DOWNGRADIENT GROUNDWATER EVALUATION

CHEMETRON REMEDIATION PROJECT

BERT AVENUE SITE

CHEMETRON CORPORATION, INC.

NEWBURGH HEIGHTS, OHIO

January 10, 1997

- B. Koh & Associates, Inc.-

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TABLE OF CONTENTS

LIST OF FIGURES

1.0 GENERAL INFORMATION

This document presents the Downgradient Groundwater Evaluation for the Bert Avenue site located in Newburgh Heights, Ohio. Chemetron Corporation, Inc. (Chemetron), performed this investigation to address comments issued by the Ohio Environmental Protection Agency (OEPA) regarding Chemetron's Closure Plan. On December 5, 1994, Chemetron submitted the Final Closure/Post Closure Plan (Dames & Moore, 1994) which contained plans to construct an onsite containment cell designed to store radioactive and solid waste at the Bert Avenue site. This plan was prepared in accordance with Ohio Administrative Code (OAC) Rules 3745-27-11 and -13.

On July 24, 1996, the OEPA approved the Closure Plan provided that Chemetron addressed 16 conditions. Condition No. 1, as stated in the approval letter, required Chemetron to describe and quantify the groundwater quality of the significant zone of saturation downgradient of the existing waste as required by OAC Rule 3745-27-06(C)(2)(d). Therefore, Chemetron undertook this evaluation with the following objectives:

- Obtain data requested by OEPA to demonstrate that the significant zone of saturation (undifferentiated unit) downgradient of the existing waste is not capable of producing sufficient ground water for analysis. Information specifically requested by OEPA included: in-situ hydraulic conductivity, stratigraphy, grain size, and laboratory permeability.

- If the undifferentiated unit is capable of producing sufficient groundwater for analysis, describe and quantify groundwater quality in the undifferentiated unit at the site downgradient of the existing waste area, as required by OAC Rule 3745-27-06(C)(2)(d).

2.0 DOWNGRADIENT INVESTIGATION

Chemetron intended to perform the downgradient evaluation in accordance with the Work Plan, Downgradient Ground Water Quality Evaluation (Work Plan, Dames & Moore, 1996) which was accepted by the OEPA on December 10, 1996. This plan specified the installation of three monitoring wells at the bottom of the ravine. Four existing wells and the three new wells would subsequently be sampled four times at a frequency of once every two days. Each sample would then be analyzed for compounds 1 to 79 listed in Appendix I of OAC Rule 3745-27-10 and also total organic carbon, phosphorus, cyanide, gross alpha/beta and total uranium.

Chemetron originally scheduled this investigation in early September, 1996; however, the drillers did not believe that the ravine bottom was stable enough to support a drill rig. Therefore, B. Koh & Associates, Inc. (BKA), performed a cursory investigation to determine the nature of the shallow geologic materials and to collect soil samples for physical soils testing. Information from the cursory investigation was used to determine the feasibility and the value of a well installation program. In the event that well installation was not feasible, data obtained from this cursory investigation would be used to fulfill the requirement for a downgradient evaluation.

2.1 DRILLING PROGRAM

On September 25, 1996, BKA mobilized to the Bert Avenue site to drill three borings (H-1, H-2, and H-3) in similar locations to those proposed in the Work Plan. Figure 1 presents the locations of the borings. BKA used a hand augur to advance the borings from the surface to the top of the lacustrine clay unit which is considered the bottom of the undifferentiated unit (saturated zone) (Dames & Moore, 1992).

A total of 11 samples were collect at approximately 1 foot intervals, and each sample was placed in a plastic bag and labeled. A BKA geologist inspected and logged the soil samples in a field book. Field classifications included: color, grain size, degree of saturation, any other descriptive features. The field geologist also made a qualitative assessment regarding the presence of a significant zone of saturation and the availability of water in this zone. All geologic information was transcribed to boring logs.

2.2 ANALYTICAL PROGRAM

All 11 soil samples were sent to GEO-TEST, Inc., Albuquerque, New Mexico, for physical soils testing. Each sample was analyzed for grain size by sieve analysis (ASTM C-136). Due to the limited sample volume of the augur head, multiple samples of similar soil type were combine to provide enough sample for the permeability tests. Soil similarity was based on soil color and results of the sieve analyses. Those samples selected and combined for the permeability tests underwent grain size analysis using ASTM D-422 to determine the sizes and quantities of soil that passed the No. 200 sieve (< 0.075 mm diameter). Permeability testing was performed using the Corps of Engineers method EM-11102-1906.

3.0 DISCUSSION OF RESULTS

3.1 STRATIGRAPHY

Appendix A contains the boring logs developed from the geologic information obtained during this investigation. Each boring was advanced to a depth of five feet. Soil types identified in this interval include: a brown to black organic silt from 0 to 1 foot deep and a gray silt and sand (varying proportions) to approximately 3.5 feet deep. Gray silty clay was encountered at 3.5 to 4 feet. This silty clay is indicative of the lacustrine unit; therefore, no further drilling was needed.

One object of this investigation was to obtain information regarding the significant zone of saturation downgradient of the waste. At the Bert Avenue site, the zone of saturation is a water table aquifer that occurs in the undifferentiated unit and is confined below by the lacustrine clay (Dames & Moore, 1992). The undifferentiated unit is described as a brown-tan to reddish brown sand and gravel interbedded with silt and clay. No materials resembling this description were encountered in any of the boreholes. On the contrary, materials resembling the lacustrine clay were encountered in all the boreholes.

Based on the above information, no significant zone of saturation exists downgradient of the existing waste. The Work Plan specifically states that in this instance, no monitoring wells will be installed. Therefore, BKA limited field activities to drilling the three hand augur borings.

3.2 GRAIN SIZE AND SIEVE ANALYSES

Results of the grain size and sieve analyses are presented in Appendix B. A review of the results indicates that, in 9 of 11 soil samples, greater than 50% of the material passed through the No. 200 sieve which means that those samples were composed mostly of silt and clay. The proportion of fines (material passing the No. 200 sieve) ranged from 44.5 to 73.4 %. Results of the grain size analysis indicated that the typical grain size distribution for the ravine sediments is as follows:

Gravel:	6 - 8%
Sand:	37 - 42%
Silt	36 - 38%
Clay:	16 - 17%

3.3 PERMEABILITY ANALYSES

The following two samples were analyzed for permeability: a composite from Boring 2 with samples from depths of 1-2 feet, 2-3 feet, and 3-4 feet, and a sample from 3 to 4 feet from Boring 3. Of the materials encountered, those aliquots selected for analysis were most likely to represent the undifferentiated unit. No suitable sample was obtained from Boring 1 for the permeability

testing. All samples were recompacted to densities representative of the undifferentiated unit (Dames & Moore, 1992).

A review of the results indicates that the permeabilities of the silty material in Borings 2 and 3 are 9.92 E -8 and 4.26 E -8 cm/sec, respectively (Appendix B). Analytical data clearly demonstrates that the soils in the boreholes exhibit permeabilities representative of silty clay and clayey materials (10^{-9} to 10^{-6} cm/sec). For comparison, permeability data gathered during the initial site characterization indicates that the undifferentiated unit exhibited an average permeability of 1.5 x 10^{-4} cm/sec, and the lacustrine clay exhibited an average permeability of 2.1 x 10^{-7} cm/sec (Dames & Moore, 1992).

4.0 CONCLUSIONS

BKA performed this Downgradient Groundwater Evaluation to determine if a significant zone of saturation downgradient of the existing waste was present and was capable of producing water for groundwater analysis. If so, then BKA would then undertake the necessary activities to quantify the aquifer properties and the groundwater quality. Based on the information presented in this report, we conclude that no such significant zone of saturation exists downgradient of the existing waste. This conclusion is based on the following information:

1. Groundwater occurs as a water table aquifer in the undifferentiated unit and is confined below by the lacustrine clay. No undifferentiated unit sediments were observed downgradient of the waste; therefore, no significant zone of saturation was observed.

2. Geologic and laboratory data all indicate that the material encountered in each borehole was the lacustrine clay.

Data from this investigation confirms the findings presented in the Final Site Characterization Report (Dames & Moore, 1992) which states that,

> "As the swampy area is immediately underlain by the confining gray lacustrine clay, which extends for a depth in excess of 75 feet below the swampy area and has hydraulic conductivity values of less than $1x\ 10^{-6}$ cm/sec, monitoring wells installed in this area would not provide useful data and were deleted from this program."

5.0 REFERENCES

1. Dames & Moore, Inc. 1992. Final Site Characterization Report, Harvard and Bert Avenue Sites, Newburgh Heights, Ohio.

2. Dames & Moore, Inc. 1996. Work Plan, Downgradient Ground Water Quality Evaluation, Bert Avenue Site, Chemetron Corporation, Inc., Newburgh Heights, Ohio.

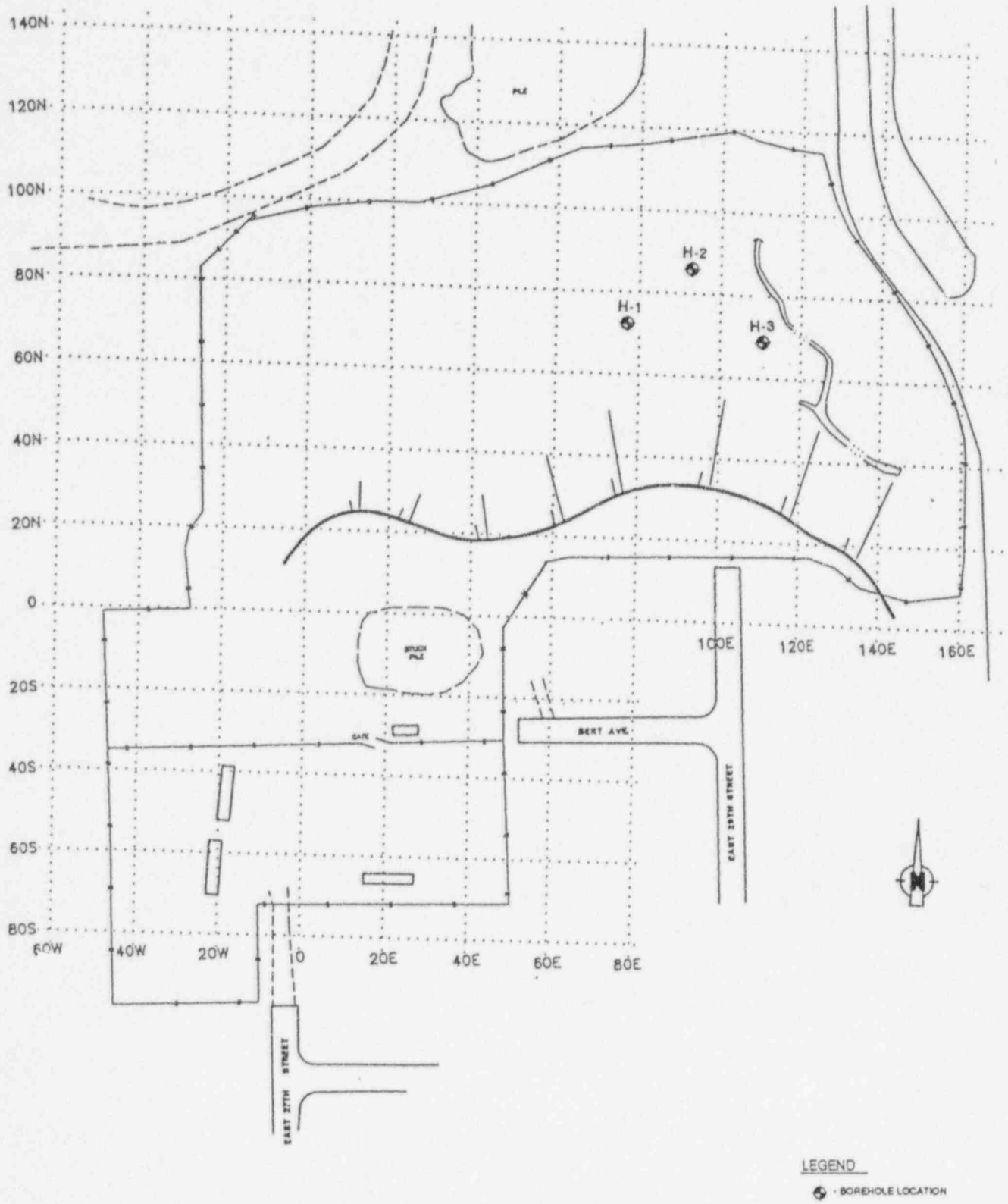

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FIGURE 1
BOREHOLE LOCATION MAP
BERT AVENUE SITE
NEWBURGH HEIGHTS, OHIO

SOURCE:
DAMES & MOORE, INC., "FINAL SITE CHARACTERIZATION REPORT, HARVARD AND BERT AVENUE SITES, NEWBURGH HEIGHTS, OHIO," JUNE 15, 1992.

DATE: 8/16/96

SCALE: 1" = 120'

APPENDIX A

Boring Logs

LOCATION OF BORING

SEE FIGURE 1 IN DOWNGRADIENT GROUNDWATER EVALUATION

CLIENT	CHEMETRON CORPORATION, INC.
LOCATION	NEWBURGH HEIGHTS
DRILLING METHOD	HAND AUGUR
BORING NO.	H-1
SAMPLING METHOD	AUGUR BUCKET
SHEET	1 OF 1
DRILLING START / FINISH	

WATER LEVEL				
TIME				
DATE				
CASING DEPTH				

TIME START / TIME FINISH / DATE START / DATE FINISH

SAMPLER TYPE	PENETRATION (FT.)	RECOVERY (FT.)	SAMPLE NO.	BLOWS/6 IN.	SCAN RESULTS (BETA/GAMMA)	DEPTH (FT.)	SOIL GRAPH	
AUGUR	1	1	1	NA		1		Black Organic SILT & Clay, wet, water bubbled in borehole
AUGUR	1	0	2	NA		2		
AUGUR	1	1	3	NA		3		Dark Gray Sandy SILT, some Clay, wet
AUGUR	1	1	4	NA		4		Gray Silty CLAY, stiffer than overlying soils, moist
AUGUR	1	1	5	NA		5		
								END OF BORING

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LOCATION OF BORING

SEE FIGURE 1 IN DOWNGRADIENT GROUNDWATER EVALUATION

CLIENT: CHEMETRON CORPORATION, INC.				LOCATION: NEWBURGH HEIGHTS
DRILLING METHOD: HAND AUGUR				BORING NO.: H-2
SAMPLING METHOD: AUGUR BUCKET				SHEET: 1 OF 1
				DRILLING
				START / FINISH
WATER LEVEL				TIME / TIME
TIME				
DATE				DATE / DATE
CASING DEPTH				

SAMPLER TYPE	PENETRATION (FT.)	RECOVERY (FT.)	SAMPLE NO.	BLOWS/6 IN.	SCAN RESULTS (BETA/GAMMA)	DEPTH (FT.)	SOIL GRAPH	
AUGUR	1	1	1	NA		1		Brown SILT with Fine Sand, damp
AUGUR	0.8	0.8	2	NA		2		Gray SILT with Fine Sand, damp, Fine Sand lens
AUGUR	1.2	1	3	NA		3		Gray SILT with Fine Sand and Clay, wet
AUGUR	1	1	4	NA		4		Gray Silty CLAY, trace Fine Sand, moist - wet
AUGUR	1	1	5	NA		5		END OF BORING

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LOCATION OF BORING

SEE FIGURE 1 IN DOWNGRADIENT GROUNDWATER EVALUATION

CLIENT: CHEMETRON CORPORATION	LOCATION: NEWBURGH HEIGHTS
DRILLING METHOD: HAND AUGUR	BORING NO: H-3
SAMPLING METHOD: AUGUR BUCKET	SHEET: 1 OF 1
	DRILLING START / FINISH
WATER LEVEL	TIME / TIME
TIME	
DATE	DATE / DATE
CASING DEPTH	

SAMPLER TYPE	PENETRATION (FT.)	RECOVERY (FT.)	SAMPLE NO.	BLOWS/6 IN.	SCAN RESULTS (BETA/GAMMA)	DEPTH (FT.)	SOIL GRAPH	
AUGUR	2	0	1	NA		1		
						2		
AUGUR	1	1	2	NA		3		Gray SILT with Fine Sand, wet
AUGUR	1	1	3	NA		4		Gray Silty CLAY, moist - wet
AUGUR	1	1	4	NA		5		Gray Silty CLAY, moist
								END OF BORING

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APPENDIX B

Laboratory Data Sheets

APPENDIX B

Laboratory Data Sheets

SIEVE ANALYSIS (ASTM C-136)								
SAMPLE	PERCENT PASSING (SCREEN SIZE)							
	3/4"	1/2"	3/8"	#4	#10	#40	#80	#200
H1at 2'-3'	100	100	100	100	90	72	59	50.0
H1at 3'-4'	100	100	100	99	98	91	83	73.4
H1 at 4'-5'	100	100	100	97	94	83	68	58.7
H2 at 0-6"	100	100	99	96	92	71	53	48.9
H2 at 1'-2'	100	100	99	96	94	82	64	53.8
H2 at 2'-3'	100	100	100	98	95	82	65	51.2
H2 at 3'-4'	100	98	98	96	92	80	61	50.1
H2 at 4'-5'	100	100	99	97	93	81	62	51.8
H3 at 0-2'	100	100	100	100	99	72	56	50.4
H3 at 2'-4'	100	100	98	97	92	73	56	44.5
H3 at 4'-5'	100	100	99	95	92	80	65	54.8

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Project: Miscellaneous Testing

FALLING HEAD PERMEABILITY (EM 1110-2-1906)

Sample:	Combination of H2 at 1'-2'; H2 at 2'-3', and H2 at 3'-4'
Sample Type:	Remolded
Specific Gravity of Sample:	2.699
Wet Unit Weight of Sample:	135.5 pcf
Dry Unit Weight of Sample:	117.2 pcf
Initial Moisture Content:	15.6 %
Void Ratio:	0.44
Permeability:	9.92E-08 cm/sec

FALLING HEAD PERMEABILITY (EM 1110-2-1906)

Sample:	Hole No. 3 at 3'-4'
Sample Type:	Remolded
Specific Gravity of Sample:	2.73
Wet Unit Weight of Sample:	134.0 pcf
Dry Unit Weight of Sample:	118.1 pcf
Initial Moisture Content:	13.4 %
Void Ratio:	0.44
Permeability:	4.26E-08 cm/sec

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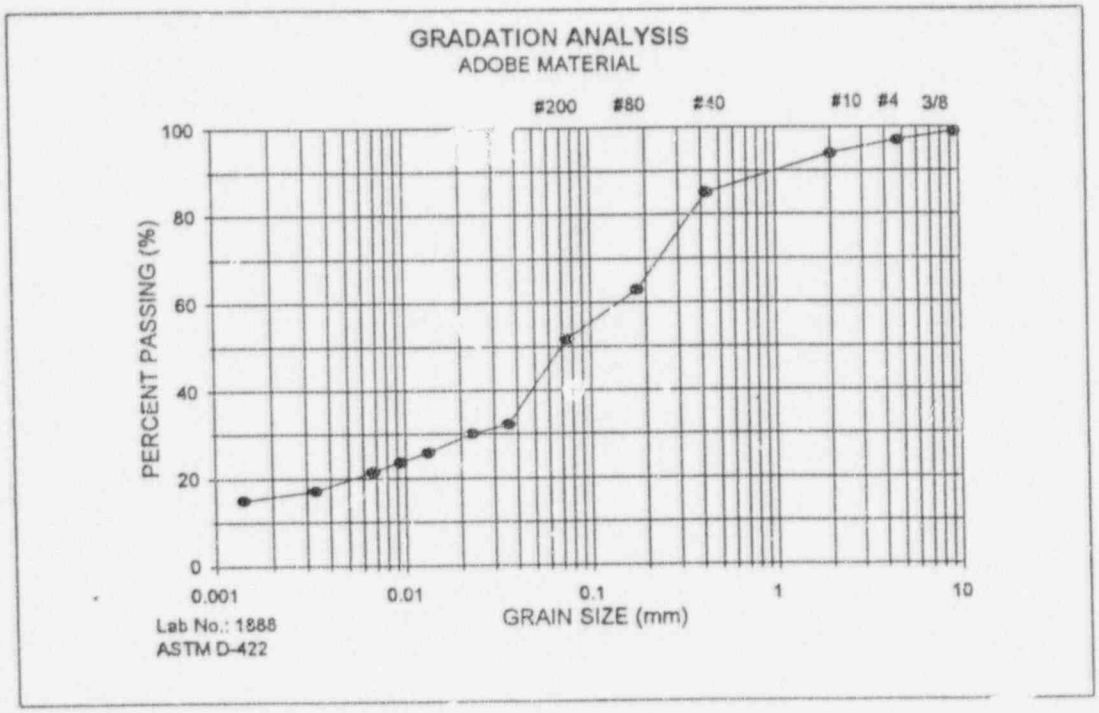
Lab No. 1888
Project No. 3-61031

Sample: Combination Sample of H2 at 1'-2', H2 at 2'-3', and H2 at 3'-4'

GRAIN SIZE ANALYSIS (ASTM D-422)

Standard Sieve	Sieve Size (mm)	Percent Passing
1/2"	12.500	100
3/8"	9.5000	99
No. 4	4.7500	97
No. 10	2.0000	94
No. 40	0.4250	85
No. 80	0.1800	63
No. 200	0.0750	51.7
	0.0359	32.3
	0.0228	30.1
	0.0133	25.8
	0.0095	23.7
	0.0068	21.5
	0.0033	17.2
	0.0014	15.1



AASHTO TEXTURAL CLASSIFICATION

GRAVEL:	6 %
SAND:	42 %
SILT:	36 %
CLAY:	16 %

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December 13, 1996
B. Koh and Associates
Page 4

Lab No. 1888
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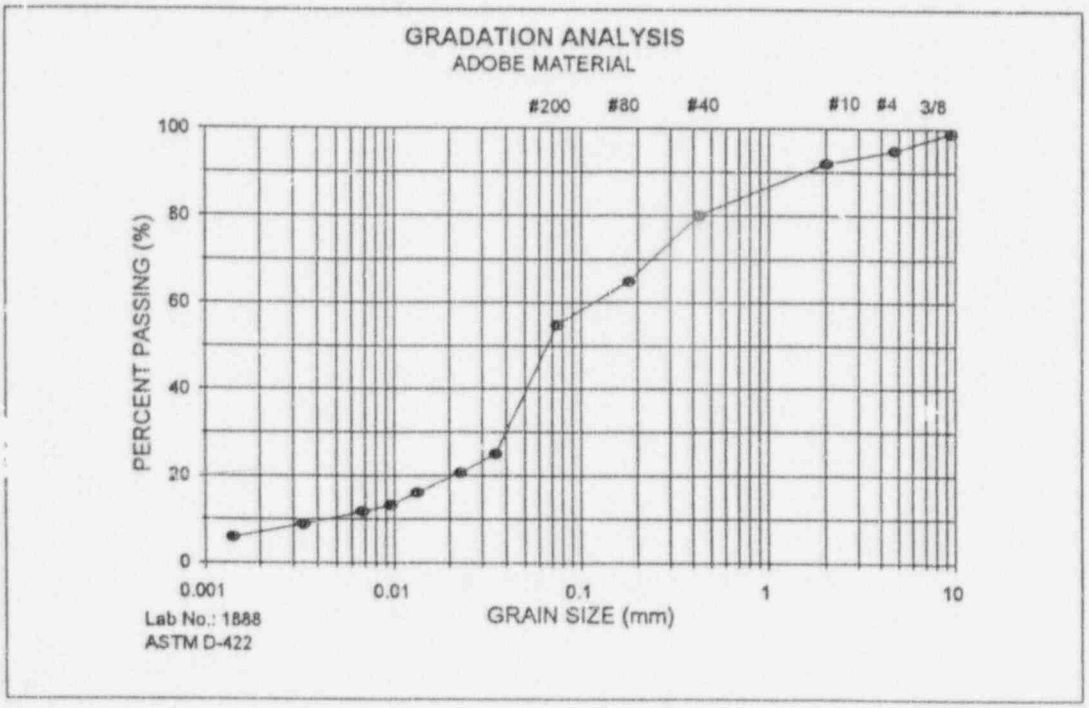
Sample: Hole No. 3 at 4'-5'

GRAIN SIZE ANALYSIS (ASTM D-422)

Standard Sieve	Sieve Size (mm)	Percent Passing
1/2"	12.500	100
3/8"	9.5000	99
No. 4	4.7500	95
No. 10	2.0000	92
No. 40	0.4250	80
No. 80	0.1800	65
No. 200	0.0750	54.8
	0.0355	25.0
	0.0228	20.6
	0.0134	16.2
	0.0096	13.2
	0.0068	11.8
	0.0034	8.8
	0.0014	5.9



AASHTO TEXTURAL CLASSIFICATION

GRAVEL:	8 %
SAND:	37 %
SILT:	38%
CLAY:	17 %

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