EL Dorado Chemical Company

P. O. Box 231
El Dorado, Arkansas 71731
501-863-1400

September 9, 1985

Mr. Jim Rigg
Arkansas Department of Pollution
Control and Ecology
8001 National Drive
Little Rock, AR 72209

Dear Mr. Rigg:

Enclosed is a copy of our groundwater protection plan that was prepared for our Part B application before we received our exempt status.

Please let me know if you need other information concerning groundwater protection.

Sincerely,

Jim Warnock

Jim Warnock
Environmental Coordinator

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8.0 ADDITIONAL INFORMATION

8.1 GROUNDWATER PROTECTION

To Be Provided By

Consulting Engineering Firm

8.0 Additional Information Requirements

This section provides the required additional information regarding the hydrogeology of the area of the surface impoundment and ground water monitoring.

8.1 Interim Status Monitoring Data

The El Dorado Chemical Company has not monitored ground water quality beneath the regulated surface impoundment during the Interim Status permit period. Consequently, no Interim Status monitoring summary is available.

Interim Status ground monitoring was not conducted at the surface impoundment because a November, 1981 ground water investigation concluded that there was a low probability of the surface impoundment contaminating the uppermost aquifer beneath the site. Attachment II in this report by McClelland Engineers, Inc.

8.2 Hydrogeologic Information

8.2.1 Regional Geology of the El Dorado Chemical Company Area

The El Dorado Chemical Company plant lies within the outcrop area of the Cockfield Formation of the Tertiary Claibourne Group. According to A Reconnaissance Study of Saltwater Contamination in the El Dorado Aquifer, Union County, Arkansas, M. E. Broom, T. F. Kraemer and W. V. Bush, U. S. Geological Survey, Water Resources Investigation Report 84-4012, the Cockfield underlies

most of the surface downdip from the outcrop of the underlying Cook Mountain Formation except where concealed by Quaternary Alluvium. Report 84-4012 also indicates the Cockfield has a maximum thickness of 300 feet and has irregularly interbedded and lenticular beds of lignitic sand and clay. The Cockfield is also reported to have massive sand beds which may make up 50 to 75 percent of the total formation thickness.

The Cockfield is currently used in Union County as a water resource for rural, domestic supply and a few industries. In 1982, the reported daily withdrawals were 0.7 mgal, county-wide. Water levels in the Cockfield are generally shallow and flow typically follows the local topography. Generally, water-table conditions prevail in the Cockfield with discharge to surface drainage. However, locally, the ground water in the Cockfield may be semi-confined by interbedded or lenticular clay beds. Cockfield recharge is primarily through precipitation in sandy outcrop areas.

The Cockfield dips, generally, to the southeast across Union County following the regional trend for this area. Consequently, the underlying Cook Mountain Formation of the Claibourne Group is encountered at increasing depths beneath the Cockfield in the dip direction. According to Report 84-4012, the Cook Mountain is approximately 100 to 150 feet thick and composed of clay and silty clay with minor sand lenses, locally. Report 84-4012, also indicates the Cook Mountain serves as a hydrologic confining unit, separating the Cockfield aquifer from aquifers underlying the Cook Mountain. Owing to the clayey nature of the Cook Mountain, the unit is reported not to be an aquifer in Union County.

8.2.2 Identification of Uppermost Aquifer and Hydraulically Interconnected Aquifers

As described in Section 8.2.1, the Cockfield Formation outcrops at the El Dorado Chemical Plant. Based on an interpretation of a geophysical log of plant water supply well 5 (personal communication, M. E. Broom to G. D. Mayo, 1982) the Cockfield extends from the surface to a depth of 154 feet (elevation 34 feet above mean sea level). This well is located approximately 2,000 feet northeast along the regional strike direction, from the regulated impoundment. This geological log also shows an interpreted Cook Mountain thickness of 98 feet (elevations 34 feet above to 64 feet below mean sea level). A copy of this log, with formational interpretation is Attachment XXI.

Inspection of this log suggests the Cockfield is composed of typical sand layers with at least one relatively thick clay layer. Below the Cockfield, the Cook Mountain portion of the log suggests a massive clay layer with one sandy horizon.

Consequently, the entire Cockfield thickness is identified as the uppermost aquifer beneath the regulated surface impoundment. The areal boundaries of the Cockfield are topographically higher recharge points on hills and ridges with topographically lower discharge points along the surface drainage of the area. The lower vertical boundary of the Cockfield aquifer is the top of the Cook Mountain Formation at approximate elevation of 34 feet above mean sea level.

8.2.3 Subsurface Conditions of the Cockfield at the Regulated Impoundment

Based on the 1982 McClelland Engineers subsurface investigation of the surface impoundment, a site-specific ground water investigation was conducted by MCI Consulting Engineers, Inc. (MCI) in January, 1985. The MCI investigation consisted of three deep and two shallow borings with water-level measurement piezometers in each boring. Attachment XXII shows the approximate boring/piezometer locations. The Borings 1, 2 and 3 were 51 to 76 feet in depth while Borings 2a and 3a were both terminated at 20 feet.

The subsurface conditions encountered during the MCI investigation can be summarized as an upper clayey to sandy zone with an abrupt lower contact with a very dense clay layer. This clay layer has a transitional lower boundary that contains thin interbedded sand and clay layers that grade to a massive sand layer. Attachment XXIII are logs of the borings of the MCI investigation.

The upper unit appears to be relatively consistent across the site. This unit is approximately below the impoundment. The general character of this unit is clayey near the surface and increases in sand content with depth. In the topographically lower borings, at the base of the impoundment dike, a sand layer was encountered at the bottom of this unit. In all borings, saturated conditions existed at the bottom of this unit, representing a surficial saturated zone, probably recharged within the immediate area of the impoundment.

MEANING POND IS LEAKING?

A compact clay layer represents an intermediate unit below the upper unit. The character of this clay layer is consistent across the site and is clay with minor silty laminations. Owing to its clayey nature, the intermediate unit serves as a lower confining layer for the surficial saturated zone at the base of the upper lithologic unit. The basal portions of the intermediate unit are transitioned with an underlying massive sand layer.

The underlying massive sand layer is the lowest unit encountered in the MCI investigation. This unit is lignitic, fine-grained sand with apparent massive beddings. This sand layer is encountered at the same relative elevation at each deep boring location. Saturated conditions with rising water levels are countered in this sand unit at each deep boring location. The subsurface conditions described above suggest that this lowest unit is a confined local aquifer.

8.2.4 Ground Water Conditions of the Surficial Saturated Zone of the Cockfield at the Regulated Impoundment

From the relative elevations corresponding to the clay layer's upper contact horizon in the three boring locations, this unit is interpreted to be thining with an upper boundary dip to the south across the site. Similarly, the surficial saturated zone appears to have a flow direction corresponding to the dip of the upper clay layer boundary. Consequently, ground water flow in the surficial saturated zone is from topographically higher portions of the plant, north of the impoundment

to the surface drainage near the base and south of the impoundment dike. Attachment XXIV is a cross-section showing these conditions.

The surficial saturated zone hydraulic conductivity is estimated to be 2.3×10^{-5} centimeters per second or 0.06 feet per day. This estimate of hydraulic conductivity is based on a slug test conducted on the piezometer at boring location 2a. The analysis of the slug test data was conducted according to the method described by Bouwer and Rice (Water Resources Research, 1976).

8.2.5 Ground Water Conditions in the Lower Saturated Zone of the Cockfield at the Regulated Impoundment

The ground water flow direction in the lower, saturated zone is northeast. This flow direction is based on ground water elevations in the deep piezometers set during the MCI investigation. Attachment XXV shows a general potentiometric surface based on these three piezometers. No slug testing was conducted on this aquifer. However, the hydraulic conductivity is probably of the same magnitude as that of the upper zone owing to similar lithology.

8.2.6 Relationship of the Surficial and Lower Saturated Zones

The surficial and lower saturated zones do not appear to be hydraulically connected at the impoundment. This interpretation is based on the comparison of the lower saturated zone, ground water elevations and the base of the upper saturated zones. The following table summarizes these elevations.

TABLE 8-1

	Base of Upper Saturated Zone Elevation	Lower Saturated Zone Ground Water Elevation
Boring 2	144.6'	158.2'
Boring 3	144.7'	157.3'

As shown in Table 8-1, a positive hydraulic head from the lower saturated zone is exerted on the base of the upper saturated zone. This indicates that the impoundment flows will not occur from the upper saturated zone to the lower and that a dense intermediate unit confining layer exists for both the upper and lower saturated zones.

8.3 Contaminant Plume Description

Since groundwater monitoring has not been conducted at the facility, no plume has been detected or can be described.

8.4 General Monitoring Program Requirements

8.4.1 Description of Wells

The facility groundwater monitoring system will include the following:

8.4.1.1 Number of Wells

The proposed monitoring system will be a total of four monitoring wells.

8.4.1.2 Locations

Three of the proposed monitoring wells will be located hydraulically downgradient of the waste management area; the fourth proposed well will be located hydraulically gradient (refer to Section 8.4.4. Attachment XXVI, for areal distribution.

8.4.1.3 Depths

Each well of the monitoring system will extend into the uppermost aquifer to monitor the surficial saturated zone at the top of the dense clay layer, as described in Section 8.2.3 of this permit application. The depth of the wells will be approximately twenty feet.

8.4.1.4 Casing Description

Each well will be schedule 40, flush-threaded, two inch (I.D.), polyvinyl chloride riser and screen. The screen length will be five feet, and the slot-size will be 0.010 inch. The annulus

around the intake portion of each well will be packed with sand to promote flow into the well. Also, the well annulus will be sealed with bentonite and bentonite/cement grout above the sand pack to prevent surface water contamination of the ground water.

8.4.1.5 Assurance of Unaffected Background Water Quality Measurement

No known sources of contamination exist hydraulically upgradient from the facility. Additionally, the proposed upgradient (background) monitoring well will be located to provide groundwater samples that are not affected by leakage from the facility. The potentiometric surface of the entire monitoring system will be determined at least annually to assure that this well is hydraulically upgradient from the facility.

8.4.1.6 Assurance of Compliance Point Ground Water Quality Measurement

The proposed hydraulically downgradient wells will constitute a point of compliance immediately adjacent to the waste management area. These wells are intended to yield samples that represent the quality of the groundwater at the point of compliance. The potentiometric surface of the entire system

will be determined at least annually to assure the point of compliance wells are positioned hydraulically downgradient.

8.4.2 Description of Sampling/Analysis Procedures

The groundwater monitoring program procedures for sampling and analysis will adhere to the following:

8.4.2.1 Sample Collection Methods

The sample collection method will be according to section 2.4.2 of Ground Water Monitoring for Owners and Operators of Interim Status Facilities (SW-963). Accordingly, the ground water elevation and the volume of the standing water column will be determined for each well prior to sampling. Subsequently, three standing water column volumes will be evacuated from each well by bailing. The volume determination and evacuation will be documented for each well by completing the appropriate information on Attachment XXVII. If a well is bailed to "dryness" before three volumes have been evacuated, no additional evacuation will be necessary. After three volumes have been evacuated or the water level in a "dry" well has fully recovered, samples will be collected using a polyvinyl chloride bailer. Each well will have a dedicated bailer.

8.4.2.2 Sample Preservation/Shipment

All samples will be placed in bottles containing proper preservatives supplied by the laboratory that will conduct the analyses.

Additionally, each sample will be placed on ice immediately after sampling and transported to the analytical laboratory within twenty-four hours.

8.4.2.3 Analytical Procedures

All analytical procedures employed in sample analysis will be according to Test Methods for Evaluation of Solid Wastes (SW-846), Methods for Chemical Analysis of Water and Wastes (EPA 600/4-79-020), or equivalent analytical procedures.

8.4.2.4 Chain of Custody Control

Chain of custody control will be maintained for every sample collected from the ground water monitoring system in accordance with Section 2.4.8 of SW-963. Chain of Custody will be maintained through the tracking system on Attachment XXVII.

8.4.2.5 Documentation of Proper Sampling and Analysis Procedures

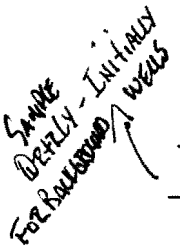
To document proper sampling procedures, Attachment XXVII will be completed with the

appropriate information during sample collection, with notation of any deviations from routine procedures. Documentation of analytical procedures and laboratory quality control will be required to be included with each sample analytical report from the analytical laboratory.

8.4.2.6 Procedure for Determining Groundwater Elevation With Each Sample

The groundwater elevation will be determined prior to sample collection at each well. The procedure for this operation will be to measure the depth of the water surface in each well from the top of the well casing. Subsequently, this depth will be subtracted from the predetermined top of casing elevation to obtain the groundwater elevation.

8.4.3 Procedures for Establishing Background Water Quality



Since no monitoring data is currently available, background groundwater quality will be established for each hazardous constituent and indicator parameter by quarterly monitoring of the upgradient well for one year. Four replicate analyses of each constituent/indicator will be conducted for each of these quarterly sampling rounds to form a statistical population for determining each constituent/indicator's background concentration and coefficient of variation. The procedures used in establishing background quality will be those

described in 40 CFR 264, Appendix IV and SW-936, Section 2.5.2 (First Year Statistical Analysis).

8.4.4. Proposed Compliance Point

The proposed compliance point is shown on Attachment XXVI. This compliance point, as shown on Attachment XXVI, is areally located at the downgradient limits of the waste management area and will provide monitoring of all directional components of downgradient flow. The upgradient well is also shown on Attachment XXVI. Vertically, these wells will extend into the uppermost aquifer, as identified in Section 8.2.2 of this permit application. The screen of these wells will be positioned in the surficial saturated zone as described in Section 8.2.3.

Relocated to Monitor Gw wells

8.5 Description of Detection Monitoring Program for Facilities Not Detecting the Presence of Hazardous Constituents

The El Dorado Chemical Company will conduct a detection monitoring program. Because no Interim Status monitoring has been conducted, the detection monitoring program is appropriate to establish background quality and to detect the possible presence of hazardous constituents. This detection monitoring program will include the following:

8.5.1 List of Indicator Parameters, Waste Constituents, and Reaction Products to be Monitored For

8.5.1.1 Type, Quantity, Concentrations Expected in Wastes

The surface impoundment is regulated on the basis of receiving corrosive (acidic) waste water from a limestone neutralization pit. No hazardous constituents listed in 40 CFR 261, Appendix VIII are expected to be present in the impoundment. (Refer to Section 3 of this application for the quantities and concentrations of acidic compounds entering an impoundment.)

Consequently, the parameters proposed to be monitored under the detection monitoring program are based on pH and indicators of nonhazardous plant wastes. These detection monitoring parameters are: NH_3 (as N), NO_3 (as N), SO_4, and pH.

8.5.1.2 Mobility, Stability, Persistence in Unsaturated Zone

The above detection monitoring parameters typically are relatively mobile, stable, and persistent in the unsaturated zone.

8.5.1.3 Detectability in Ground Water

Each of these detection monitoring parameters are readily detectable in ground water utilizing standard analytical procedures.

8.5.2 Background Ground Water Concentration Values and Coefficients of Variation for Proposed Parameters

The El Dorado Chemical Company will establish background ground water quality with the upgradient well from the monitoring system described in Section 8.4.4. of this permit application. The background concentration values and coefficients of variation for the monitoring parameters will be determined from quarterly monitoring of the upgradient well for one year, as described in Section 8.4.3 of this permit application.

8.5.3 Description of Ground Water Monitoring System

The ground water monitoring system to be used for detection monitoring will be as described in Sections 8.4.1 and 8.4.4 of this permit application.

8.5.4 Description of Proposed Sampling, Analysis, and Statistical Comparison Procedures

8.5.4.1 Sample Collection Methods

Sample collection methods for detection monitoring will be as described in Section 8.4.2.1 of this permit application.

8.5.4.2 Sample Preservation/Shipment

Sample preservation and shipment for detection monitoring will be as described in Section 8.4.2.2 of this permit application.

8.5.4.3 Analytical Procedures

The analytical procedures for sample analysis will be according to the following standard or equivalent procedures:

NO_3 (as N)	Method 352/353 (EPA 600-4-79-020)
NH_3 (as N)	Method 350 (EPA 600-7-79-020)
pH	Method 9040 (SW 846)
SO_4	Method 375 (EPA 600-4-79-020)

All analyses for detection monitoring will be conducted in a US EPA or State of Arkansas certified analytical laboratory. All pH determinations will be made in the field at the time of the sampling for all detection monitoring samples to preclude erroneous or noncomparable results for time dependent sample alteration.

8.5.4.4 Chain of Custody Control

Chain of Custody control will be maintained for all ground water samples collected during detection monitoring as described in Section 8.4.2.4 of this permit application.

8.5.4.5 Documentation of Proper Sampling and Analysis Procedures

The sampling and analysis procedures for each ground water sample during detection monitoring will be documented as described in Section 8.4.2.5 of this permit application.

8.5.4.6 Procedures for Determining Ground Water Elevation

The procedures used to determine the ground water elevation for each well during detection monitoring sampling will be as described in Section 8.4.2.6 of this permit application.

8.5.4.7 Sampling Frequency

The sampling frequency will be at least quarterly for the initial year of detection ~~monitoring~~ to establish background quality. The sampling frequency for subsequent years of detection monitoring will be at least semi-annually. once in year

8.5.4.8 Procedures for Determining Statistically Significant Increase for Any Monitored Parameter

After background quality has been determined, each monitoring parameter's background concentration and coefficient of variation will ~~be statistically~~ compared with each subsequent semi-annual sampling result in accordance with ~~the~~ Cochran's Approximation to the Behrens-Fisher Student's t-test procedures described in 40 CFR 264, Appendix IV. (Appendix on Statistical Testing.)

8.5.4.9 Procedure for Annual Determination of Uppermost Aquifer Flow Rate and Direction

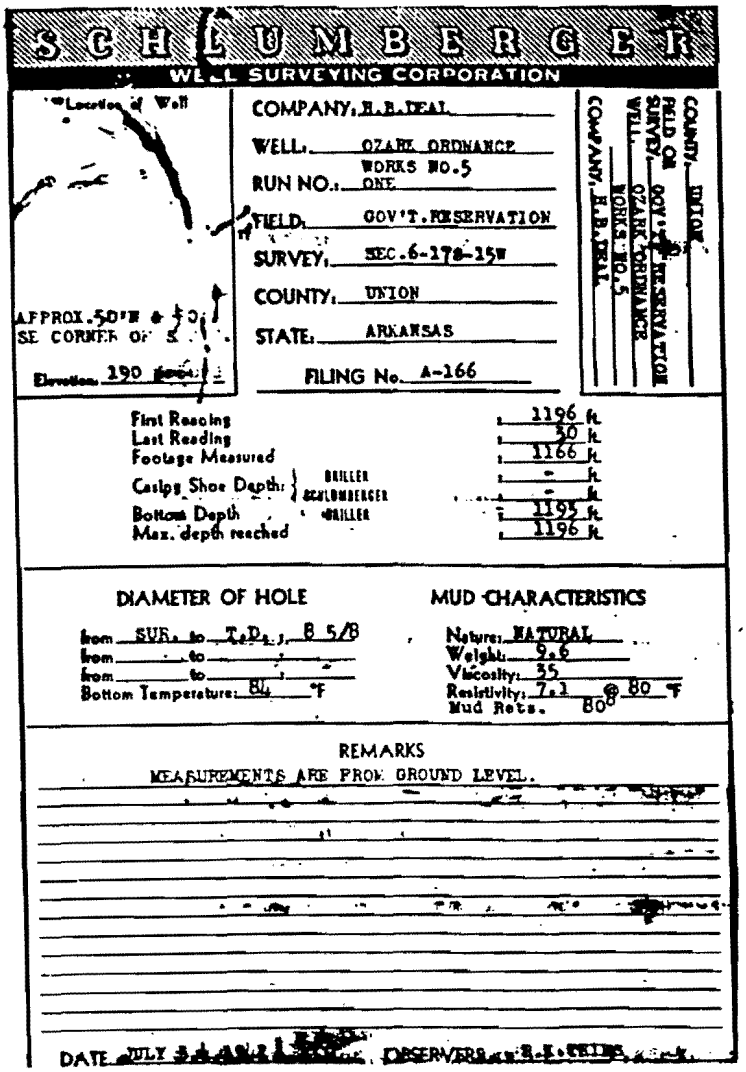
The uppermost aquifer flow direction will be determined annually by drafting the potentiometric surface of the surficial saturated zone based on a set of ground water elevations measured from the

detection monitoring system. The uppermost aquifer flow rate will be determined by slug testing of wells from the detection monitoring system with subsequent analysis by the Bouwer and Rice (Water Resources Research, June, 1976) or equivalent method.

8.5.5 Procedure to be Implemented If a Statistically Significant Increase in Any Constituent or Parameter is Identified at Any Compliance Point Monitoring Well

For any compliance point well, if a statistically significant increase in a constituent or a parameter is identified or if any parameter analytical result is identified over its National Interim Primary Drinking Water Standard, El Dorado Chemical will implement the actions described in 40 CFR 264.98(h).

Attachment XXI Geophysical Log of Deep Water Intake Well 5



SCHLUMBERGER
WELL SURVEYING CORPORATION

Location of Well

APPROX. 50'N & 50'E SE CORNER OF S.

Elevation 190 [illegible]

COMPANY: H.B.DEAL
WELL: OZARK ORDNANCE WORKS NO.5
RUN NO.: ONE
FIELD: GOV'T.RESERVATION
SURVEY: SEC.6-17S-15W
COUNTY: UNION
STATE: ARKANSAS

FILING No. A-166

COMPANY H.B.DEAL
WELL OZARK ORDNANCE WORKS NO.5
FIELD OR SURVEY GOV'T. RESERVATION
COUNTY UNION

First Reading		1196 ft
Last Reading		30 ft
Footage Measured		1166 ft
Casing Shoe Depth:	DRILLER	- ft
	SCHLUMBERGER	- ft
Bottom Depth	DRILLER	1195 ft
Max. depth reached		1196 ft

DIAMETER OF HOLE

from SUR. to T.D.; B 5/8
from to
from to
Bottom Temperature: 84 °F

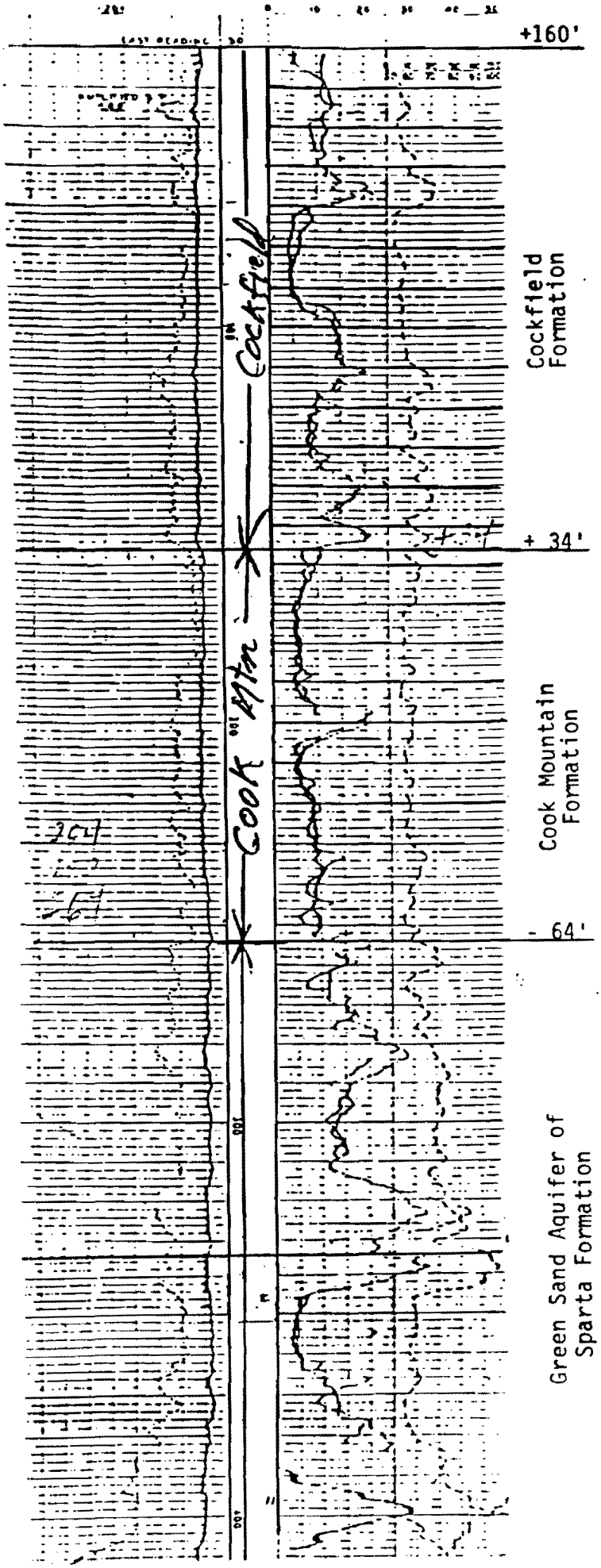
MUD CHARACTERISTICS

Nature: NATURAL
Weight: 9.6
Viscosity: 35
Resistivity: 7.1 @ 80 °F
Mud Rets. 80°

REMARKS

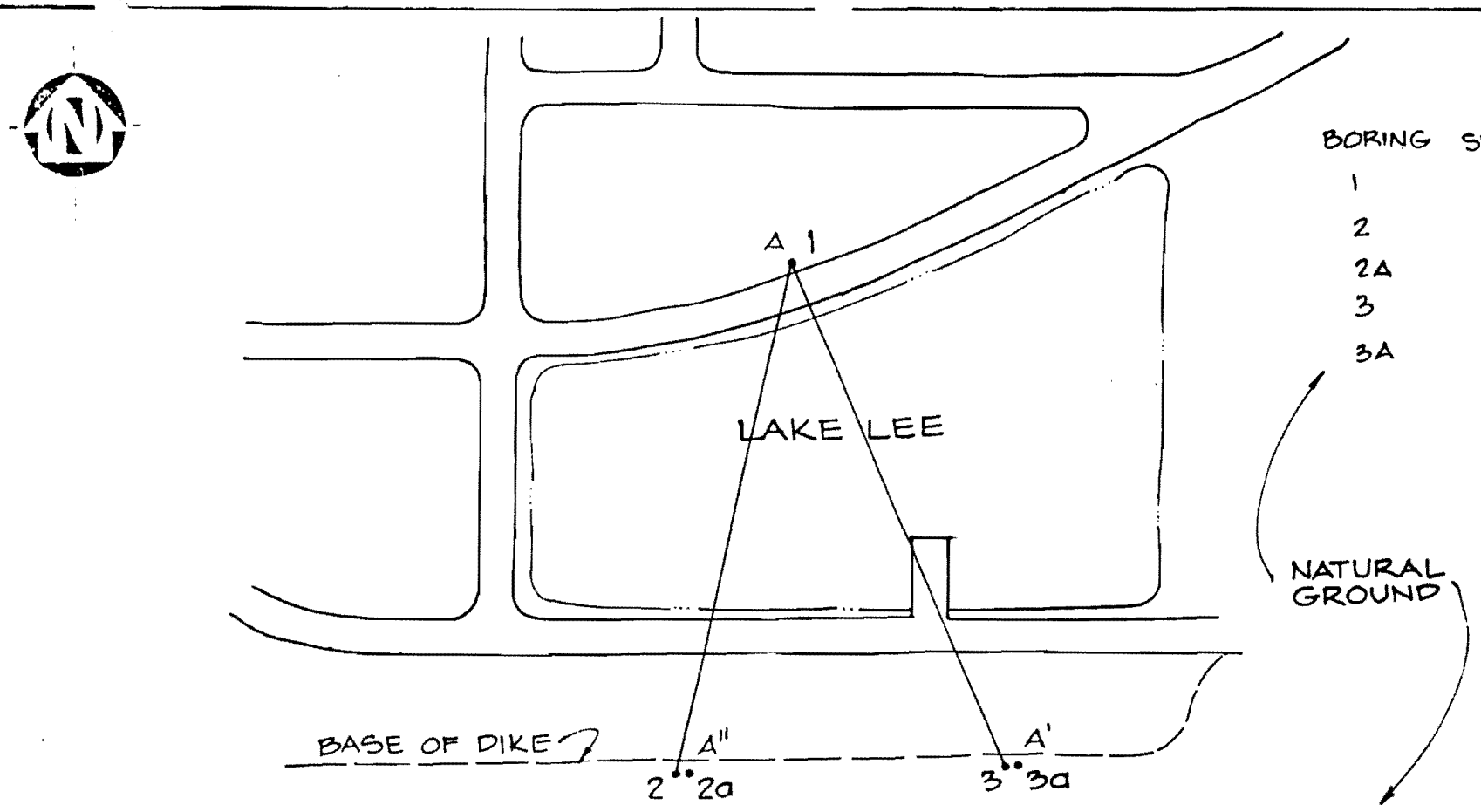
MEASUREMENTS ARE FROM GROUND LEVEL.

DATE JULY [illegible] OBSERVER [illegible]



Note: See Attachment I-5, "Location of Deep Water Intake Wells" for well 5 location.

Reference for Formational Interpretation "Personal Communication, M.E. Broom to G.D. Mayo, 1982".



BORING	SURFACE ELEV.
1	183.1'
2	163.6'
2A	163.8'
3	163.7'
3A	163.6'

NOTE: CROSS SECTIONS ARE ON ATTACHMENT XXIV

100 0 100 200

1"=100' scale feet

ATTACHMENT XXII

APPROXIMATE LOCATIONS
of
BORINGS AND CROSS-SECTIONS
EL DORADO CHEMICAL CO.

SCALE: 1" = 100' | DATE

MCI/CONSULTING ENGINEERS, INC

MCI CONSULTING ENGINEERS, INC.
4301 Hillsboro Road
Suite 224
Nashville, Tennessee 37215
Telephone (615) 383-4807

Corporate Headquarters
Nashville, Tennessee

Branch Offices
Knoxville, Tennessee
Huntsville, Alabama
Louisville, Kentucky

BORING LOG

SITE	El Dorado Chemical Company		
HOLE LOCATION	See Attachment XXII	DATE 1/7/85	HOLE NO. 1
SURFACE ELEVATION	183.1'	DRILLER	B. Casto
FOOTAGE SAMPLED	76.5'	HELPER	M. Harris
TOP OF ROCK	ELEV.	LOGGED BY	George D. Mayo
FOOTAGE CORED		WATER-DRILLING 15', 59'	ELEV. 168.1
BOTTOM OF HOLE 76.5'	ELEV. 106.6'	WATER-COMPLETION 24'	ELEV. 159.1

SAMPLING RECORD

SAMPLE NUMBER	FROM	TO	SAMPLE BLOWS	DESCRIPTION AND REMARKS
1	0.0	2.0		Brown silty, sandy clay - moist
Auger	2.0	5.0		Do. above
2	5.0	7.0		Brown and gray slightly sandy clay - moist
Auger	7.0	10.0		Do. above
3	10.0	12.0		Brownish gray slightly sandy silty clay - moist
Auger	12.0	15.0		Do. above
4	15.0	17.0		Brownish Gray slightly sandy, silty clay-wet,soft
				water at 15'
Auger	17.0	20.0		Do. Above, hard drilling
5	20.0	22.0		Gray plastic clay with silty laminations-dry
Auger	22.0	25.0		Do. above, hard drilling
6	25.0	27.0		Brownish gray clay with silty laminations-dry
				some lignitic laminations
Auger	27.0	30.0		Do. Above, hard drilling
7	30.0	32.0		Brownish gray clay with silty laminations-dry
Auger	32.0	35.0		Do. above, hard drilling
8	35.0	36.5		Brownish gray slightly silty clay with silty
				laminations - dry
Auger	36.5	40.0		Do. above, easier drilling
9	40.0	41.5		Brownish gray clay with silty sand lenses, wet

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Louisville, Kentucky

BORING LOG

SITE	El Dorado Chemical Company				
HOLE LOCATION	See Attachement XXII		DATE	1/7/85	HOLE NO. 1
SURFACE ELEVATION	183.1'		DRILLER	B. Castro	
FOOTAGE SAMPLED	76.5'		HELPER	M. Harris	
TOP OF ROCK		ELEV.	LOGGED BY	George D. Mayo	
FOOTAGE CORED			WATER-DRILLING	15', 59'	ELEV. 168.1
BOTTOM OF HOLE	76.5'	ELEV 106.6'	WATER-COMPLETION	24'	ELEV. 159.1

SAMPLING RECORD

SAMPLE NUMBER	FROM	TO	SAMPLE BLOWS	DESCRIPTION AND REMARKS
Auger	41.5	45.0		Do. above, easier drilling
10	45.0	46.5		Brownish gray clay with silty sandy lenses, wet
Auger	46.5	50.0		Do. above, easier drilling
11	50.0	51.5		Greenish gray clay with find sand partings
Auger	51.5	55.0		Do. above, easier drilling
12	55.0	56.5		Greenish gray clay with find sand partings
Auger	56.5	60.0		Do above, easy drilling at 59'
13	60.0	61.5		Gray silty sand, wet
Auger	61.5	65.0		Do above, easy drilling
14	65.0	66.5		Gray silty sand with few thin clay layers
Auger	66.5	70.0		Do. above, easy drilling
15	70.0	71.5		Gray silty sand with few thin clay layers
Auger	71.5	75.0		Do. above, easy drilling
16	75.0	76.5		Gray silty sand with few thin clay layers
				Piezometer 1 - 1" I.D. PVC Pipe
				Concrete Plug at surface, 0.8 stickup
		12.0	56.0	Cuttings
		55.0	56.0	Bentonite Pellets
		56.0	76.5	Sand
		61.0	66.0	Screened Interval

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Louisville, Kentucky

BORING LOG

SITE El Dorado Chemical Company			
HOLE LOCATION See Attachment XXII		DATE 1/9/85	HOLE NO. 2&2a
SURFACE ELEVATION 163.6'		DRILLER B. Casto	
FOOTAGE SAMPLED 50'		HELPER M. Harris	
TOP OF ROCK	ELEV.	LOGGED BY George D. Mayo	
FOOTAGE CORED		WATER-DRILLING 15' - 34'	ELEV. 148.
BOTTOM OF HOLE 50'	ELEV. 113.6	WATER-COMPLETION —	ELEV.

SAMPLING RECORD

SAMPLE NUMBER	FROM	TO	SAMPLE BLOWS	DESCRIPTION AND REMARKS
1	0.0	2.0		Brown silty, sandy clay, moist
washbore	2.0	5.0		Wash bore with water
2	5.0	7.0		Gray silty sand with small lignite pieces, wet
wash	7.0	10.0		Do. above
3	10.0	12.0		Light gray sand clay, moist
wash	12.0	15.0		Do. above
4	15.0	17.0		Light gray and Reddish brown silty sand with clayey sand at 15'
wash	17.0	20.0		Do. above
5	20.0	22.0		Greenish gray clay with very fine sand laminations
wash	22.0	25.0		Do. above
6	25.0	26.5		Greenish gray clay with silty laminations
wash	26.5	30.0		Do. above - very hard drilling 27-28'
7	30.0	31.5		Brownish gray clay with silty laminations
wash	31.5	35.0		Do. above-easy drilling at 34.0'
8	35.0	36.5		Gray silty sand, wet
wash	36.5	40.0		Do. above-easy drilling
9	40.0	41.5		Gray silty sand with few brownish gray thin clay layers
wash	41.5	45.0		Do. above - easy drilling

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BORING LOG

SITE	El Dorado Chemical Company		
HOLE LOCATION	See Attachment XXII	DATE 1/9/85	HOLE NO. 2&2a
SURFACE ELEVATION	163.6'	DRILLER B. Casto	
FOOTAGE SAMPLED	50'	HELPER M. Harris	
TOP OF ROCK	ELEV.	LOGGED BY George D. Mayo	
FOOTAGE CORED		WATER-DRILLING	ELEV.
BOTTOM OF HOLE 50'	ELEV 113.6	WATER-COMPLETION	ELEV.

SAMPLING RECORD

SAMPLE NUMBER	FROM	TO	SAMPLE BLOWS	DESCRIPTION AND REMARKS
10	45.0	46.5		Gray silty sand - wet
wash	46.5	50.0		Do. above - easy drilling
11	50.0	51.5		Gray silty sand, wet
				Piezometer 2 - 1" I.D. PVC Pipe
				Concrete Plug at Surface, 1.7' stickup
		31.0	15.0	Cuttings
		30.0	31.0	Bentonite Pellets
		31.0	51.5	Sand
		35.0	40.0	Screened Interval
				Piezometer 2a - 5± west of 2-1" I.D. PVC Pipe
				Concrete Plug at Surface, 1.6' stickup.
		8.0	12.0	Cuttings
		11.0	12.0	Bentonite Pellets
		12.0	20.0	Sand
		13.0	18.0	Screened Interval

MCI CONSULTING ENGINEERS, INC.
4301 Hillsboro Road
Suite 224
Nashville, Tennessee 37215
Telephone (615) 383-4807

Corporate Headquarters
Nashville, Tennessee

Branch Offices
Knoxville, Tennessee
Huntsville, Alabama
Louisville, Kentucky

BORING LOG

SITE El Dorado Chemical Company			
HOLE LOCATION See Attachment XXII		DATE 1/10/85	HOLE NO. 3&3a
SURFACE ELEVATION 163.7		DRILLER B. Casto	
FOOTAGE SAMPLED 51.5		HELPER M. Harris	
TOP OF ROCK	ELEV.	LOGGED BY George D. Mayo	
FOOTAGE CORED		WATER-DRILLING 15', 35'	ELEV. 148.7
BOTTOM OF HOLE 51.5	ELEV. 112.2	WATER-COMPLETION	ELEV.

SAMPLING RECORD

SAMPLE NUMBER	FROM	TO	SAMPLE BLOWS	DESCRIPTION AND REMARKS
1	0.0	2.0		Gray Silty Sand, moist
Washbore	2.0	5.0		Washbore with water
2	5.0	7.0		Gray silty clay with some fine sand
Wash	7.0	10.0		Do. above
3	10.0	12.0		Gray Clay with some find sand
Wash	12.0	15.0		Do. above
4	15.0	17.0		Gray Silty sand with some lignite, wet
Wash	17.0	20.0		Do. Above
5	20.0	21.5		No sample - Ironstone (?) layer
Wash	20.0	25.0		Hard Drilling - Very hard drilling 20.0-20.7
6	25.0	26.5		Greenish gray clay with silty laminations
Wash	26.5	30.0		Hard Drilling 26.5-28.0 - Easier 28-30
7	30.0	31.5		Brownish Gray clay with very thin (10mm) sand layers
Wash	31.5	35.0		Do. above, easier drilling
8	35.0	36.5		Brownish gray clay with many thin sand layers, wet
Wash	36.5	40.0		Do. above -
9	40.0	41.5		Gray silty sand with brownish gray thin clay layers, wet
Wash	41.5	45.0		Do. above

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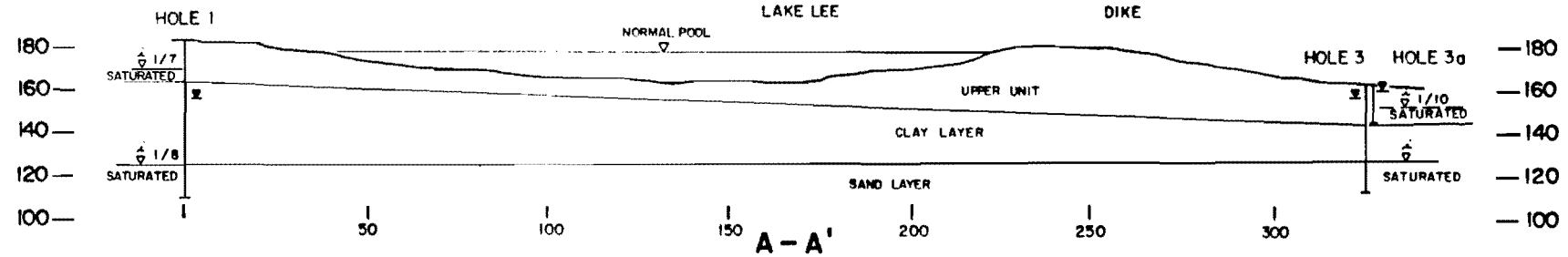
BORING LOG

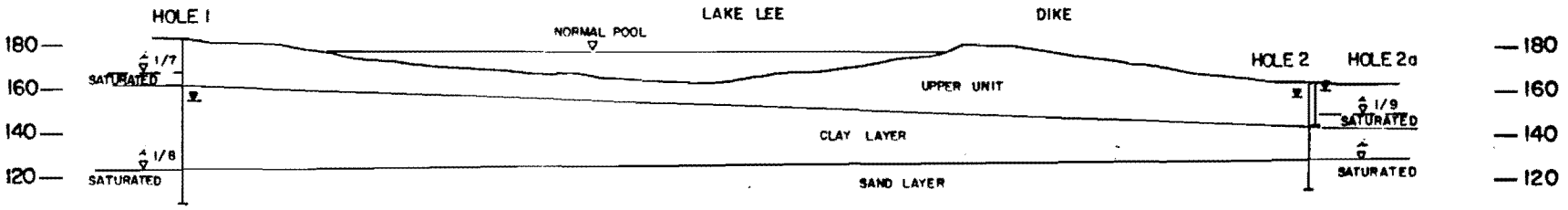
SITE	El Dorado Chemical Company		
HOLE LOCATION	See Attachment XXII	DATE 1/10/85	HOLE NO. 3&3a
SURFACE ELEVATION	163.7	DRILLER	B. Casto
FOOTAGE SAMPLED	51.5	HELPER	M. Harris
TOP OF ROCK	ELEV.	LOGGED BY	George D. Mayo
FOOTAGE CORED		WATER-DRILLING	15', 35' ELEV. 148.7
BOTTOM OF HOLE	51.5 ELEV. 112.2	WATER-COMPLETION	ELEV.

SAMPLING RECORD

SAMPLE NUMBER	FROM	TO	SAMPLE BLOWS	DESCRIPTION AND REMARKS
10	45.0	46.5		Gray silty sand with some lignite, wet
Wash	46.5	50.0		Do. above
11	50.0	51.5		Gray silty sand, wet
				Piezometer 3 - 1" I.D. PVC Pipe
				Concrete Plug at surface, 1.1' stickup
		18.0	22.0	Cuttings
		22.0	26.5	Bentonite pellets
		26.5	51.5	Sand
		35	40	Screened interval
				Piezometer 3a - 5' west of 3 - 1" I.D. PVC pipe
				Concrete Plug at surface, 1.2' stickup
		5	10	Cuttings
		10	11	Bentonite Pellets
		11	20	Sand
		13	18	Screened Interval



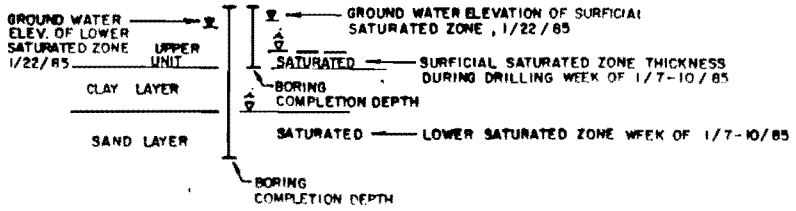
A - A'



A - A"

NOTES:

1. GROUND WATER ELEVATIONS OF THE SURFICIAL SATURATED ZONES MAY BE AFFECTED BY LAKE LEE
2. SECTION LINES ARE SHOWN ON ATTACHMENT XXII
3. BORING LOGS ARE ATTACHMENT XXIII



LEGEND

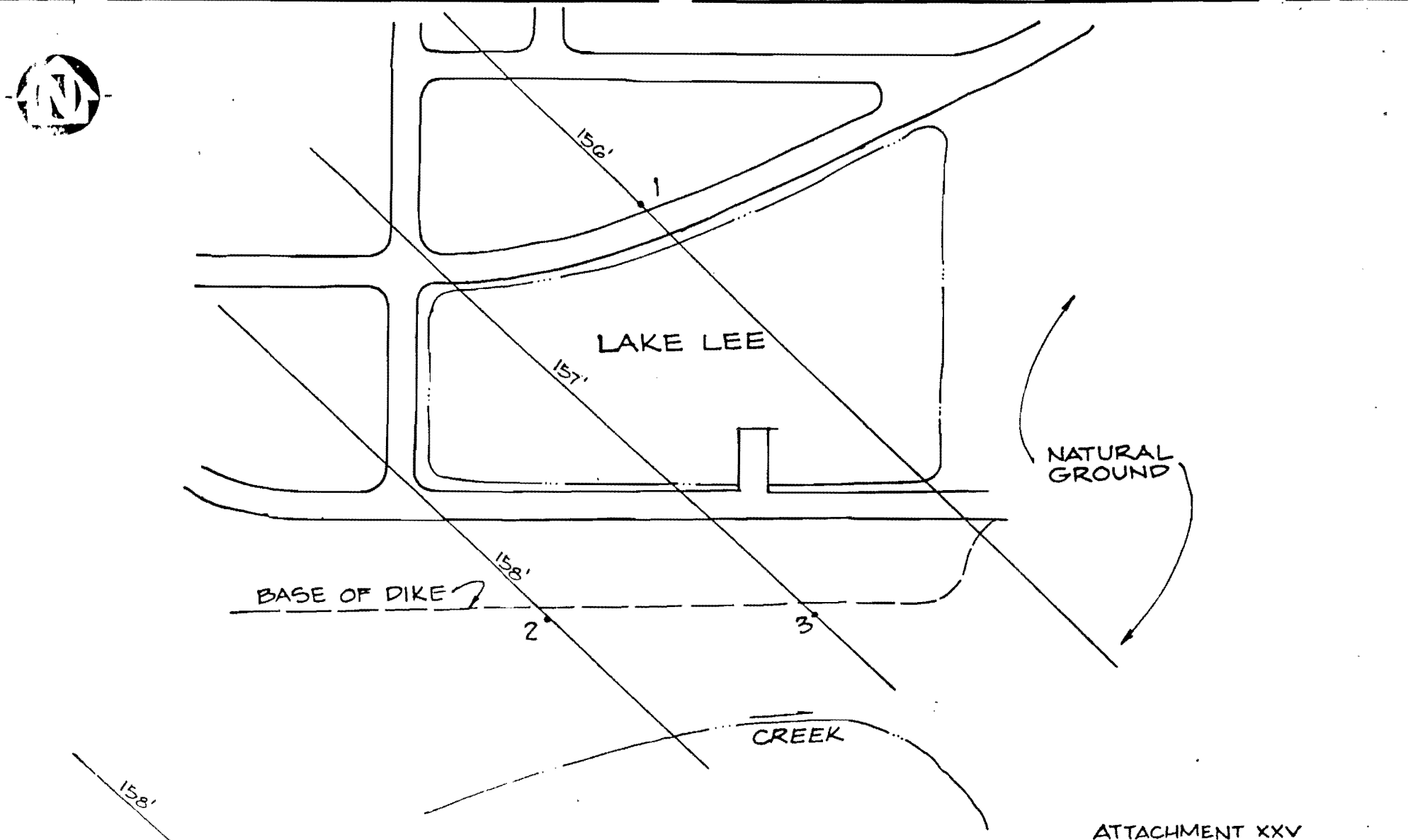
ATTACHMENT XXIV
GENERALIZED CROSS-SECTIONS
A - A'
A - A"

SCALE: 1" = 30' HORIZ.; 1" = 50' VERT.

PREPARED FOR:
EL DORDADO CHEMICAL CO.

MCI CONSULTING ENGINEERS, INC.
NASHVILLE BIRMINGHAM HUNTSVILLE LOUISVILLE

PROJ.	DATE	SHEET OF

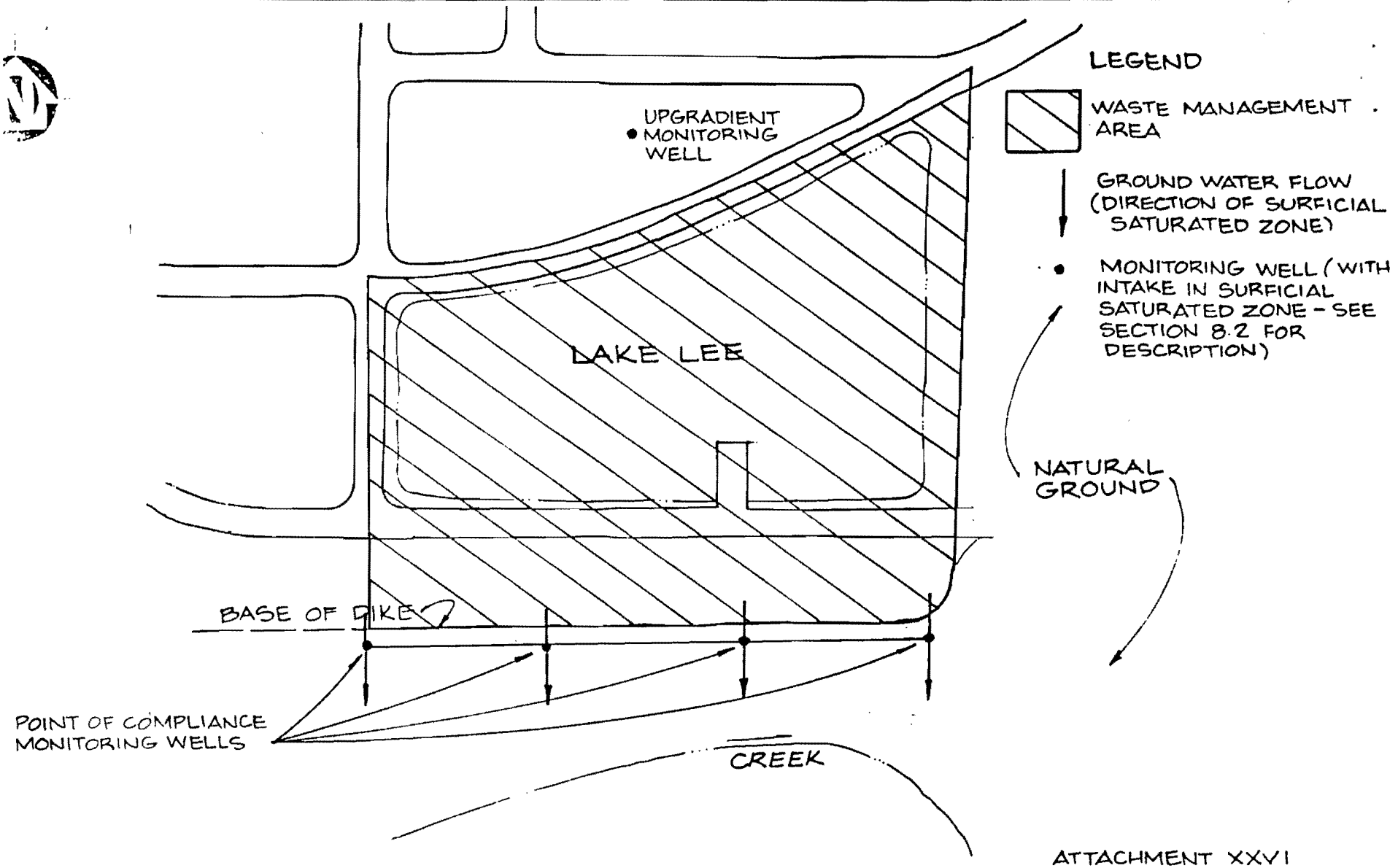


ATTACHMENT XXV

POTENTIOMETRIC SURFACE
of
LOWER SATURATED ZONE
JANUARY 22, 1985
EL DORADO CHEMICAL COMPANY

SCALE: 1" = 100' | DATE

MCI/CONSULTING ENGINEERS INC



ATTACHMENT XXVI

DETECTION MONITORING SYSTEM

EL DORADO CHEMICAL CO

SCALE: 1" = 100' | DATE

MCI/CONSULTING ENGINEERS, INC

ATTACHMENT XXVII (Continued)

D. Field pH Measurements

Well	pH			
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____
____	____	____	____	____

E. Tracking System

Relinquished By	Relinquished To	Date Received	Time	Method of Transport	Samples Properly Preserved	Seal Integrity
_____	_____	_____	____	_____	_____	_____
_____	_____	_____	____	_____	_____	_____
_____	_____	_____	____	_____	_____	_____
_____	_____	_____	____	_____	_____	_____

Attachment IVII

FIELD DATA

A.

Well	Depth to Water	Depth to Bottom	Difference	Volume (Diff.x 0.2)	Volume Purged	Date	Time

B.

Well	Sampling Date	Time	No. of Bottles	Weather	Sampling Personnel	Remarks

C. Analyses Requested

Well					
pH					
NO_3					
NH_3					
SO_4					

MCI
Consulting Engineers, Inc.

4301 Hillsboro Road, Suite 224
Nashville, Tennessee 37215
615 383-4807

Engineering, Planning, Landscape Architecture

June 12, 1985

Mr. Jim Warnock
El Dorado Chemical Company
P.O. Box 231
El Dorado, Arkansas 71731

Dear Jim:

It was good to see you again at the Federation conference. I enjoyed talking with you at lunch and am glad that Lake Lee is no longer a regulated unit. I did find the well diagram originals when I returned after the meeting in Little Rock, and they are enclosed.

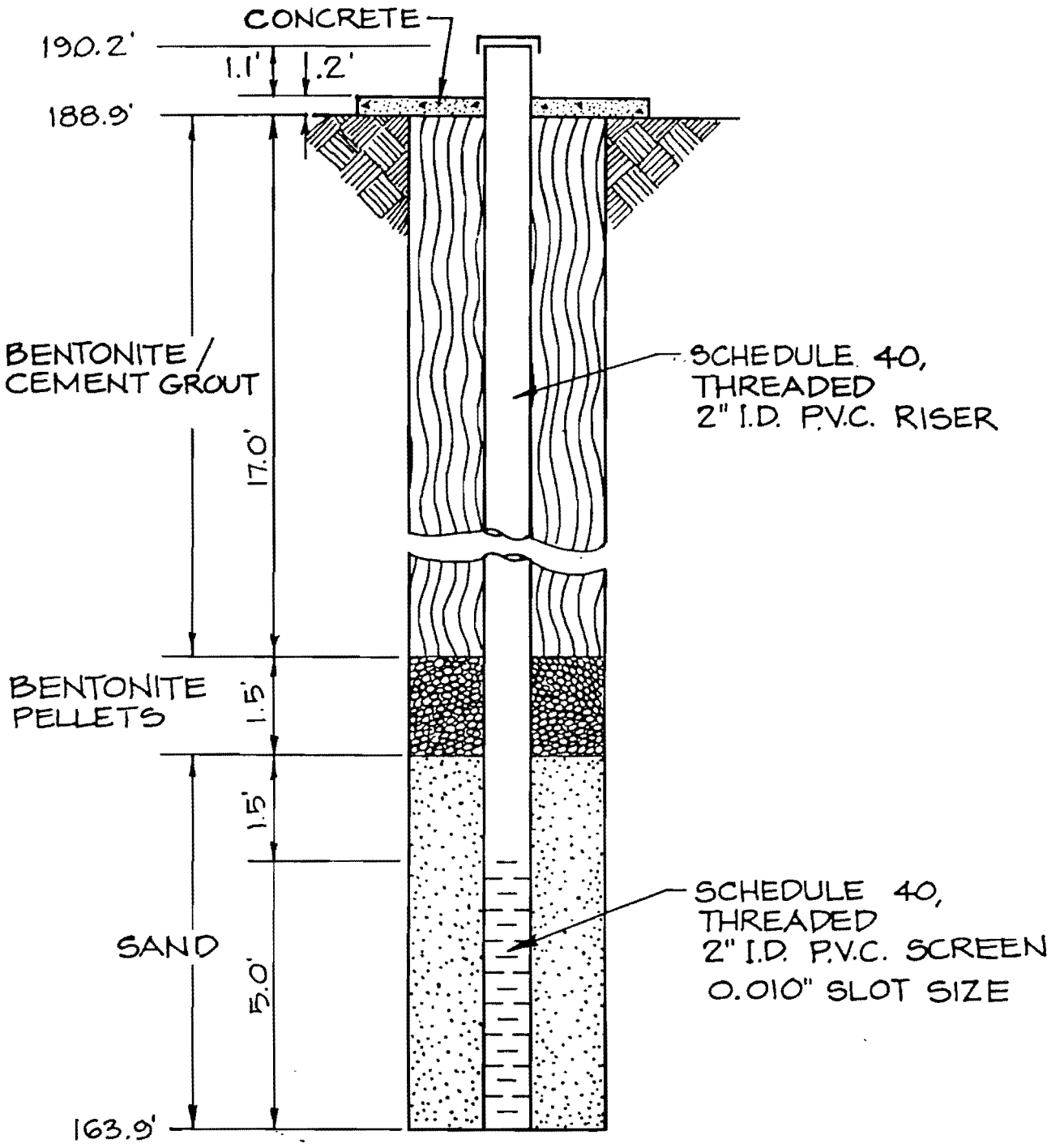
Always feel free to call me if you have any questions or need any help with environmental projects at El Dorado Chemical. Again, I enjoyed working with you on the Lake Lee ground water project.

Sincerely,

MCI CONSULTING ENGINEERS, INC.

George D. Mayo
Hydrogeologist

GDM/js



MONITORING WELL L-1

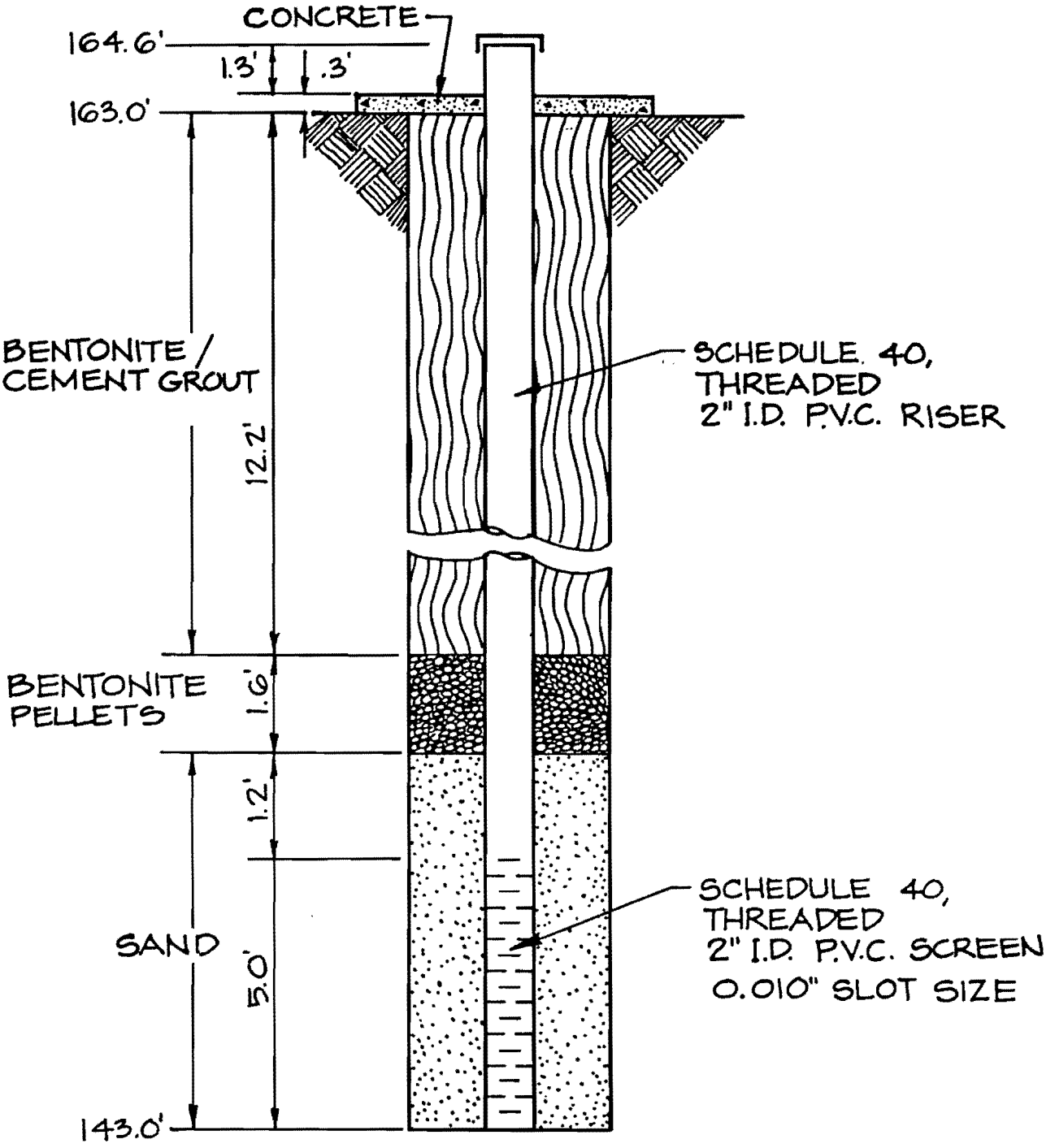
EL DORADO CHEMICAL CO.

EL DORADO, ARKANSAS

SCALE: NO SCALE | DATE

MCI/CONSULTING ENGINEERS, INC.

NASHVILLE KNOXVILLE HUNTSVILLE LOUISVILLE



MONITORING WELL L-2

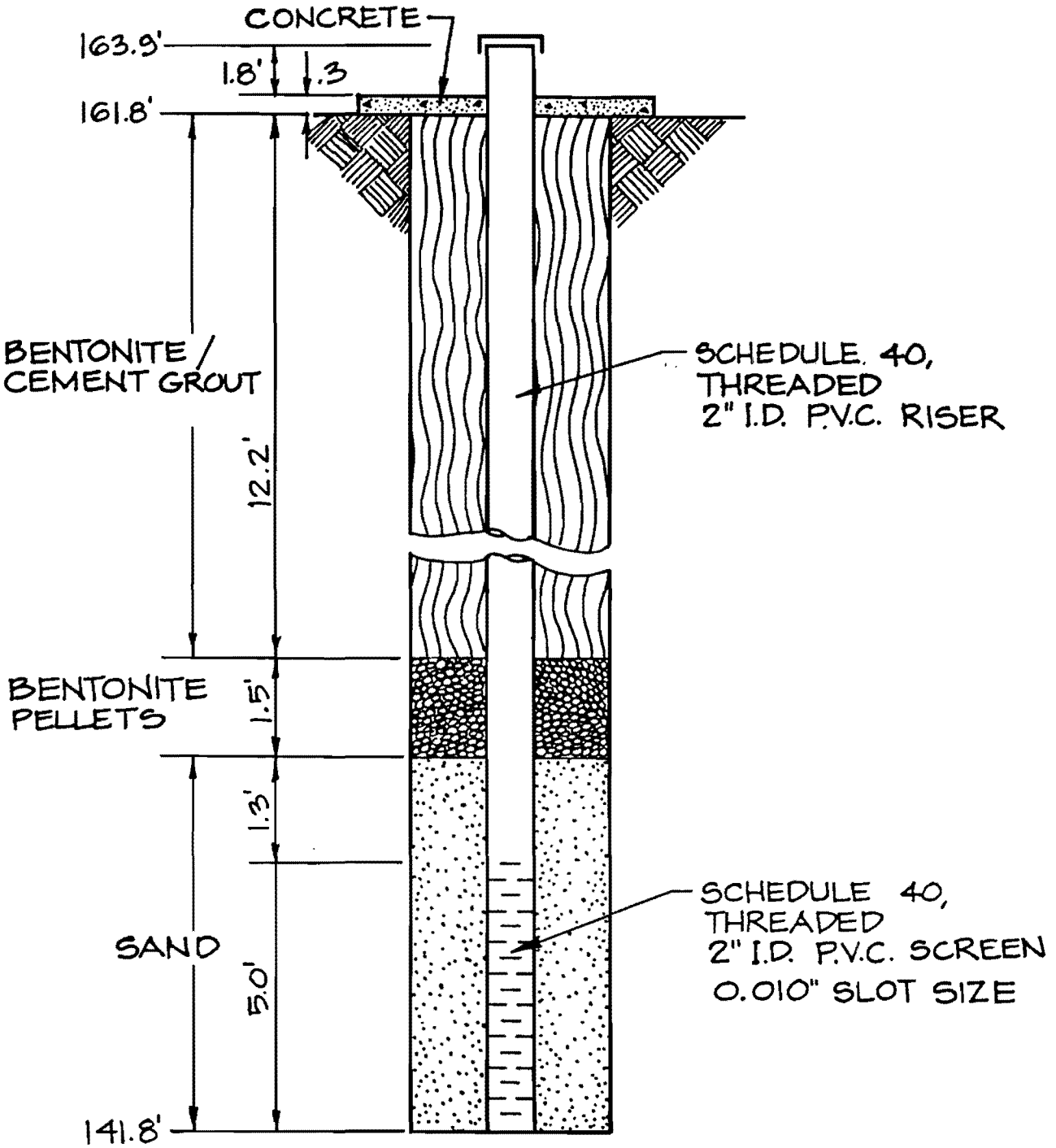
EL DORADO CHEMICAL CO.

EL DORADO, ARKANSAS

SCALE: NO SCALE | DATE

MCI/CONSULTING ENGINEERS, INC.

NASHVILLE KNOXVILLE HUNTSVILLE LOUISVILLE



MONITORING WELL L-3

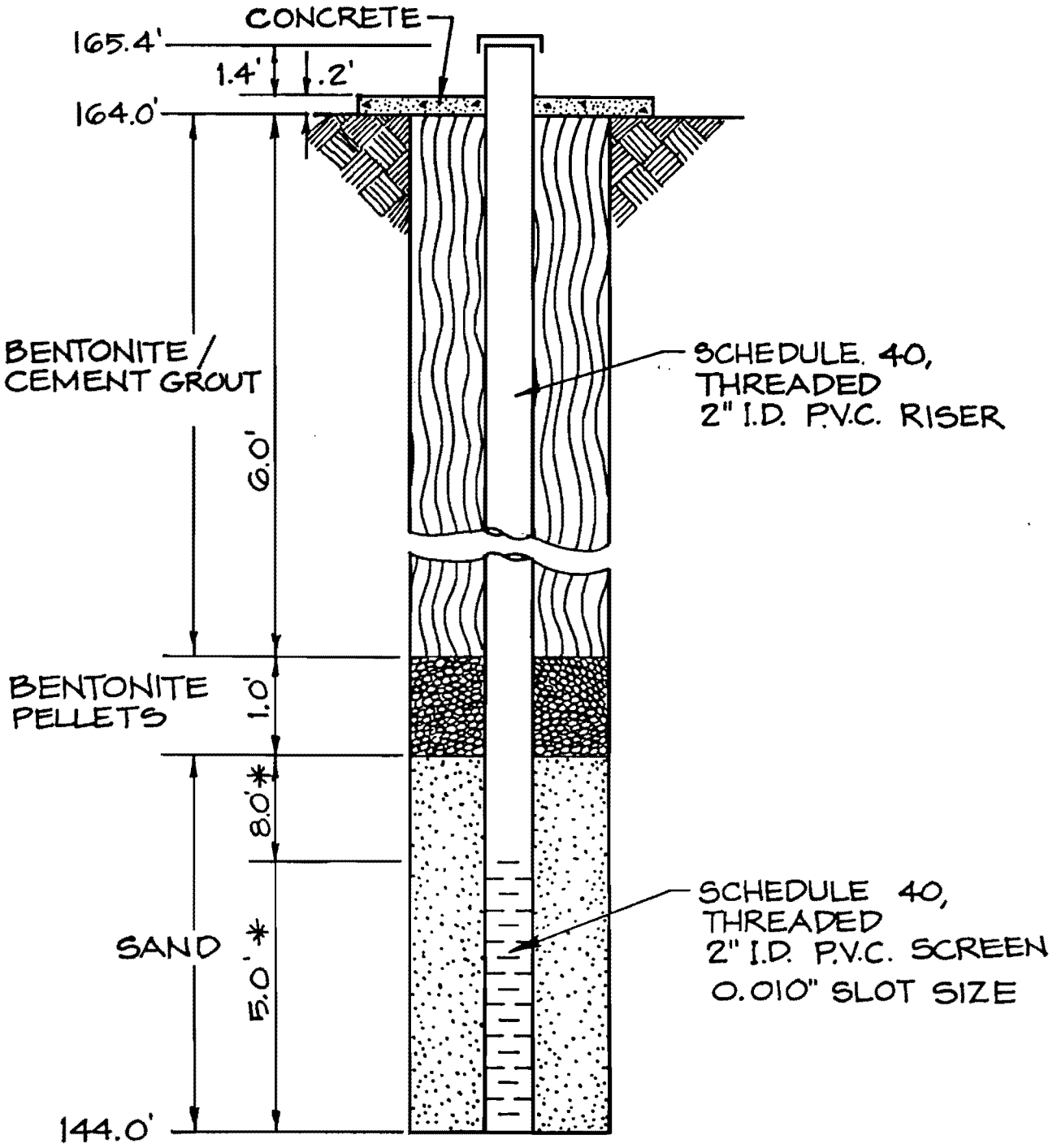
EL DORADO CHEMICAL CO.

EL DORADO, ARKANSAS

SCALE: NO SCALE	DATE

MCI/CONSULTING ENGINEERS, INC.

NASHVILLE KNOXVILLE HUNTSVILLE LOUISVILLE



*NOTE: NATURAL SAND DUE TO HOLE COLLAPSE.

MONITORING WELL L-4

EL DORADO CHEMICAL CO.

EL DORADO, ARKANSAS

SCALE: NO SCALE	DATE

MCI/CONSULTING ENGINEERS, INC.

NASHVILLE KNOXVILLE HUNTSVILLE LOUISVILLE

ELDORADO CHEMICAL CORP.

SITE INSPECTION 3-29-94

LEE POND - pH at time of visit 3.0

TOURED SITE W/ GLENN DIXELY / JOHN LAMB (EMPIRE

TWO PONDS LAKE LEE ONSITE & LAKE KILLDEER

FOUND GROUND WATER STUDY FOR LAKE LEE.

GOT G.W. MONITORING DATA FOR BOTH ON LAKE LEE & KILLDEER