results
BENZENE	< 0.004
TOLUENE	0.019
ETHYLBENZENE	0.011
XYLENE	0.171

TEST RESULTS BY SAMPLE

Sample Description: 113095-3, Cell #2, West Lab No: 03A
Test Description: TCLP BTEX Method: SW-846, 8020 Test Code: BTX_TC
Collected: 11/30/95 Category: S

Date Started	12/11/95	Analyst	ABJ
Detection Limit	0.004	Units	mg/L
Method	SW-846, 8020		

Compound	Results
BENZENE	< 0.004
TOLUENE	0.020
ETHYLBENZENE	0.024
XYLENE	0.245

TEST RESULTS BY SAMPLE

Sample Description: 113095-4, Cell #2, East Lab No: 04A
Test Description: TCLP BTEX Method: SW-846, 8020 Test Code: BTX_TC
Collected: 11/30/95 Category: S

Date Started	12/11/95	Analyst	ABJ
Detection Limit	0.004	Units	mg/L
Method	SW-846, 8020		

Compound	Results
BENZENE	< 0.004
TOLUENE	0.034
ETHYLBENZENE	0.026
XYLENE	0.270

TEST RESULTS BY SAMPLE

Sample Description: 12195-5, Cell #3, West Lab No: 05A
Test Description: TCLP BTEX Method: SW-846, 8020 Test Code: BTX_TC
Collected: 11/30/95 Category: S

Date Started	12/11/95	Analyst	ABJ
Detection Limit	0.004	Units	mg/L
Method	SW-846, 8020		

Compound	Results
BENZENE	< 0.004
TOLUENE	0.033
ETHYLBENZENE	0.033
XYLENE	0.404

TEST RESULTS BY SAMPLE

Sample Description: 12195-6, Cell #3, East Lab No: 06A
Test Description: TCLP BTEX Method: SW-846, 8020 Test Code: BTX_TC
Collected: 12/01/95 Category: S

Date Started	12/11/95	Analyst	ABJ
Detection Limit	0.004	Units	mg/L
Method	SW-846, 8020		

Compound	Results
BENZENE	< 0.004
TOLUENE	0.056
ETHYLBENZENE	0.043
XYLENE	0.583

CHAIN OF CUSTODY

PAGE 1 OF 1

ITTER ENVIRONMENTAL & GEOTECHNICAL SERVICES
2900 N. Big Spring, Midland, Texas 79705
Bus: (915) 682-7404 • Metro: (915) 570-6007 • Fax: (915) 682-7440

REPORT TO	INVOICE TO
COMPANY: RITTER ENVIRONMENTAL	COMPANY: RITTER ENVIRONMENTAL
ADDRESS: 2900 N. Big Spring	ADDRESS:
CITY/STATE/ZIP: Midland, TX 79705	CITY/STATE/ZIP:
ATTENTION: MITCH PHONE #:	ATTENTION: PHONE #:

PROJECT/SITE NAME:	REMARKS:	TURN AROUND TIME
PHILLIPS / SOUTH FOUR LAKES		☐NORMAL ☑RUSH ☐OTHER
SOLIDIFICATION		

DATE	TIME	COMP.	GRAB	SAMPLE #	SAMPLE DESCRIPTION	MATRIX	# CONT	REQUESTED ANALYSIS: TCLP TPH	REQUESTED ANALYSIS: TCLP BTEX					REMARKS
11/28/95		✓		112895-1	CELL #1 SOUTH END	SOIL	1	✓	✓					Cooled to 4°C - Good Cond.
11/28/95		✓		112895-2	CELL #1 NORTH END	SOIL	1	✓	✓					" "
11/30/95		✓		113095-3	CELL #2 WEST END	SOIL	1	✓	✓					" "
11/30/95		✓		113095-4	CELL #2 EAST END	SOIL	1	✓	✓					" "
12/1/95		✓		12195-5	CELL #3 WEST END	SOIL	1	✓	✓					" "
12/1/95		✓		12195-6	CELL #3 EAST END	SOIL	1	✓	✓					" "

RELINQUISHED BY: (SIGN)	DATE/TIME:	RECEIVED BY:	DATE/TIME:	SAMPLE CONDITION:	DATE/TIME:
Mitch Ritter	12/8/95	[signature]	12/08/95 09:25		