COOK-JOYCE INC.
ENGINEERING AND CONSULTING
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HYDROGEOLOGIC INVESTIGATION

SECTION 32; TOWNSHIP 21 RANGE 38
Eunice, New Mexico

19 NOVEMBER 2003

Prepared for:

Lockwood Greene Engineering & Construction
1500 International Drive
Spartanburg, South Carolina 29304

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1.0 INTRODUCTION

In accordance with the Scope-of-Services outlined in a letter from Cook-Joyce, Inc. (CJI) dated 19 August 2003, CJI was contracted by Lockwood-Greene Engineering and Construction (LG) to conduct a hydrogeologic investigation of an undeveloped property in southeastern New Mexico. The hydrogeologic investigation was conducted on behalf of Louisiana Energy Services' efforts to license and operate a uranium enrichment facility at this site. The following sections detail CJI investigational activities at the site.

1.1 SITE DESCRIPTION

The approximate 560-acre site is located 2 miles east of Highway 18 in Eunice, Lea County, New Mexico, as shown on the Site Location Map (Figure 1). The property includes the portion of Section 32, Township 21, and Range 38 of the New Mexico State grid system that lies north of New Mexico State Highway 234, which runs east and west across the southern portion of Section 32. There are no permanent structures on-site. Currently the property is used for cattle grazing.

The site is characterized by sandy topsoil, sparse vegetation including mesquite trees, some rolling sand dunes, and about 30 feet of topographic relief from north to south. Although there are numerous operational oil wells within close proximity to the site, there are none on the subject property. There are three man-made features on-site. The first is a gravel road that trends north-south near the center of the site. The road is primarily used by haul trucks entering and exiting an adjacent surface mine facility that is located north of the site. The second man-made feature is a gravel pad approximately 200' x 300' that was constructed in early September during field activities. The third feature is an underground carbon dioxide gas pipeline that is operated by Trinity Pipeline and crosses the site from approximately the northwest corner to the southeast corner of the property.

1.2 ADJACENT PROPERTIES

There are several industrial developments within relatively close proximity to the site (see Figure 2). The site is bordered to the north by a railroad spur that operates between the town of

Eunice and Waste Control Specialists, LLC (WCS). WCS operates a permitted RCRA landfill and waste storage and processing facilities, and specializes in hazardous and low-level nuclear waste at their facility. The WCS facility, which is located just across the border in the State of Texas, is located within about one-half mile east/northeast of the eastern-most portion of the subject property. WCS also owns the adjacent undeveloped property to the east (Section 33), between Section 32 and the WCS facility.

The Lea County Municipal Landfill is located immediately south of State Highway 234 near the southeast corner of the subject property. With the exception of the Lea County Municipal Landfill and a few oil wells, adjacent property south of State Highway 234 is undeveloped. Although primarily undeveloped property borders the site to the west, there is a landfarm in operation within about one-half mile of the western boundary of the subject site. Though not thoroughly investigated as a part of this project, the D & D Landfarm appears to remediate soil from off-site sources that may have been affected by oil exploration processes.

There are two industrial facilities located about one-quarter mile north of the subject property. The two facilities are Wallach Gravel Quarry and Sundown. Wallach has operated a surface mining operation on their property since about the 1950's. Sundown operates an oil recovery/recycling facility which includes a sludge pond and an oil storage tank farm that is used to store oil and sludge recovered from oil exploration processes.

In addition to the active facilities located in the area of the site, an abandoned sand and gravel quarry is located to northeast of the site on WCS property and which is referred to on USGS maps as Baker Spring.

2.0 HYDROGEOLOGIC INVESTIGATION FIELD ACTIVITIES

On 25 August 2003, CJI personnel mobilized to the site to conduct field activities related to the hydrogeologic investigation. The field activities were conducted to collect data to identify and characterize the hydrogeologic conditions of the uppermost water-bearing zone beneath the site. The investigation consisted of the installation of nine borings to the top of the redbed to determine: a) the depth to the redbed, and b) if shallow groundwater is present in the overlying sand unit. Because groundwater was not located in the shallow sand unit, three additional monitor wells were installed into a silty sand unit in the redbeds at an approximate depth of 240 feet below ground level (bgl). These three monitor wells were gauged to evaluate if groundwater was present. Only one of the three wells produced groundwater. Groundwater samples were collected from this monitor well. Detailed field activities are described in Appendix B.

2.1 GENERAL GEOLOGIC CONDITIONS

Prior to initiation of the field investigation, the general hydrogeologic conditions were evaluated. The data reviewed were obtained from past investigations of the WCS property, the Lea County Landfill, and pedestrian surveys of the Wallach sand and gravel operation to the north. The area is underlain with approximately 25 to 50 feet of primarily unconsolidated sand with thin to medium lenses of gravel. Perched or localized pockets of groundwater in this unit were identified as being present to the north of the site in the Wallach mining excavation and to the east in some piezometers located on the WCS property.

The sand unit is underlain by the Triassic aged Dockum Group or redbeds. The redbed consist primarily of a clay mudstone that is interbedded with silt and sandstone zones. Laterally consistent silt and sandstone zones have been identified at depths of approximately 125 feet and 230 feet below ground level (bgl). In addition, a discontinuous silt zone at approximately 180 feet BGL has been identified in past investigations of the WCS property. Groundwater has not been identified in the 125-foot silty sandstone zone. Groundwater in the 180-foot zone is present at some locations but not continuously across the WCS property. Groundwater is present in a 230-foot zone across the entire portion of the WCS property that has been investigated.

2.2 SHALLOW SUBSURFACE INVESTIGATION

Prior to mobilizing to the site, nine proposed boring locations based on a 1,00-foot center grid pattern were overlain on an USGS-based site map (see Figure 3) and the associated coordinates for each of these boring locations was ascertained. On 25 August 2003, CJI personnel conducted a walking survey of the majority of the site while the predetermined boring locations were staked. Boring locations were located using a hand-held GPS unit. With the exception of B-1, each boring location was staked as close to the predetermined coordinates as possible. Due to the presence of sand dunes, it was necessary to field-locate B-1 about 75' northwest of its mapped location.

Nine borings, B-1 through B-9, were installed and geologically logged to the geological contact of the "redbeds". The borings were drilled using solid and hollow stem augers and the borings were geologically logged from the cuttings. The boring logs are presented in Appendix A. The borings ranged in depth from 35 feet to 60 feet. The depth and elevation of the redbed in each of the borings is shown in Table 1. Once the borings were advanced to the contact, the boreholes were then allowed to remain open for a minimum of 24 hours to determine if shallow groundwater was present.

The upper unit was typically described as a dry, red and gray, silty sand with some gravel and gravel layers present. The borings were gauged for a minimum period of 24 hours and groundwater was not identified in any of the nine borings. Following the gauging period, the borings were backfilled with cuttings from the drilling operations.

2.3 DEEP SUBSURFACE INVESTIGATION

Upon completion of the shallow subsurface investigation, an investigation of the underlying strata was conducted for the purpose of identifying the uppermost water-bearing zone at the expected depth of 230 feet bgl. This portion of the investigation consisted of the installation of three test borings to define the interval of the suspected 230-foot uppermost groundwater-bearing zone. Once the subsurface geologic data were obtained through geophysical logs, these data were used to design three monitor wells (MWs) near B-1, B-7, and B-9. A summary of the field activities is presented in Appendix B.

2.3.1 Geophysical Borings

Three test borings were drilled with air rotary method to a depth of 250 feet bgl without the collection of soil or core samples. The borings were filled with water from a supply well on the WCS property that is completed into the Santa Rosa formation of the Dockum Group. CJI personnel then geophysically logged the borings. The three test boreholes (B-3, B-7, and B-9) were logged for resistivity using a Mineral Logging Systems unit 1502-282. The geophysical logs of the three test boreholes can be found in Appendix C of this report.

The geophysical logs indicate that more resistive zones, which are indicative of zones of higher sand and silt content than the baseline clay zones, are located at approximate depths of 100 feet and 225 feet BGL in each of the three borings. A discontinuous resistive zone, at an approximate depth of 185 feet BGL, was also detected in Borings B-3 and B-9, but not in B-7.

2.3.2 Monitor Well Drilling and Installation Program

The three monitor wells were designed based on the results of the geophysical logs. The design consisted of the placement of the screened interval across the 230-foot zone that is approximately 15 feet in thickness. A sand filter pack was placed in the annular space around the screen and extended a minimum of 3 feet above the screen. Well centralizers were placed approximately every 50 feet along the well casing to prevent the well from contacting the borehole wall to ensure a proper filter pack and well seal. Above the sand filter pack, bentonite chips were placed to seal the screened interval from potential infiltration from above. The bentonite chips were placed to a depth of 75 feet bgl. A cement-bentonite grout was placed above the bentonite chip seal. Monitor Well Completion Diagrams for each of the wells are presented in Appendix D.

The wells were completed at the surface with 4-inch square steel box tubing with a lockable cap and a 4-foot square concrete pad. Cattle panels were placed around the wells to help prevent livestock from damaging the wells. A detailed summary of the monitor well drilling and construction activities is included in Appendix B.

2.4 SURVEY DATA

A survey of the locations and elevations of the 9 borings and 3 monitor wells was conducted by Pettigrew and Associates, a Registered Professional Surveyor. In addition, top-of-casing elevation and top of concrete pad elevation data were collected at each of the monitor wells. The results of these data are shown on the boring logs and the Monitor Well Construction Diagrams and a report of the survey results are presented in Appendix G. The boring and monitor well surveyed locations are shown on Figure 3.

2.5 GROUNDWATER LEVEL DATA COLLECTION

On 22 September, CJI began collecting groundwater elevation data from MW-1, MW-2, and MW-3 to evaluate groundwater recharge in the screened interval. Measurements were collected using an electric e-line that records to 0.01 foot. The results of the groundwater level data are presented on Table 2.

Groundwater was present in Monitor Well MW-2 but Monitor Wells MW-1 and MW-3 did not produce groundwater. Groundwater levels continued to recharge in MW-2 throughout the monitoring period.

Due to the lack of groundwater in Monitor Wells MW-1 and MW-3, deionized water was placed in the wells. The wells were surged in an attempt to remove any smearing of the borehole walls that might have been present and that could have prevented the well from producing groundwater. The wells were surged a total of five times over a five day period using a surge block that forced water to move back and forth through the borehole wall to remove any fines that may have caused smearing. Water levels were recorded for a three-week period after surging. The water level in MW-1 remained relatively constant and the water level in MW-3 fell during the monitoring period, which would indicate that the screened intervals in these two wells are dry.

2.6 GROUNDWATER SAMPLING

Groundwater samples were collected from Monitor Well MW-2. Lockwood Greene coordinated the delivery of the sample containers and determined the parameters to be analyzed for the sampling events. Severn Trent Laboratories (STL) and Framatome supplied the sample containers. Two groundwater sampling events were conducted. Due to the short holding times of some of the parameters, each of the sampling events was conducted over a two day period. Samples were collected on 14 October 2003 and 11 November 2003 for the containers supplied by STL. Samples were collected on 19 October 2003 and 12 November 2003 for the containers supplied by Framatome.

Because groundwater had not reached equilibrium in MW-2 prior to each sampling event, the available groundwater in the well had not stagnated and therefore purging was not conducted prior to sampling. The samples were collected using new dedicated disposable 2-inch diameter bailers. The samples were placed in the laboratory supplied containers and placed on ice for next day delivery to the laboratories. The samples were transported under standard chain-of-custody procedures. During the sampling activities, the sampling team donned latex gloves to prevent cross contamination.

3.0 DATA ANALYSIS

The data collected from the field investigation activities and from past investigations on the WCS property to the east have been used to develop a general model of the site characteristics. The model includes a top of redbed contour map, a hydraulic gradient map of groundwater in the 230-foot zone, and a hydraulic conductivity calculation of the 230-foot zone.

The top of redbed structure map is presented as Figure 4. The top of red bed represents the paleogeographic surface of this unit prior to being covered by the overburden sand and silt material that extends to the current land surface. Based on the structure map there is a northwest-southeast trending ridge in the redbed that is located to the northeast of the subject site. Along the southwest toe of this ridge appears to be a top of redbed drainage that slopes to the south. To the east of the subject site in Section 33, the redbeds generally slope towards this drainage feature. Beneath the site, the drainage feature generally slopes to the southwest corner of the property in an east to west drainage feature. This drainage feature has relief of approximately 40 feet.

A groundwater gradient map from wells completed in the 230-foot zone on the WCS site has been extended to include the groundwater elevation data from Monitor Well MW-2. The groundwater gradient map is presented as Figure 6. The gradient is shown to be in a south-southwesterly direction on the WCS site and appears to be in a south-southeasterly direction in the area of MW-2 on the LES property. The gradient in the area of MW-2 is approximately 0.011 feet per foot.

Based on recovery rates of groundwater in Monitor Well MW-2, the hydraulic conductivity of the 230-foot zone has been calculated at 3.7×10^{-6} cm/sec (3.8 feet/year). The hydraulic conductivity was calculated using Hvorslev's rising head slug test method. The hydraulic conductivity calculations are presented in Appendix E.

Using the calculated groundwater gradient and the hydraulic conductivity value, the groundwater velocity has been calculated to be 0.3 feet per year. The calculation of groundwater velocity is presented in Appendix F. It should be noted that the porosity value used in the calculation was developed from laboratory analysis of soil samples collected from this zone from the WCS site.

4.0 CONCLUSIONS

Based on the field activities and data collected to date, the following conclusions have been made:

- The surface soils at the site consist mainly of fine sand and silt. There are minimal amounts of gravel in certain zones but gravel is not consistently present throughout the site;

- The upper geologic contact of the redbeds, in boreholes B-1 through B-9, is found between 23' BGL and 46' BGL. The red bed surface is a paleogeographic surface that slopes towards the southwest corner of the property;

- Shallow groundwater was not detected above the redbeds in boreholes B-1 through B-9;

- The 230-zone, that is believed to correspond with the water-bearing zone that WCS is monitoring, is found to be approximately 15 feet thick and was encountered at depths ranging from 214 feet to 222 feet BGL;

- Based on interpretation of on-site and off-site data the groundwater gradient in the 230-foot zone is approximately 0.011 feet per foot to the south-southeast beneath the area of investigation;

- The hydraulic conductivity of the 230-foot zone has been calculated to be 3.7×10^{-6} cm/sec; and

- The velocity of the groundwater flow is approximately 0.3 feet per year.

TABLES

TABLE 1
SHALLOW BORHOLE SURVEY DATA
Lockwood Greene Engineering and Construction
Eunice, New Mexico

Boring	Surface Elevation (feet MSL)	Depth to Redbed (feet MSL)	Elevation at Top of Redbed (feet MSL)
B-1	3,396	55	3,341
B-2	3,402	34	3,368
B-3	3,403	23	3,380
B-4	3,401	45	3,356
B-5	3,409	43	3,366
B-6	3,415	45	3,370
B-7	3,415	26	3,389
B-8	3,423	38	3,385
B-9	3,421	46	3,375

TABLE 2
GROUNDWATER LEVEL DATA
Lockwood Greene Engineering and Construction
Eunice, New Mexico

Monitor Well MW-1	
DATE	DTW TOC
9/22/03	dry
9/23/03	dry
9/24/03	dry
9/25/03	dry
9/26/03	dry
9/29/03	dry
9/30/03	dry
10/1/03	dry
10/2/03	dry
10/3/03	dry
10/6/03	dry
10/7/03	dry
10/8/03	dry
10/9/03	dry
10/10/03	dry
10/13/03	dry
10/14/03	dry
10/15/03	dry
10/16/03	212.1
10/17/03	215.02
10/18/03	215.03
10/19/03	214.56
10/20/03	214.52
10/22/03	214.43
10/24/03	214.32
10/27/03	214.35
11/4/03	214.37
11/7/03	214.4
11/10/03	214.36
11/11/03	N/A
11/12/03	N/A

Monitor Well MW-2	
DATE	DTW TOC
9/22/03	190.78
9/23/03	165.04
9/24/03	153.85
9/25/03	149.68
9/26/03	148.67
9/29/03	138.71
9/30/03	135.11
10/1/03	164.07
10/2/03	149.14
10/3/03	142.58
10/6/03	145.03
10/7/03	138.11
10/8/03	140.64
10/9/03	136.9
10/10/03	133.68
10/13/03	N/A
10/14/03	140.53
10/15/03	165.48
10/16/03	148.52
10/17/03	141.86
10/18/03	N/A
10/19/03	133.55
10/20/03	147.56
10/22/03	130.79
10/24/03	125.54
10/27/03	120.33
11/4/03	115.84
11/7/03	115.02
11/10/03	114.91
11/11/03	114.24
11/12/03	121.82

Monitor Well MW-3	
DATE	DTW TOC
9/22/03	dry
9/23/03	dry
9/24/03	dry
9/25/03	dry
9/26/03	dry
9/29/03	dry
9/30/03	dry
10/1/03	dry
10/2/03	dry
10/3/03	dry
10/6/03	dry
10/7/03	dry
10/8/03	dry
10/9/03	dry
10/10/03	dry
10/13/03	dry
10/14/03	dry
10/15/03	dry
10/16/03	220.36
10/17/03	224.37
10/18/03	224.58
10/19/03	224.73
10/20/03	224.79
10/22/03	224.98
10/24/03	225.23
10/27/03	225.5
11/4/03	228.14
11/7/03	228.31
11/10/03	226.58
11/11/03	N/A
11/12/03	N/A

DTWTOC - Depth to water from top of casing.
Monitor Well MW-2 was developed on 9/30, 10/2, 10/7, 10/8, and 10/10.
Groundwater samples were collected from MW-2 on 10/14, 10/15, 10/19, 11/11, and 11/12.
Monitor Wells MW-1 and MW-3 were surged five times using 12 to 13 gallons of DI water from 10/16 - 10/20.

FIGURES

REV.	DATE	DESCRIPTION	DR BY	APP BY

COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH 512-474-9097
AUSTIN, TEXAS 78701

PROJECT:
LOCKWOOD GREENE

SHEET TITLE:
LAND USE MAP

DES BY			SCALE: SEE BAR SCALE
DR BY	SDB	SDB	PROJECT NO. 03070
CHK BY	DHG	DHG	CJI NO. 03070006
APP BY	DHG	DHG	SHEET 1 OF 1 SHEETS
DATE ISSUED: 11-18-2003			FIGURE NO. 2
PURPOSE: REPORT			

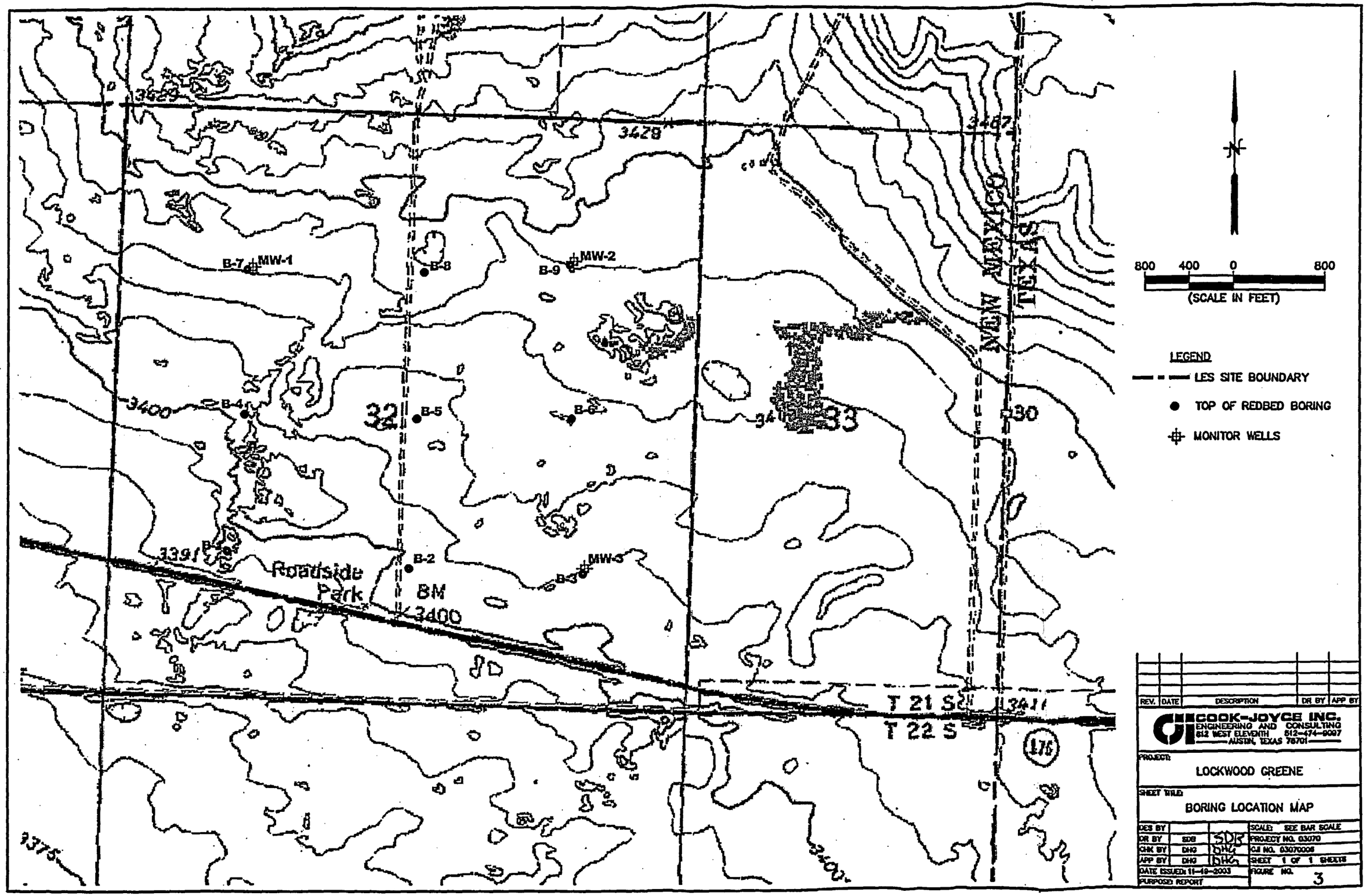
REV.	DATE	DESCRIPTION	DR BY	APP BY

COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH 512-474-9097
AUSTIN, TEXAS 78701

PROJECT:
LOCKWOOD GREENE

SHEET TITLE:
SITE LOCATION MAP

DES BY			SCALE: SEE BAR SCALE
DR BY	SDB	SDB	PROJECT NO. 03070
CHK BY	DHG	DHG	CJI NO. 03070007
APP BY	DHG	DHG	SHEET 1 OF 1 SHEETS
DATE ISSUED: 11-10-2003			FIGURE NO. 1
PURPOSE: REPORT			



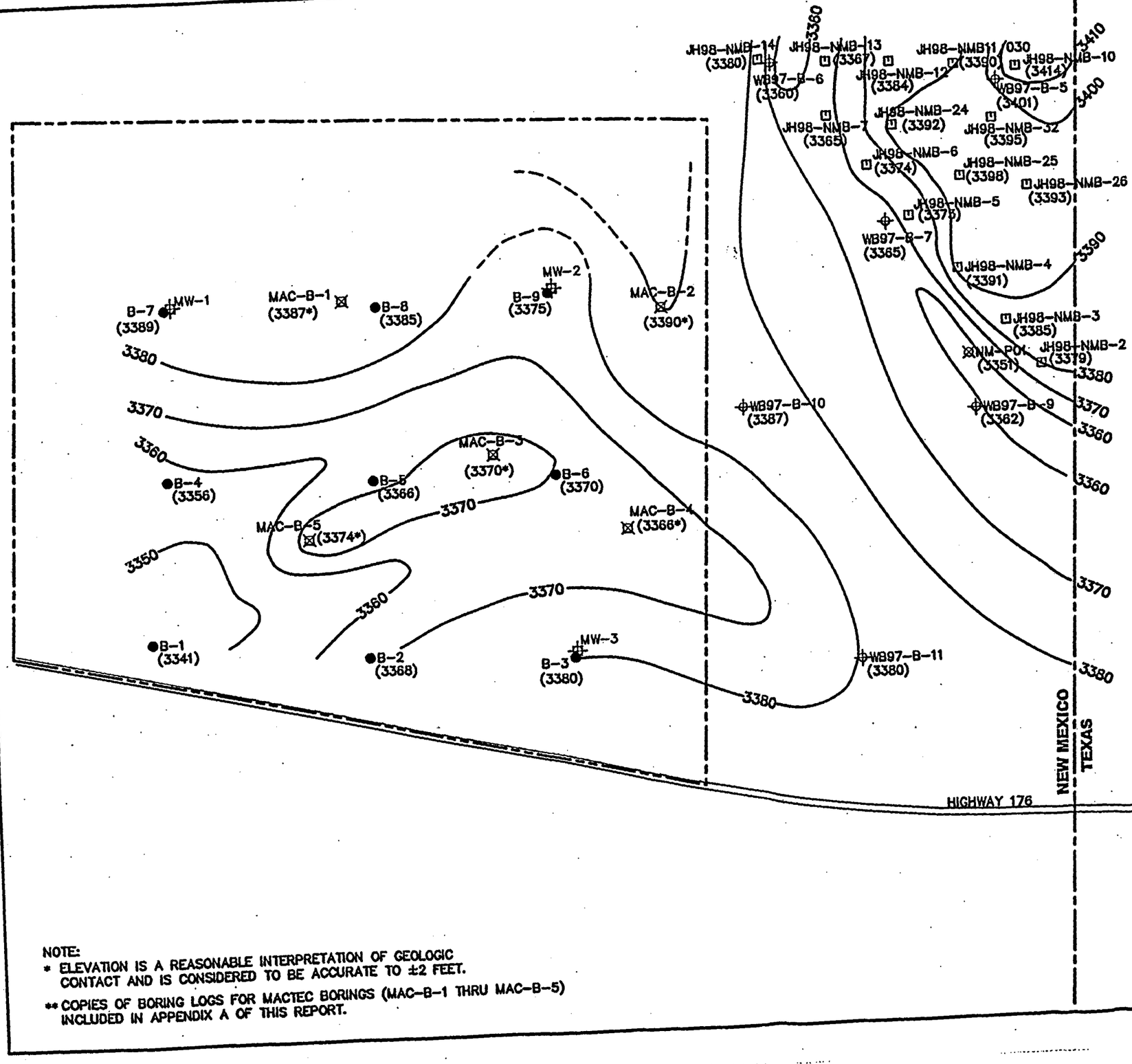
REV.	DATE	DESCRIPTION	DR BY	APP BY

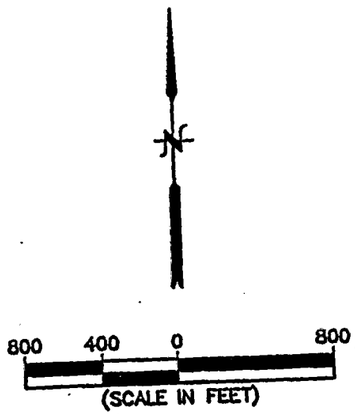
COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH 512-474-9007
AUSTIN, TEXAS 78701

PROJECT:
LOCKWOOD GREENE

SHEET TITLE:
BORING LOCATION MAP

DES BY			SCALE: SEE BAR SCALE
DR BY	SDS	SDS	PROJECT NO. 03070
CHK BY	DHG	DHG	CJI NO. 03070006
APP BY	DHG	DHG	SHEET 1 OF 1 SHEETS
DATE ISSUED: 11-19-2003			FIGURE NO. 3
PURPOSE: REPORT			





LEGEND

- LES SITE BOUNDARY
- CJI BORING
- MONITOR WELLS
- WEAVER BOOS BORINGS
- EXISTING PIEZOMETER
- JACK HOLT BORINGS
- MACTEC BORINGS

NOTE:

* ELEVATION IS A REASONABLE INTERPRETATION OF GEOLOGIC CONTACT AND IS CONSIDERED TO BE ACCURATE TO ±2 FEET.

** COPIES OF BORING LOGS FOR MACTEC BORINGS (MAC-B-1 THRU MAC-B-5) INCLUDED IN APPENDIX A OF THIS REPORT.

REV.	DATE	DESCRIPTION	DR BY	APP BY

COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH 512-474-9097
AUSTIN, TEXAS 78701

PROJECT: LOCKWOOD GREENE

SHEET TITLE: TOP OF RED BED STRUCTURE MAP

DES BY			SCALE: SEE BAR SCALE
DR BY	SDS		PROJECT NO. 03070
CHK BY	EJH		CJI NO. 03070004
APP BY	DHJ		SHEET 1 OF 1 SHEETS
DATE ISSUED: 11-19-2003			FIGURE NO. 4
PURPOSE: REPORT			

LEGEND

- PIEZOMETERS
- SUPPLEMENTAL WELLS
- MONITORING WELL
- GROUNDWATER FLOW DIRECTION

1200 600 0 1200

(SCALE IN FEET)

WCS SITE

LES SITE

EXISTING RCRA PERMIT BOUNDARY

RCRA LANDFILL

TP-0001 3387

TP-0005 3368

TP-0004 3355

JH93-68-2 3344

JM98-NMB-24 3324

JH93-7C 3303

MW-1

MW-2 3311.01

MW-3

NM-P01 3293

3301 JH99-A-24-99

3286 JH99-A-22-99

3380 3370 3360 3350 3340 3330 3320 3310 3300

REV.	DATE	DESCRIPTION	DR BY	APP BY

COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH 512-474-6007
AUSTIN, TEXAS 78701

PROJECT: LOCKWOOD GREENE SITE INVESTIGATION

SHEET TITLE: 2003 FALL 230-FOOT ZONE GROUNDWATER GRADIENT CONTOURS

DES BY	DHG	DWG	SCALE: SEE BAR SCALE
DR BY	SDB	SDR	PROJECT NO. 03070
CHK BY	JAS		CJI NO. 03070005
APP BY	DHG	DWG	SHEETS 1 OF 1 SHEETS
DATE ISSUED: 11-19-2003			FIGURE NO. 5
PURPOSE: REPORT			

APPENDIX A

LITHOLOGIC LOGS

LOG OF BORING NO. B-1

Lockwood Greene Engineering and Construction

TYPE: 6" Flight Augers LOCATION: Eunice, N.M.

DEPTH, FT	SYMBOL	SAMPLES	BLOWS PER FOOT OR REC/(RQD), %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH
				N 522,969.2 E 925,623.0 El 3396.49	
0				Fine sand with silt - very loose, very dry, red, (SM).	
5					
10					
15					3381.5
				Fine sand with silt and gravel (<1/2" Dia.) - very dry, red and gray, (SW).	15.0
20					
25					
30				Fine sand with silt and gravel (<1-1/2" Dia) - very dry, gray and red, (SW).	
35					
40				Fine sand with silt and abundant gravel (<1-1/2" Dia.) - very dry, red, (SW).	
45					
50					
55					3341.5
				Top of red bed, silty clay - very dry, red, (CL).	55.0
60					3336.5
				TD-60'	60.0

COMPLETION DEPTH: 60.0'

DATE: 8-28-03 PROJECT NO.: 03070

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LOG OF BORING NO. B-2

Lockwood Greene Engineering and Construction

TYPE: 8" Hollow-Stems LOCATION: Eunice, N.M.

N 522,906.4 E 927,284.7 El 3402.31

DEPTH, FT	SYMBOL	SAMPLES	BLOWS PER FOOT OR REC/(RQD), %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH
0				Fine sand with silt and gravel (<1/2" Dia.) - very loose, very dry, tan, (SW).	
5				Fine sand with silt and gravel (<1/2" Dia.) - very loose, very dry, red, (SW).	
10					
15				Fine sand with silt and gravel (<1/2" Dia.) - very dry, gray and red, (SW). Gravel layer from 15.5' - 16.5'	
20					
25					
30					
35				Top of red bed, silty clay - very dry, red, some chert present, (CL).	3368.3 34.0
40				TD=40'	3362.3 40.0

COMPLETION DEPTH: 40.0'

DATE: 8-27-03 PROJECT NO.: 03070

03072 03070 11-17-03

COOK-JOYCE INC.
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LOG OF BORING NO. B-3

Lockwood Greene Engineering and Construction

TYPE: 6" Flight Augers LOCATION: Eunice, N.M.

DEPTH, FT	SYMBOL	SAMPLES	BLOWS PER FOOT OR REC/(RQD), %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH
				N 522,942.0 E 928,870.2 El 3403.38	
0				Fine sand with silt - very loose, very dry, red, (SM).	
5					3396.4 7.0
				Fine sand with silt and gravel (<1/4" Dia.) - very dry, gray, (SW).	
10					
15					
				Fine sand with silt and gravel (<1/2" Dia.) - very dry, gray and red, some chert present, (SW).	
20					3380.4 23.0
				Top of red bed, silty clay - very dry, red, (CL).	
25					
30					
35					3368.4 35.0
				TD=35'	

COMPLETION DEPTH: 35.0'

DATE: 8-28-03 PROJECT NO.: 03070

GEO72 03070 11-17-03

COOK-JOYCE INC.
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(512)474-9097 FAX (512)474-8463

LOG OF BORING NO. B-4

Lockwood Greene Engineering and Construction

TYPE: 6" Flight Augers LOCATION: Eunice, N.M.

DEPTH, FT	SYMBOL	SAMPLES	BLOWS PER FOOT OR REC/(RQD), %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH
				N 524,233.0 E 925,711.8 El 3400.66	
0				Fine sand with silt - very loose, very dry, gray and red, (SM).	
20					3379.7 21.0
20				Fine sand with silt and gravel (<1" Dia.) - very dry, red and gray, (SW).	
40				Fine sand with silt and gravel (<1" Dia.) - very dry, gray and red, (SW).	
45					3355.7 45.0
45				Top of red bed, silty clay - very dry, red, (CL).	
60					3340.7 60.0
60				TD=60'	

COMPLETION DEPTH: 60.0'

DATE: 8-28-03 PROJECT NO.: 03070

COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH
AUSTIN, TEXAS 78701-2000
(512)474-9097 FAX (512)474-8463

LOG OF BORING NO. B-5

Lockwood Greene Engineering and Construction

TYPE: 0-40' Hollow-Stems 40-45' Air Rotary LOCATION: Eunice, N.M.

N 524,274.0 E 927,281.5 El 3408.85

DEPTH, FT	SYMBOL	SAMPLES	BLOWS PER FOOT OR REC/(RQD), %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH
0				Fine sand with silt - very loose, very dry, red, (SM).	
5					
10				Fine sand with silt - very dry, red and gray, caliche present, (SM).	
15					
20					
25					
30					3378.9
				Fine sand with silt and gravel (< 1/2" Dia.) - very dry, gray and red, (SW). 6" gravel layer from 32'-32.5'.	30.0
35				3" gravel layer	
40					3365.9
				Top of red bed, silty clay - very dry, red, (CL).	43.0
45					3363.9
				TD=45'	45.0

COMPLETION DEPTH: 45.0'

DATE: 8-27-03 PROJECT NO.: 03070

03070 11-17-03

COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH
AUSTIN, TEXAS 78701-2000
(512)474-8097 FAX (512)474-8463

LOG OF BORING NO. B-6

Lockwood Greene Engineering and Construction

TYPE: 6" Flight Augers LOCATION: Eunice, N.M.

N 524,346.4 E 928,685.6 El 3414.75

DEPTH, FT	SYMBOL	SAMPLES	BLOWS PER FOOT OR REC/(ROD), %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH
0				Fine sand with silt - very loose,very dry,red, (SM).	
5				Fine sand with silt - very dry, red and gray, (SM).	
					3404.8
10				Fine sand with silt and gravel (<1/4" Dia.) - very dry, gray, (SW).	10.0
15					
20				Fine sand with silt and gravel (<1/2" Dia.) - very dry, gray, (SW).	
25					
30					
35					
					3374.8
40				Fine sand with silt - very dry, red and gray, (SM).	40.0
					3369.8
45				Top of red bed, silty clay - very dry, red, (CL).	45.0
50					
55					
					3354.8
60				TD=60'	60.0

COMPLETION DEPTH: 60.0'

DATE: 8-28-03 PROJECT NO.: 03070

03072 03070 11-19-03

COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH
AUSTIN, TEXAS 78701-2000
(512)474-9097 FAX (512)474-8463

LOG OF BORING NO. B-7

Lockwood Greene Engineering and Construction

TYPE: 6" Flight Augers LOCATION: Eunice, N.M.

N 525,545.0 E 925,661.4 El 3415.00

DEPTH, FT	SYMBOL	SAMPLES	BLOWS PER FOOT OR REC/(RQD), %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH
				Fine sand with silt - very loose, very dry, red, (SM).	
5					
10				Fine sand with silt - very dry, red and gray, (SM).	
15					
20					3392.0
				Fine sand with silt and gravel (<1" Dia.) - very dry, gray and red, (SW).	23.0
25					3389.0
				Top of red bed, silty clay - very dry, red, (CL).	26.0
30					
35					
					3375.0
40				TD=40'	40.0

COMPLETION DEPTH: 40.0'

DATE: 8-28-03 PROJECT NO.: 03070

GB072 03070 11-17-03

COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH
AUSTIN, TEXAS 78701-2000
(512)474-9097 FAX (512)474-8463

LOG OF BORING NO. B-8

Lockwood Greene Engineering and Construction

TYPE: Hollow-Stem Augers 0-40', 40-45' Air Rotary LOCATION: Eunice, N.M.

DEPTH, FT	SYMBOL	SAMPLES	BLOWS PER FOOT OR REC/(RQD), %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH
				N 525,604.7 E 927,274.2 El 3423.29	
0				Fine sand with silt - very loose, very dry, red, (SM).	
5					
10					
15					
20					3403.3
				Fine sand with silt and gravel (<1" Dia.) - very dry, caliche and chert present, red, gray, and tan, (SW).	20.0
25					
30					
35					
					3385.3
				Top of red bed, silty clay - very dry, red, (CL).	38.0
40					
					3378.3
45				TD-45'	45.0

COMPLETION DEPTH: 45.0'

DATE: 8-26-03 PROJECT NO.: 03070

03072 03070 11-17-03

COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH
AUSTIN, TEXAS 78701-2000
(512)474-8097 FAX (512)474-8463

LOG OF BORING NO. B-9

Lockwood Greene Engineering and Construction

TYPE: 6" Flight Augers LOCATION: Eunice, N.M.

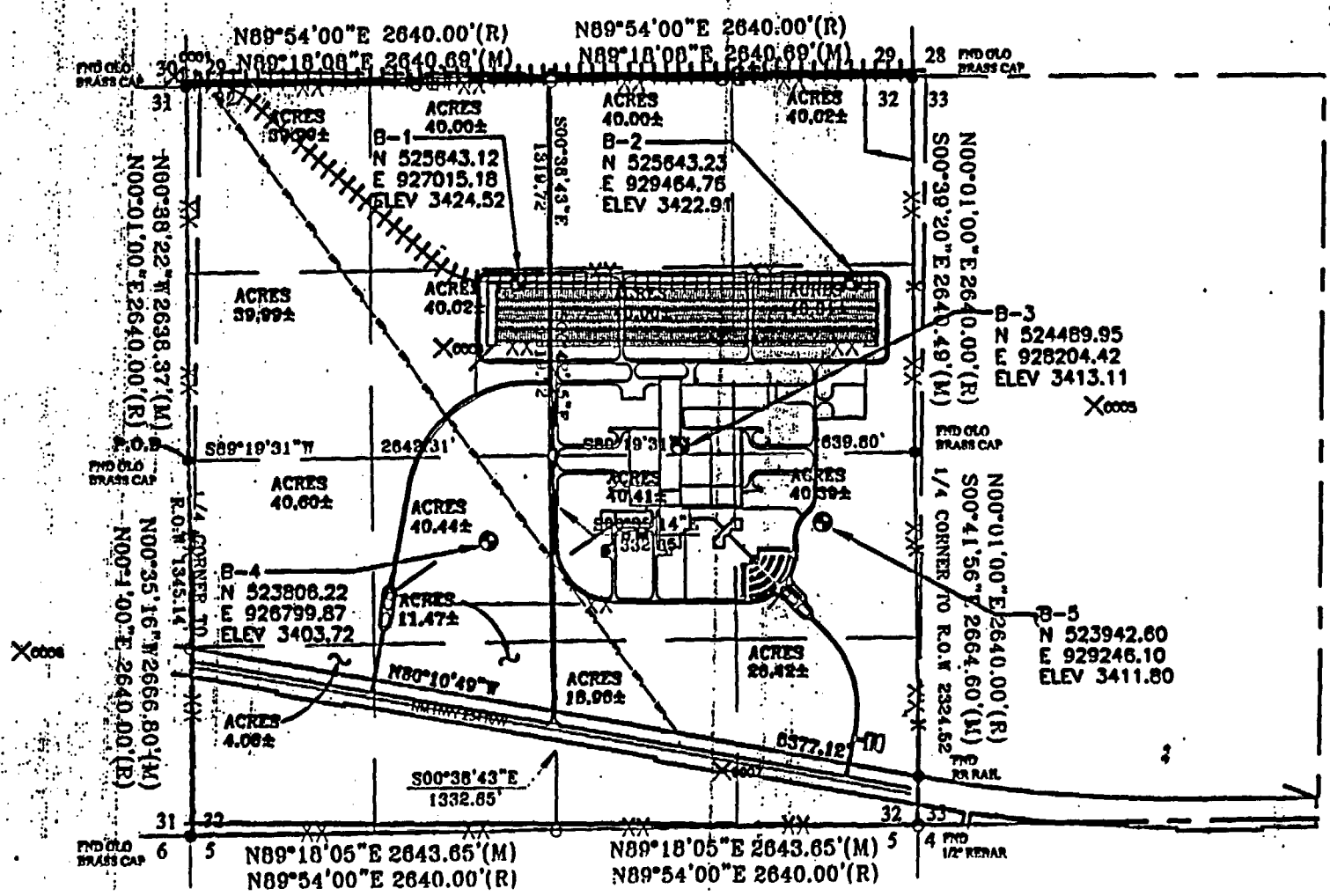
DEPTH, FT	SYMBOL	SAMPLES	BLOWS PER FOOT OR REC/(RQD), %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH
				N 525,735.9 E 928,595.5 El 3421.33	
0				Fine sand with silt - very loose, very dry, red, (SM).	
5					3415.3
				Fine sand with silt and gravel (<1/2" Dia.) - very loose, slightly moist, (SW).	6.0
10					3407.3
15				Fine sand with silt - very dry, red and gray, (SM).	14.0
20				Fine sand with silt - very dry, gray, (SM).	
25					
30					
35				Fine sand with silt - very dry, red and gray, (SM).	
40					
45					3375.3
				Top of red bed, silty clay - very dry, red, (CL).	46.0
50					
55					
60					3361.3
				TD=60'	60.0

COMPLETION DEPTH: 60.0'

DATE: 8-28-03 PROJECT NO.: 03070

GBOT2 03070 11-17-03

COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH
AUSTIN, TEXAS 78701-2000
(512)474-9097 FAX (512)474-8463



SOURCE: THIS DRAWING WAS ADAPTED FROM A CONCEPTUAL SITE PLAN SOIL BORING LAYOUT DATED SEPTEMBER 2, 2003 AND PROVIDED BY LOCKWOOD GREENE

LEGEND

B-1 ◆ BORING LOCATION AND IDENTIFICATION

MACTEC

MACTEC Engineering and Consulting, Inc.
1725 Louisville Drive
Knoxville, Tennessee 37921-5904
865-588-6544 • Fax: 865-588-6026

FIGURE 2: BORING LOCATION PLAN
NATIONAL ENRICHMENT FACILITY
LEA COUNTY, NEW MEXICO

DRAFTING BY:	PREPARED BY: MSH	CHECKED BY: DWS
JOB NUMBER: 3043031049/0001	DATE: OCTOBER 2, 2003	SCALE: 0 1000

GROUP SYMBOLS	TYPICAL NAMES	GROUP SYMBOLS	TYPICAL NAMES
	TOPSOIL		CONCRETE
	ASPHALT		DOLOMITE
	GRAVEL		LIMESTONE
	FILL		SHALE
	SUBSOIL		LIMESTONE/SHALE - Limestone with shale interbeds
	ALLUVIUM		SANDSTONE
	COLLUVIUM		SILTSTONE
	RESIDUUM - Soft to firm		AUGER BORING
	RESIDUUM - Stiff to very hard		UNDISTURBED SAMPLE ATTEMPT

	Undisturbed Sample 1.5-2.0 = Recovered (ft) / Pushed (ft)		
	Split Spoon Sample		Auger Cuttings
	Rock Core 60-100 = RQD / Recovery		Dilatometer
	No Sample		Crandall Sampler
	Rotary Drill		Pressure Meter
▽	Water Table at time of drilling	○	No Recovery
		▼	Water Table after 24 hours

Correlation of Penetration Resistance with Relative Density and Consistency

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 10	Loose	3 - 4	Soft
11 - 20	Firm	5 - 8	Firm
21 - 30	Very Firm	9 - 15	Stiff
31 - 50	Dense	16 - 30	Very Stiff
Over 50	Very Dense	31 - 50	Hard
		Over 50	Very Hard

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

SILT OR CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

No.200 No.40 No.10 No.4 3/4" 3" 12"

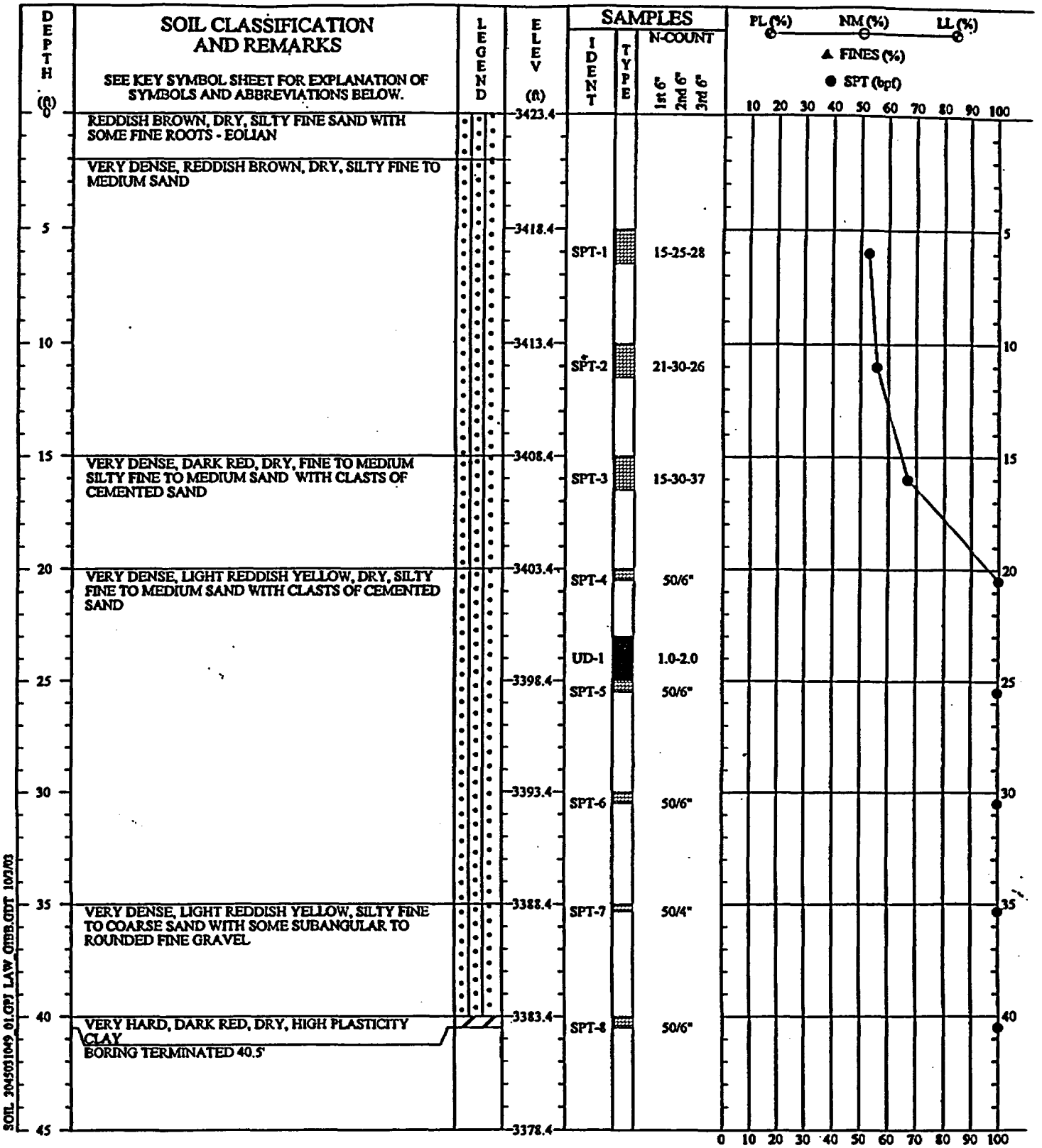
U.S. STANDARD SIEVE SIZE

Reference: The Unified Soil Classification System, Corps of Engineers, U.S. Army Technical Memorandum No. 3-357, Vol. 1, March, 1953 (Revised April, 1960)

KEY TO SYMBOLS AND DESCRIPTIONS

MACTEC

MACTEC Engineering and Consulting, Inc.
1725 Louisville Drive
Knoxville, Tennessee 37921-5904
865.588.9644 • Fax: 865.588.9026



REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING A SAFETY HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BACK FILLED ON 9/9/2003.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

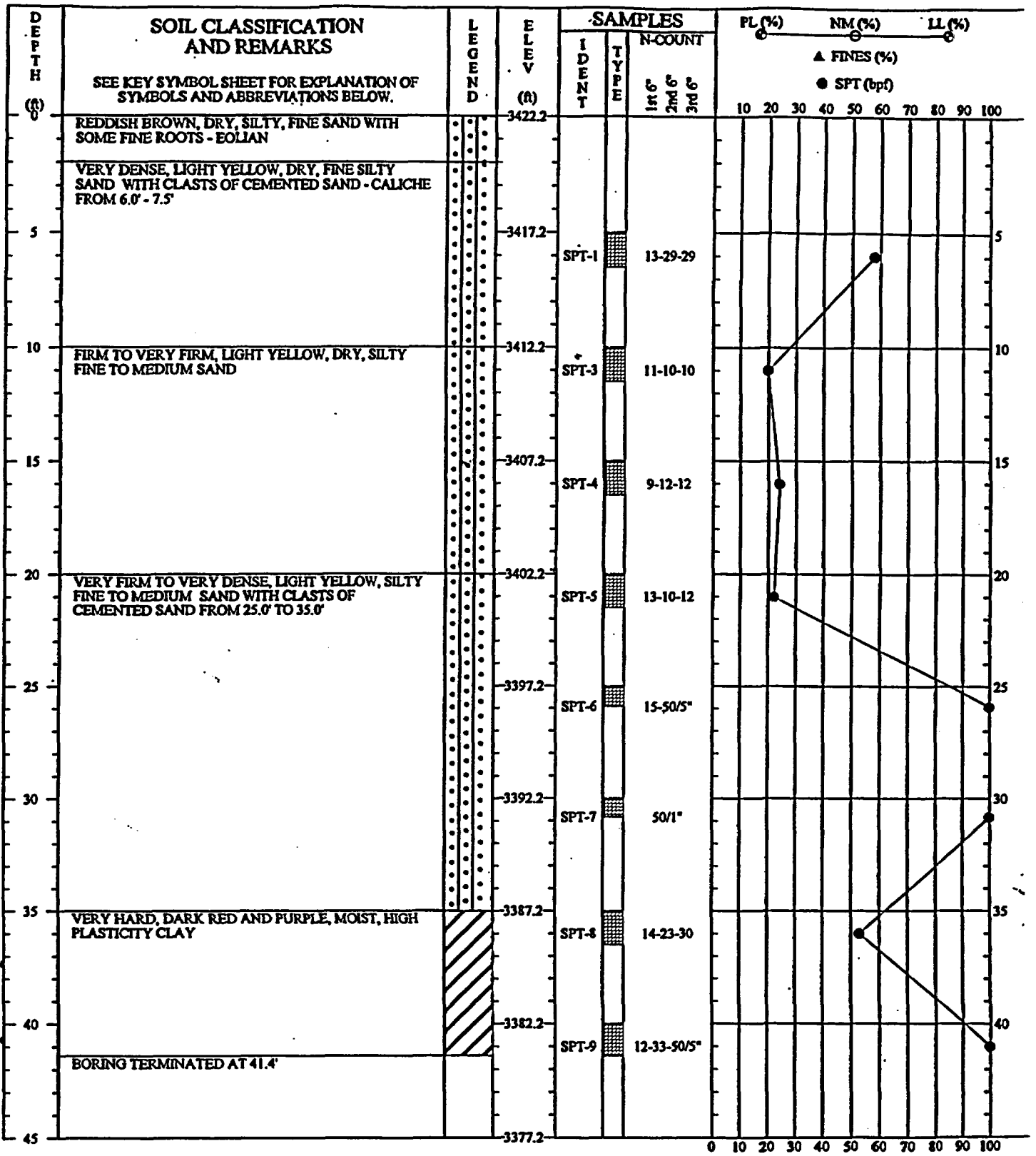
SOIL TEST BORING RECORD

PROJECT: NEF - Lea County, New Mexico

DRILLED: September 9, 2003 **BORING NO.:** B-

PROJ. NO.: 3043031049/0001 **PAGE** 1 OF

MACTEC



SOIL 3043031049 01.GPJ LAW_GTBB.GDT 10/3/03

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING A SAFETY HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BACK FILLED ON 9/9/2003.

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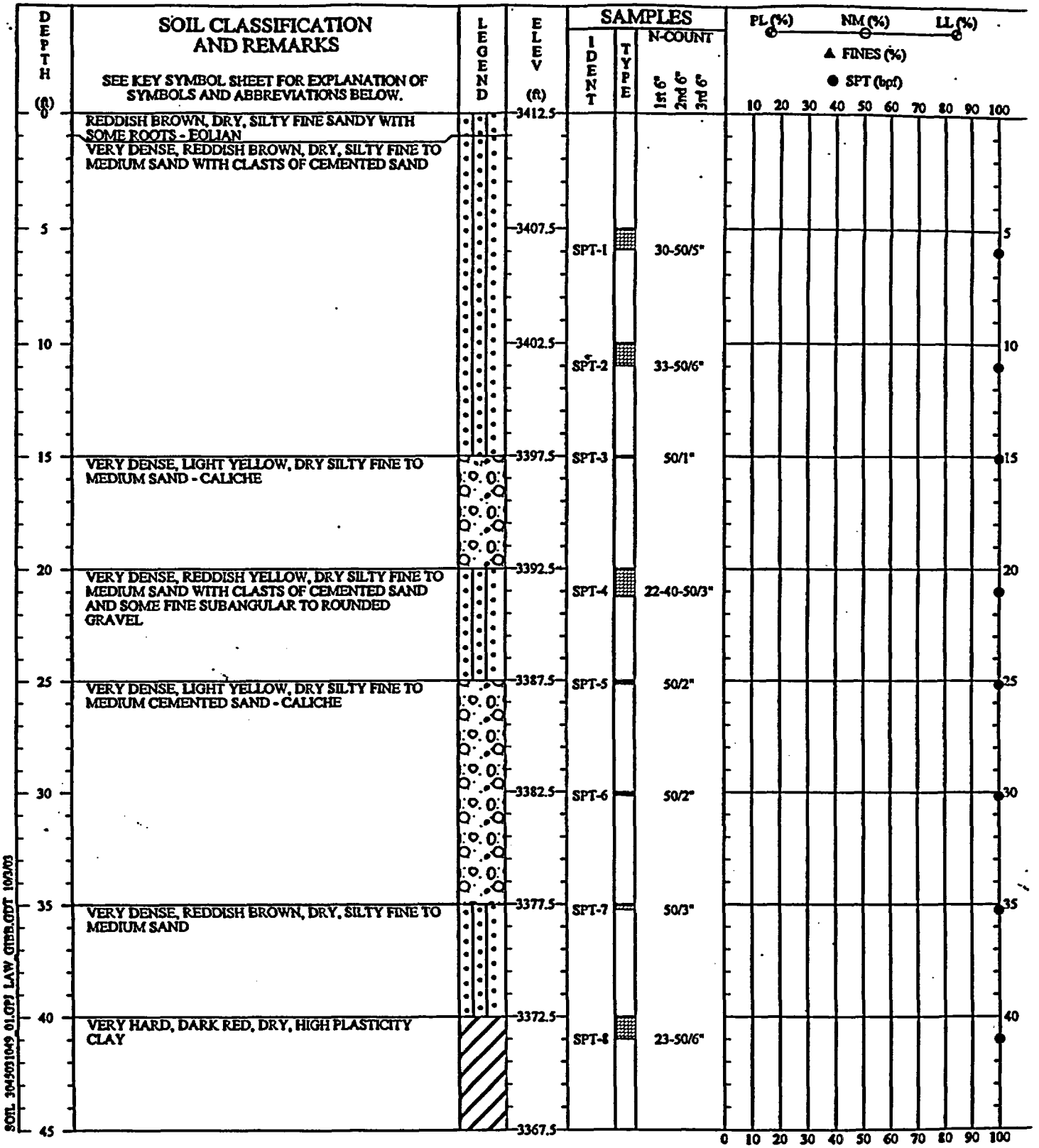
SOIL TEST BORING RECORD

PROJECT: NEF - Lea County, New Mexico

DRILLED: September 9, 2003 BORING NO.: B-2

PROJ. NO.: 3043031049/0001 PAGE 1 OF 1

MACTEC



SOIL 3043031049 01.GPJ LAW_GTBB.GDT 10/3/03

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING A SAFETY HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BACK FILLED ON 9/10/2003.

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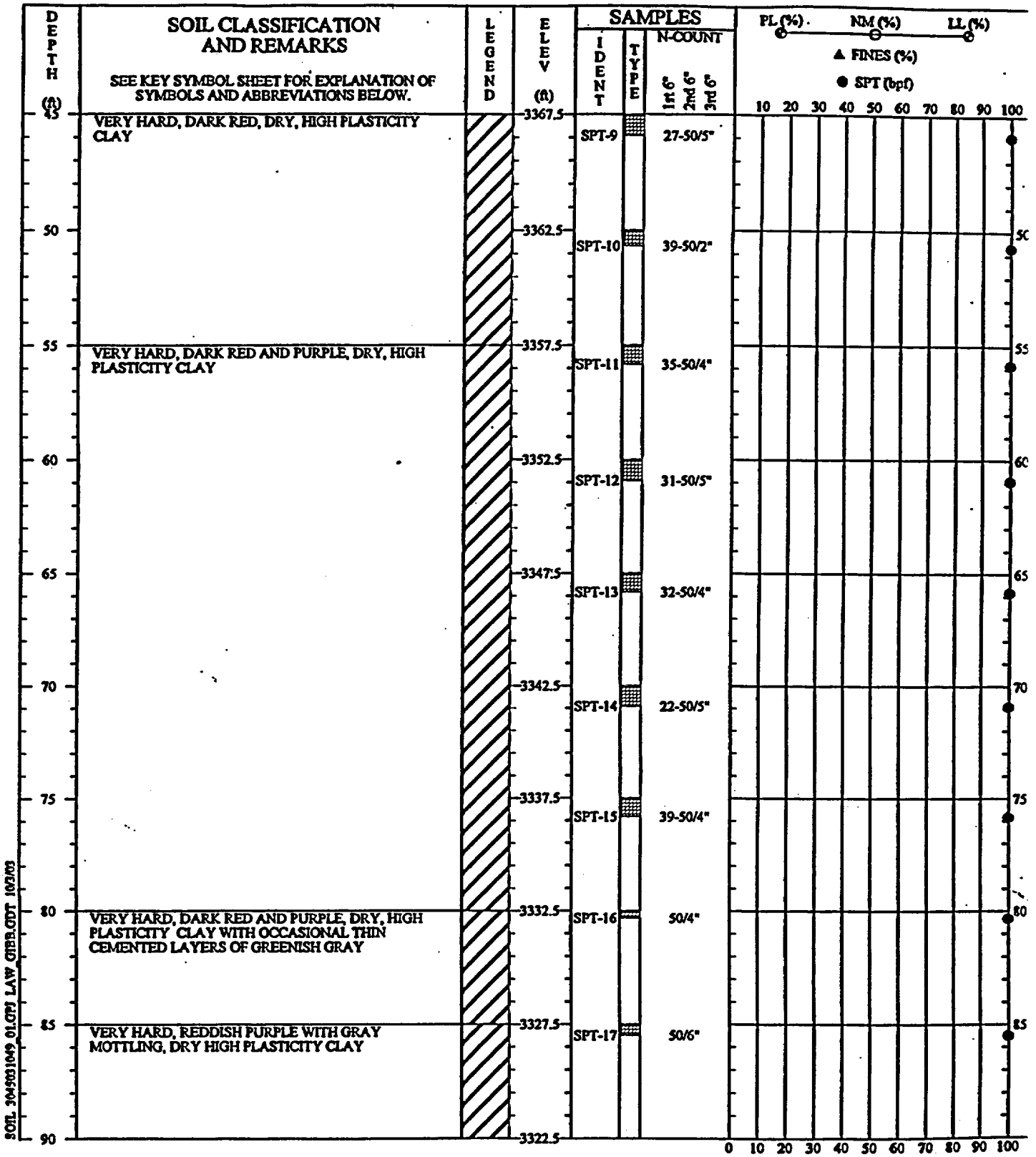
SOIL TEST BORING RECORD

PROJECT: NEF - Lea County, New Mexico

DRILLED: September 10, 2003 BORING NO.: B-3

PROJ. NO.: 3043031049/0001 PAGE 1 OF 3

MACTEC



SOIL 3043031049 01.GPJ LAW_GIBB.GDT 10/3/03

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING A SAFETY HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BACK FILLED ON 9/10/2003.

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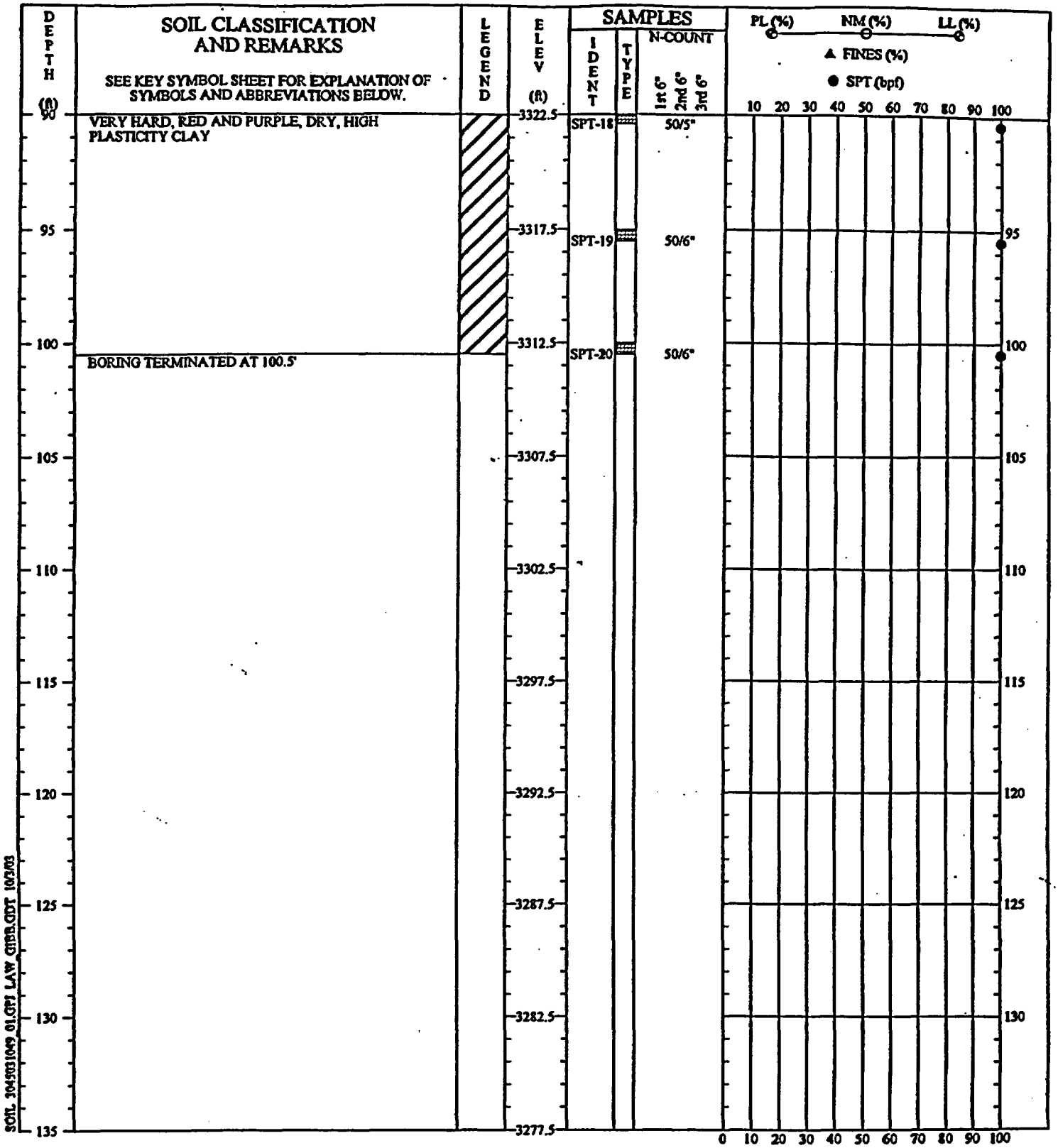
SOIL TEST BORING RECORD

PROJECT: NEF - Lea County, New Mexico

DRILLED: September 10, 2003 BORING NO.: B

PROJ. NO.: 3043031049/0001 PAGE 2 OF

MACTEC



SOIL 3043031049 01.GPJ LAW_GIBB.GDT 10/3/03

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING A SAFETY HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BACK FILLED ON 9/10/2003.

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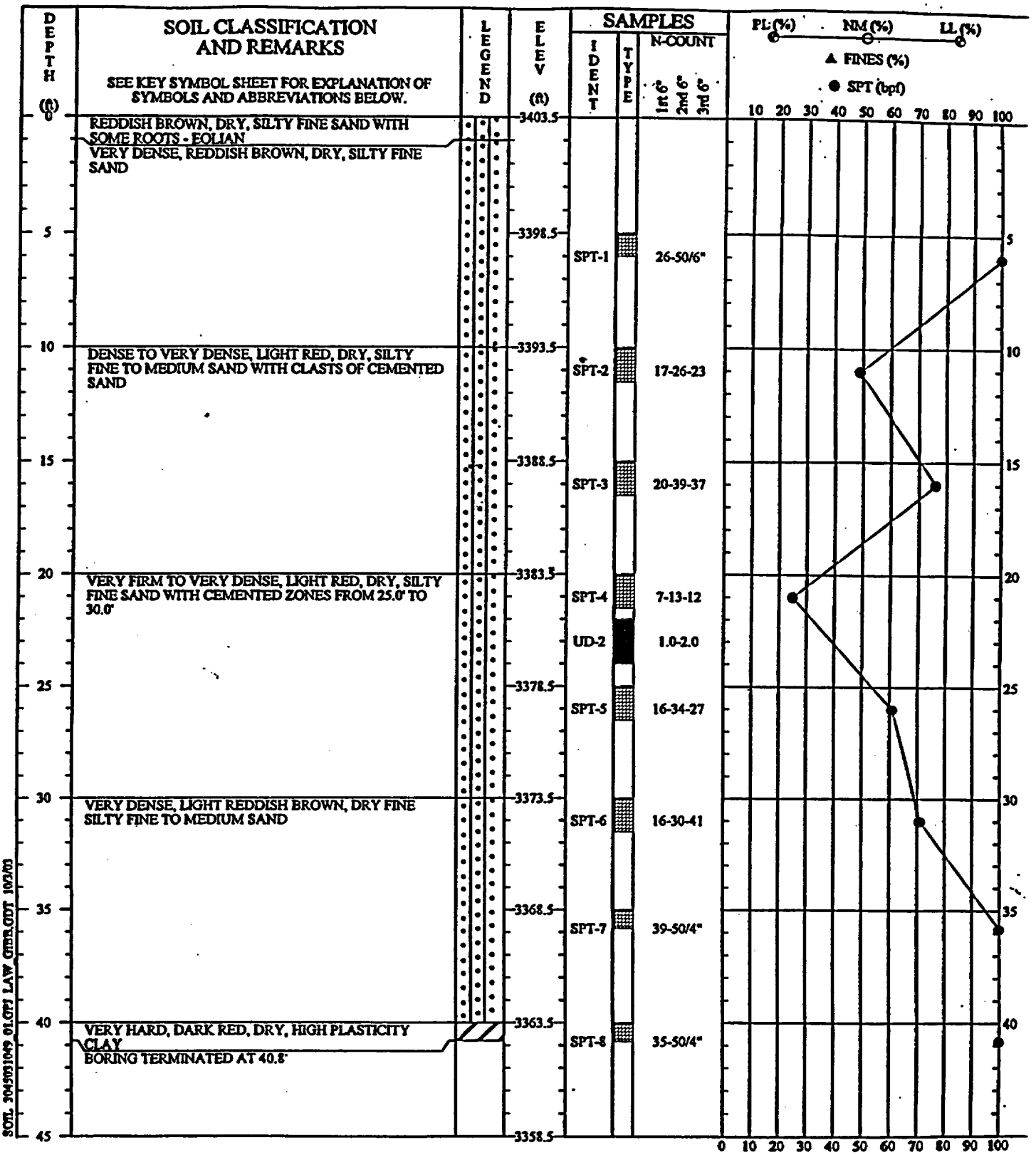
SOIL TEST BORING RECORD

PROJECT: NEF - Lea County, New Mexico

DRILLED: September 10, 2003 BORING NO.: B-3

PROJ. NO.: 3043031049/0001 PAGE 3 OF 3

MACTEC



SOIL 3043031049 01.GPJ LAW_CBR.GDT 10/3/03

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING A SAFETY HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BACK FILLED ON 9/9/2003.

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SOIL TEST BORING RECORD

PROJECT: NEF - Lea County, New Mexico

DRILLED: September 9, 2003 BORING NO.: B-

PROJ. NO.: 3043031049/0001 PAGE 1 OF

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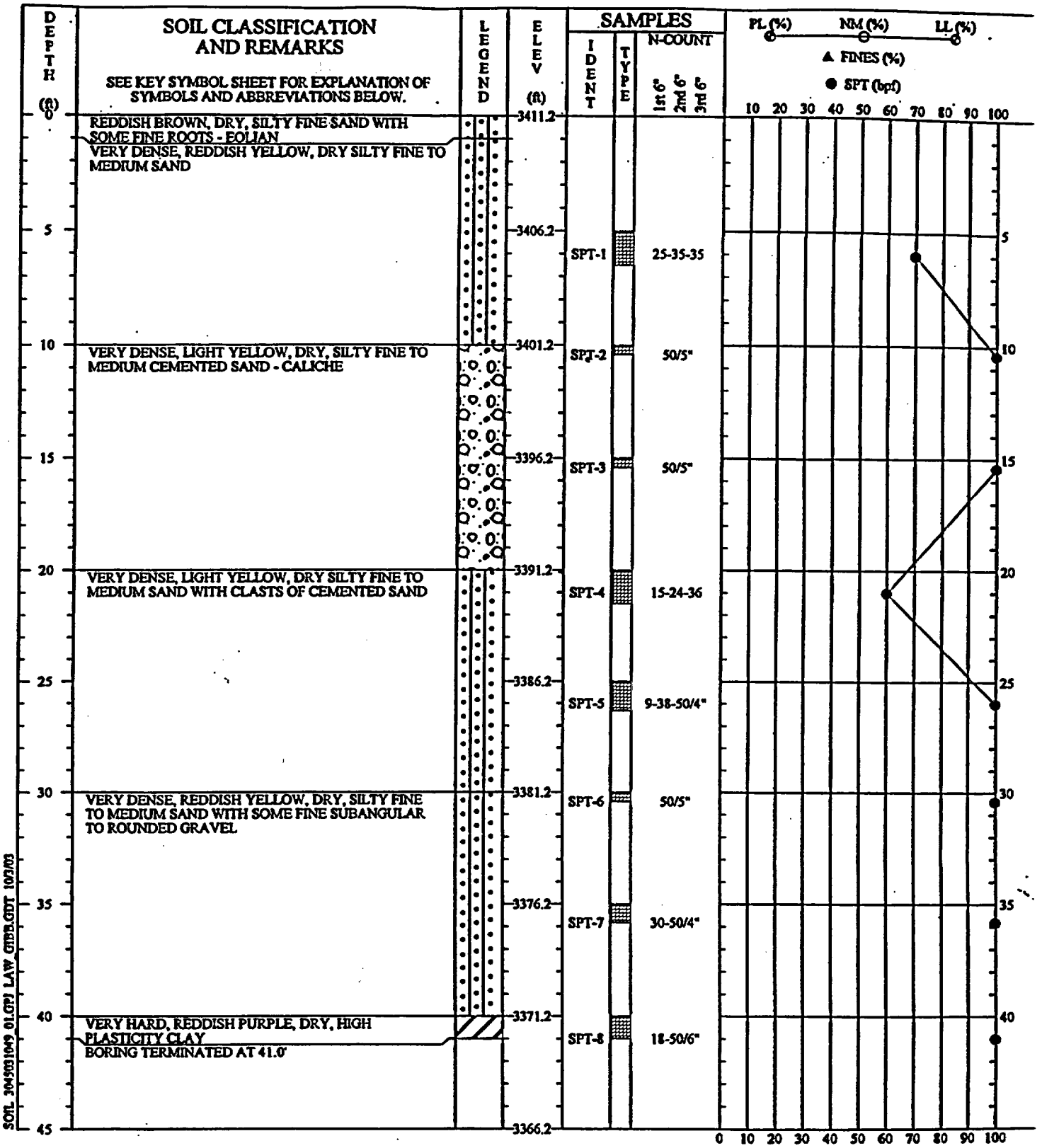

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING A SAFETY HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BACK FILLED ON 9/10/2003.

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SOIL TEST BORING RECORD

PROJECT: NEF - Lea County, New Mexico

DRILLED: September 10, 2003 **BORING NO.:** B-5

PROJ. NO.: 3043031049/0001 **PAGE 1 OF 1**

MACTEC

APPENDIX B

SUMMARY OF FIELD ACTIVITIES

SUMMARY OF FIELD ACTIVITIES

Shallow Boring Program

On 26 August 2003, Total Support Services, Inc. (TSS), LG, and CJI personnel were on-site with a Mobil B-59 drill rig to install the nine shallow subsurface soil borings. Initially, CJI proposed to air rotary drill each of the borings to the redbeds. However, due to the looseness and subsequent continuous cave-ins of the sandy soil near the surface, hollow-stem augers were used to keep the boreholes open. After attempts to air rotary drill B-8 and B-5 through hollow-stem augers proved difficult, solid-stem augers were determined to be the preferred method of installing the shallow boreholes. Although hollow-stem augers were used to advance B-2, solid-stem augers were utilized to advance the remaining six shallow boreholes.

In each of the nine shallow boreholes, a CJI geologist lithologically logged the soil using the USCS classification system from borehole cuttings. Particular attention was paid to the upper contact of the redbeds (see Figure 4). The lithologic logs of each of these borings can be found in Appendix A of this report. Upon reaching the upper contact of the redbeds, each borehole was over-drilled several feet so that the borehole might remain open below the contact. On 28 August 2003, the last of the shallow boreholes were completed. On 29 August, each borehole was gauged using an electric water level indicator to determine whether any groundwater had collected in the boring. The top of redbed depths and elevations are shown on Table 1.

Deep Boring Program

The deep subsurface investigation was originally proposed to be conducted using mud rotary drilling techniques which would allow the collection of soil core samples in B-1, B-7, and B-9 from the top of the redbeds to the bottom of the uppermost water-bearing zone. The lower contact of the shallowest water-bearing zone was anticipated to be between 220' and 250' BGS.

On 3 September, TSS personnel mobilized to the site with a Mobil B-53 drill rig to conduct the deep subsurface investigation. TSS set up on B-1 and attempted to set hollow-stem augers to the top of the redbeds. However, due to geologic conditions (the presence of large gravel), the

hollow-stem augers became lodged in the borehole at a depth of about 50' BGL. Numerous unsuccessful attempts were made to dislodge the augers. Eventually another borehole was advanced near the first borehole location. The result was the same and the augers were lodged at about 45' BGL. After unsuccessfully attempting to retrieve the drilling equipment from the two boreholes, the equipment was abandoned. A total of 40' of hollow-stem augers was lost in B-1. At that time, due to geologic conditions, a decision to abandon B-1 and replace that monitor well location with B-3 was made.

Following the abandonment of B-1, TSS moved to B-7. Prior to mud rotary drilling B-7, hollow-stem augers were advanced to the top of the redbeds to keep the upper sand from collapsing into the borehole. Once the hollow-stems were in place, mud rotary drilling was to be used to advance the borehole to total depth (TD). However, due to prior drilling difficulties and time constraints, the decision to utilize air rotary drilling methods to advance B-7 to 180' BGS prior to converting to mud rotary drilling techniques was made. On 7 September, TSS began core sampling B-7 starting at 180' BGS. Due to mud rotary drilling difficulties there was essentially no recovery of core soil samples from 180'-205' BGS. After numerous unsuccessful attempts to collect core soil samples from B-7, a decision was made to air core each of the three test boreholes to 250' BGS and then geophysically log the boreholes to determine monitor well design information.

At that time, TSS began advancing B-9 to 250' using air rotary drilling techniques. After casing the upper 45' of soil using 8-1/4" outer diameter (OD) hollow-stem augers, test borehole B-9 was advanced to a TD of 250' BGS. After tripping the drilling equipment out of the borehole, an electric water level indicator was used to check for the presence of groundwater. It was determined that there was no groundwater in the test borehole immediately upon completion of drilling activities. The borehole was allowed to remain open overnight and was checked the following day. On 10 September, CJI personnel determined groundwater in B-9 was at about 232.22' BGS. Using the same drilling methods, the test borehole at B-7 and the first test borehole at B-3 were completed to about 250' BGS on 11 September and 12 September, respectively. The test boreholes were dry to TD immediately upon completion of drilling activities. Groundwater was not present in B-7 even after allowing it to remain open overnight.

The test borehole at B-3 was geophysically logged immediately after drilling and was not allowed to remain open overnight for subsequent groundwater level data collection.

Before geophysical logging activities could be completed in the test borehole at B-3, the borehole collapsed to 25' BGS. Therefore, a second test borehole was drilled at B-3 to about 250' BGS on 13 September. The second test borehole was also dry upon completion of drilling activities and was geophysically logged immediately thereafter.

Monitor Well Drilling and Installation Program

After the test boreholes at B-3, B-7, and B-9 were geophysically logged, TSS began to make preparations to advance a borehole at each of these locations in which a monitor well would be installed. The boreholes would be cased to the top of the redbeds using 10" OD hollow-stem augers and then air drilled to TD using air rotary drilling methods with a 6"-diameter bit. After setting up to begin this process at B-3, the B-59 drill rig broke down and was not able to be repaired. For this reason, TSS and CJI demobilized from the site on 14 September.

On 18 September, TSS and CJI mobilized to the site. In addition, due to additional time constraints, a second drill rig (CME 75) supplied by Enviro-Drill, Inc. (EDI) was on-site to facilitate monitor well drilling and installation processes.

TSS set up on B-7 (MW-1) and advanced 10" OD hollow-stem augers to 30' BGS. After completing this task, TSS moved to B-3 and began drilling MW-3 by also installing 30' of 10" OD augers. EDI began drilling at B-9 (MW-2) by installing 50' of 10" OD hollow-stem augers. TSS and EDI advanced each monitor well boring to TD using air rotary drilling techniques and 6"-diameter bits. Both crews were using Sullair 900 air compressors. However, EDI drilled using 125 pounds per square inch (PSI) air pressure while TSS drilled using 150 PSI air pressure. On 19 September, TSS reached TD of 240' BGS in MW-3 borehole and EDI reached TD of 235.5' BGS in MW-2 borehole. After completing the installation of MW-3, TSS set up over the augers previously set in the MW-1 borehole. On 20 September, TSS reached TD of 231' BGS in MW-1 borehole.

Upon reaching TD, each crew installed the monitor well material, as witnessed by CJI and LG personnel. Monitor well construction diagrams detailing the installations can be found in Appendix D of this report. Each monitor well was constructed using 2-inch diameter Schedule 40 PVC sealed in its factory packaging. Personnel who handled the unpackaged screen or casing donned latex gloves prior to handling the material. Each monitor well was constructed using 15' of 0.010-inch slotted screen and enough riser to bring the monitor well to the surface. Stainless steel centralizers were attached to the riser about every 50' to hold the monitor well in place. After inserting the screen and riser into the monitor well borehole, a sand filter pack was poured from the surface to bring the sand filter at least three feet above the top of the screened interval. Following placement of the sand filter, bentonite chips were poured from the surface to a level of 75' BGS. The bentonite chips were then hydrated using 10 gallons of distilled water. After pouring in the distilled water, the chips were allowed to hydrate. A cement/bentonite slurry was then placed into the monitor well borehole to fill the annulus to about ground level. Then grout was placed into the annulus by pressure grouting from the bottom up using tremie pipe. After the grout was placed to this level, the hollow-stem augers were removed. The monitor wells were then allowed to set up overnight. The following day, bentonite chips were added to bring the plug to about surface level. After pouring in the appropriate amount of bentonite chips, they were hydrated with five gallons of distilled water. The drop in the level of the cement/bentonite slurry was between 7' and 17' BGS in the three monitor wells.

A variance from the general construction process in Monitor Well MW-1 is noted. While removing the hollow-stem augers from Monitor Well MW-1, TSS experienced some difficulties. About 15' of augers became lodged in the hole and, due to darkness, had to remain in the borehole overnight. The augers were eventually removed the following day. However, in the process of removing them, some loose soil caved in on top of the cement/bentonite slurry.

Each of the monitor wells was surface-completed with a 4'x4'x6" concrete pad and a protective steel upright casing. Prior to pouring concrete for the pads, plastic was laid down within the form to help keep the moisture from being drawn out to the underlying sandy soil. In addition, 6"x6" wire mesh was cut and laid in the forms to help strengthen the concrete. A three-sided, pre-fabricated metal fence was then placed around each pad to protect the monitor well from

cows and other potential harm. In addition, each of the protective casings was locked with a padlock to help prevent tampering.

APPENDIX C

GEOPHYSICAL LOGS

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:

"ELECTRIC LOG" HOLE NO: B-3; B-7; AND B-9

WITHIN THIS PACKAGE..

D-01

APPENDIX D

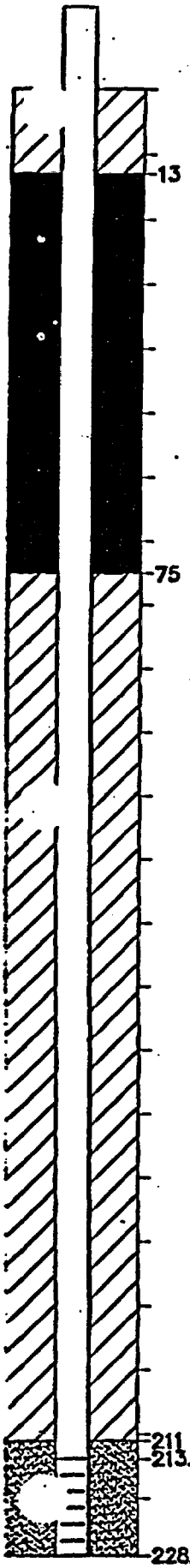
MONITOR WELL CONSTRUCTION DIAGRAM

Well No.: MW-1
Boring No.: B-7

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coordinates: 525569.741 N
925710.071 E
New Mexico State Plane Zone 3001 (NAD83)

Elevation Ground Level: 3415.44'
Top of Casing: 3418.37'
Screened Interval: 3186.7' – 3201.7'



DRILLING SUMMARY

Total Depth: 231'
Borehole Diameter: 10"Augers 0 – 30' BGS
6" Air 30' – 231' BGS
Casing Stick-up Height: 2.93'
Driller: Total Support Services
Rig: B-59
Bit(s): 6" Rotary Bit, 10" Hollow Stem Augers
Drilling Fluid: Air
Protective Casing: 4" x 4" Steel

CONSTRUCTION TIME LOG[1]

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling:				
Augers	9/18	17:25	9/18	17:55
Air Drill	9/20	10:30	9/20	14:20
Geophys Log:	9/12	10:45	9/12	11:30
Casing:	9/20	16:05	9/20	16:35
Filter Placement:	9/20	16:40	9/20	16:47
Cementing:	9/20	17:42	9/20	18:02
Bentonite Seal:	9/20	16:47	9/20	17:42
	9/21	11:03	9/21	11:15

WELL DESIGN AND SPECIFICATIONS

Basis: Geologic Log ___ Geophysical Log X
Casing String(s): C = Casing S - Screen

Depth	String(s)	Elevation
0' – 213. 8'	C	3201.7' – 3415. 4'
213. 8' – 228. 8'	S	3186.7' – 3201.7'

Casing: C1 2" Flush Threaded Schedule 40 PVC
C2
Screen: S1 2" Flush Threaded Schedule 40 PVC, 0.01" Slot
S2

WELL DEVELOPMENT

WELL COMPLETION

Filter Pack: 211' – 229' BGS (7-50 lb. bags of 20-40 filtered Unimin silica sand)

Bentonite Seal: 75' – 211' BGS (40½-50 lb. Bags)

Grout Seal: 2 pours: 1st pour; 100 gallons water, 6-92.5 bags Portland cement, and ½-50 lb. bag CETCO Super Gel; 2nd pour 75-gallons water, 4-92.5 lb. bags Portland cement and 1/3-50 lb. bag CETCO Super Gel.

COMMENTS: [1]All dates 2003. Hydrated chips from 75' – 211' BGS with 10 gallons distilled water. On 9/21, added 13 bags of Bentonite from 1' – 13' BGS and hydrated with 5 gallons of distilled water. Centralizers at 51', 101', 151', and 201' BGS.

Site Name: LES EUNICE, N.M.

Supervised by: Edward E. Hyder

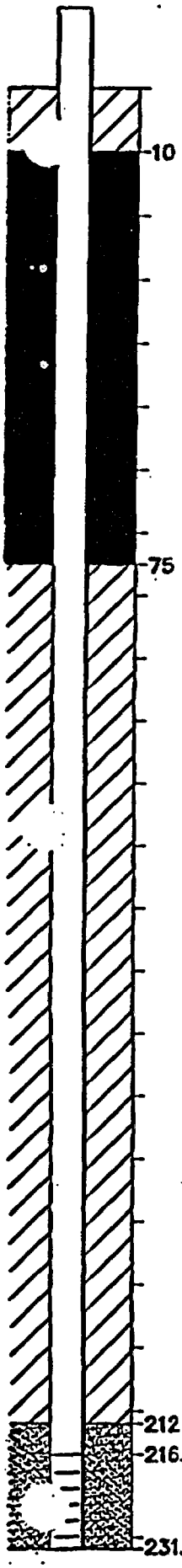
Date: 11/19/03

Well No.: MW-2
Boring No.: B-9

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coordinates: 525770.200 N
928625.728 E
New Mexico State Plane Zone 3001 (NAD83)

Elevation Ground Level: 3422.14'
Top of Casing: 3425.25'
Screened Interval: 3180.32' – 3205.32'



DRILLING SUMMARY

Total Depth: 235.5'
Borehole Diameter: 10"Augers 0 – 50' BGS
6" Air 50' – 235.5' BGS
Casing Stick-up Height: 3.11'
Driller: Enviro-Drill, Inc.

Rig: CME-75
Bit(s): 6" Cutter Bit, 10" Hollow Stem Augers
Drilling Fluid: Air
Protective Casing: 4" x 4" Steel

CONSTRUCTION TIME LOG[1]

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling:				
Augers	9/18	17:49	9/18	19:35
Air Drill	9/19	08:25	9/19	12:45
Geophys Log:	9/10	12:00	9/10	19:00
Casing:	9/19	15:40	9/19	16:20
Filter Placement:	9/19	16:25	9/19	16:35
Cementing:	9/19	19:05	9/19	20:32
Bentonite Seal:	9/19	16:36	9/19	17:02
	9/20	11:15	9/20	11:25

WELL DESIGN AND SPECIFICATIONS

Basis: Geologic Log ___ Geophysical Log X
Casing String(s): C = Casing S - Screen

Depth	String(s)	Elevation
0' – 216.82'	C1	3200.32' – 3422.14'
216.82' – 231.82'	S1	3180.32' – 3205.32'

Casing: C1 2" Flush Threaded Schedule 40 PVC
C2
Screen: S1 2" Flush Threaded Schedule 40 PVC, 0.010" Slot
S2

WELL DEVELOPMENT

Filter Pack: 212' – 232' BGS (8-50 lb. bags of 20-40 filtered Unimin silica sand)

Bentonite Seal: 75' – 212' BGS (41 1/3-50 lb. Bags)

Grout Seal: 3 pours: 1st pour; 160 gallons of water, 6-92.5 lb. Bags Portland cement, and 1-50 lb. bag CETCO Super Gel. 2nd pour; 60 gallons of water, 2-92.5 lb bags of Portland, and 1/3-50 lb bag of CETCO Supergel. 3rd pour; 25 gallons of water, 1-92.5 lb bags of Portland, and 1/8-50 lb bag of CETCO Supergel.

COMMENTS: [1]All dates 2003. Hydrated chips with 10 gallons distilled water from 75' – 212'. Centralizers at 47', 97', 147', and 197' BGS. On 9/20 added 7 bags of Bentonite chips from 1' – 10' BGS and hydrated with 5 gallons of distilled water.

Site Name: LES EUNICE, N.M.

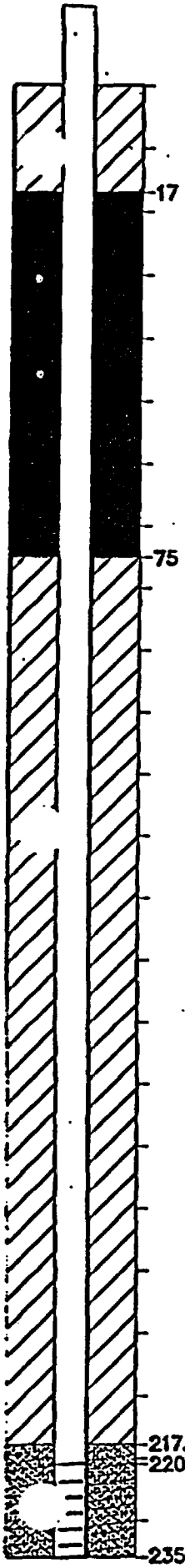
Supervised by: Edward E. Hughes

Date: 11/19/03

Well No.: MW-3
Boring No.: B-3

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coordinates:	622989.922 N 928883.152 E	Elevation Ground Level:	3403.98'
		Top of Casing:	3406.98'
New Mexico State Plane Zone 3001 (NAD83)		Screened Interval:	3168.08' – 3183.08'



DRILLING SUMMARY

Total Depth: 240'
Borehole Diameter: 10"Augers 0 – 30' BGS
6" Air 30' – 240' BGS
Casing Stick-up Height: 3.0'
Driller: Total Support Services, Inc..
Rig: B-59
Bit(s): 6" Rotary Bit, 10" Hollow Stem Augers
Drilling Fluid: Air
Protective Casing: 4" x 4" Steel

CONSTRUCTION TIME LOG[1]

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling:				
Augers	9/18	19.14	9/18	19:48
Air Drill	9/19	10:45	9/19	14:45
Geophys Log:	9/13	16:00	9/13	17:50
Casing:	9/19	17:15	9/19	17:55
Filter Placement:	9/19	18:00	9/19	18:08
Cementing:	9/19	19:15	9/19	19:33
Bentonite Seal:	9/19	18:10	9/19	18:42
	9/20	08:18	9/20	08:30

WELL DESIGN AND SPECIFICATIONS

Basis: Geologic Log ___ Geophysical Log X
Casing String(s): C = Casing S - Screen

Depth	String(s)	Elevation
0' – 220.9'	C	3183.08' – 3403.98'
220.9' – 235.9'	S	3168.08' – 3183.08'

Casing: C1 2" Flush Threaded Schedule 40 PVC
C2
Screen: S1 2" Flush Threaded Schedule 40 PVC, 0.010" Slot
S2

WELL DEVELOPMENT

WELL COMPLETION

Filter Pack: 217.8' – 235.8' BGS (7-1/2 50 lb. bags of 20-40 filtered Unimin silica sand)

Bentonite Seal: 75' – 217.8' BGS (44 ½-50 lb. Bags)

Grout Seal: 2 pours: 1st pour ; 17' – 75' BGS, 150 gallons water, 8-50 lb. bags Portland cement, and 2/3 50-lb. bag CETCO Super Gel. 2nd pour; 95 gallons of water, 4-50 lb. bags Portland cement, and 1/3-bag of CETCO Supergel.

COMMENTS: [1]All dates 2003. Hydrated chips with 10 gallons distilled water (75' – 217.8' BGS). On 9/20, added 17 bags of Bentonite chips from 1' – 17' BGS and hydrated with 5 gallons of distilled water. Centralizers at 51', 101', 151', and 201' BGS.

Site Name: LES Eunice, N. M.
Supervised by: Edward E. Hyde
Date: 11/19/03

LOCKWOOD GREENE\FINAL\03070\
F031119_WELL NO. MW-3.DOC

APPENDIX E

HYDRAULIC CONDUCTIVITY CALCULATIONS

COOK-JOYCE INC.

SHEET NO.___ OF_____

PROJECT Lockwood Greene JOB NO. 03070 PREP. BY DG DATE 11/17/03

SUBJECT Hvorslev Slug Test Calc. CHKD. BY_____ DATE_____

PHASE/TASK_____ APP. BY_____ DATE_____

TD = 286.5 FT
H = 190.5 FT
H_o = 44.72 FT
$H - H_o$ = 75.78 FT

Time (HRS)	ΔH (FT)	h (FT)	$\frac{H-h}{H-H_o}$
0	190.78	44.72	1
24	165.04	70.46	0.66
48	153.85	81.65	0.51
72	149.68	85.82	0.46
96	148.67	86.83	0.44
168	138.71	96.79	0.31
192	135.11	100.39	0.27

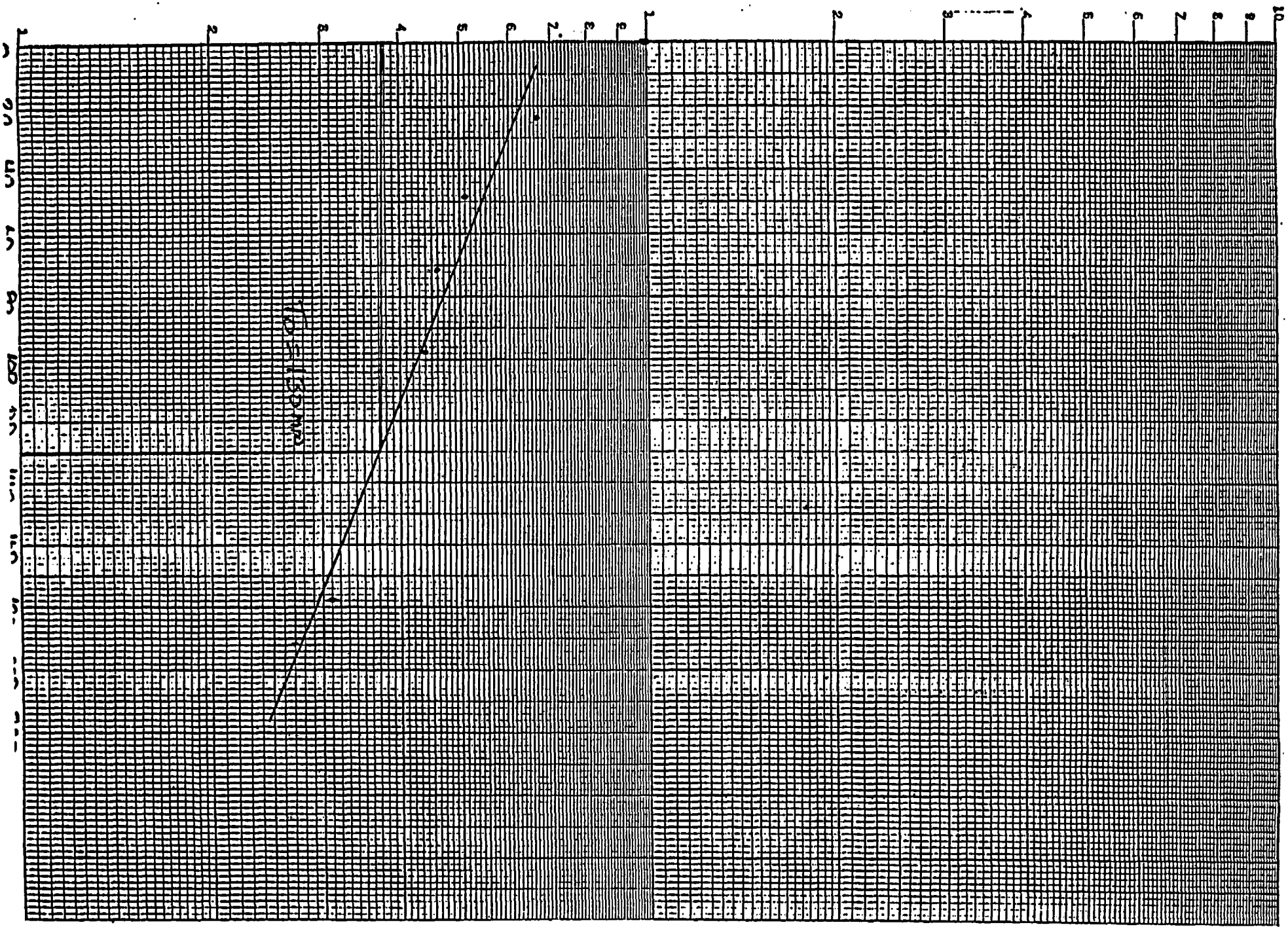
$$K = \frac{r^2 \ln(L/R)}{2LT_o}$$

$$= \frac{(0.083\ FT)^2 \ln(15\ FT / 0.25\ FT)}{2\ 15\ FT\ 130\ MIN}$$

$$= 7.2 \times 10^{-6}\ FT/MIN$$

$$= 3.7 \times 10^{-6}\ CM/SEC$$

$$= 3.78\ FT/YR$$



APPENDIX F

GROUNDWATER VELOCITY CALCULATIONS

COOK-JOYCE INC.

SHEET NO.___ OF_____

PROJECT Lockwood Greene JOB NO. 03070 PREP. BY DG DATE 11/17/03

SUBJECT Groundwater Velocity Calc. CHKD. BY_____ DATE_____

PHASE/TASK_____ APP. BY_____ DATE_____

$$V = \frac{K i}{n}$$

K = Hydraulic Conductivity

i = Hydraulic Gradient

n = Porosity

V = Velocity

K = 3.8 FT/YR

i = 0.011

n = 0.14

$$V = \frac{3.8\ \text{FT/YR} \cdot 0.011}{0.14}$$

V = 0.3 FT/YR

APPENDIX G

SURVEY RESULTS

DEBRA P. HICKS, P.E./L.S.I.
WILLIAM M. HICKS, III, P.E./P.S.

PETTIGREW and ASSOCIATES
1110 N. GRIMES
HOBBS, NEW MEXICO 88240
(505) 393-9827

23 September, 2003

Cook-Joyce Inc.
812 West Elevneth
Austin, Texas 78701-2000
Facsimile Number: 512-474-8463

ATTN: Ed Hughes / Doug Granger
RE: Location of monitoring wells and borehole locations within the LES site east of Eunice New Mexico.

Dear Mr. Granger:

Below I have tabulated the data you have requested for the borehole locations:

Borehole locations			
Northing	Easting	Elevation	Description
622969.203	925622.959	3396.49	BH-1
622906.403	927284.708	3402.31	BH-2
622941.969	928870.232	3403.38	BH-3
624232.996	925711.777	3400.66	BH-4
624273.953	927281.455	3408.85	BH-5
624346.448	928685.553	3414.75	BH-6
625545.025	925661.407	3415.00	BH-7
625604.689	927274.151	3423.29	BH-8
625735.902	928595.512	3421.33	BH-9

Additionally here is the data you requested for the three monitoring wells:

Monitoring Wells			
Northing	Easting	Elevation	Description
625569.741	925710.071	3418.31	MW-1 VAULT
		3418.37	MW-1 CASING
		3416.00	MW-1 CONC
		3415.44	MW-1 GRND
625770.200	928625.728	3425.11	MW-2 VAULT
		3425.25	MW-2 CASING
		3422.60	MW-2 CONC
		3422.14	MW-2 GRND
622989.922	928883.152	3406.97	MW-3 VAULT
		3406.98	MW-3 CASING
		3404.33	MW-3 CONC
		3403.98	MW-3 GRND

RE: Location of monitoring wells and borehole locations within the LES site east of Eunice New Mexico.

All observations were made from USC&GS Benchmark 12DD. We used real-time differentially corrected global positioning system observations at each location. Horizontal and vertical control values (X,Y,Z) at benchmark 12DD were derived from 3 continuously operating reference stations in the area. The above listed coordinates are referenced to New Mexico State Plane Coordinates Zone 3001 (NAD83), with the vertical referenced to NAVD(88). The X&Y values have been scaled to ground values.

Sincerely,
PETTIGREW and ASSOCIATES, P.A.

Daniel R. Muth, PS