Shaw
Shaw Environmental & Infrastructure, Inc.

Geotechnical Laboratory
304 Directors Drive
Knoxville, TN 37923
(865) 690-3211

~~EBER101024~~ KB 11-22-10
EBER1010024 KB 11-22-10

CERTIFICATE OF ANALYSIS

Mr. Michael Neely
CH2M Hill Plateau Remediation Company
P.O. Box 1600
Mail Stop – B6-06
Richland, WA 99352

October 15, 2010

This is the Certificate of Analysis for the following samples:

Shaw Project ID: Eberline Analytical
Shaw Project Number: 139736
Date Received by Lab: 08/26/2010
Number of Samples: Two
Sample Type: Soil

I. Introduction/Case Narrative

Two soil samples were received by the Shaw Geotechnical Laboratory on August 26, 2010. The samples were submitted for determination of bulk density (ASTM D 2937), moisture content (ASTM D 2216), particle size (sieve only ASTM D 422) and saturated hydraulic conductivity/ permeability (ASTM D 5084) as listed on the Chain of Custody/Sample Analysis Request. The sample numbers received were B26FB7 and B26HR6.

Please see Appendix A, Sample Number Cross Reference List; Appendix B, Analysis Results; Appendix C, Chain-of-Custody/Sample Receipt Records.

"I certify that this data package is in compliance the SOW, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the laboratory manager or a designee, as verified by the following signature."

Reviewed and Approved:

R. Gregory Bennett
Geotechnical Laboratory Manager, Technology Applications Group

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II. Analytical Results/Methodology

REFERENCES: United Nations, *Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria*, third ed. New York, 1999. United States Army Corps of Engineers (USACE), Engineer Manual 1110-2-1906, *Laboratory Soils Testing*, appendix II, 1970; United States Environmental Protection Agency, SW846, *Test Methods for Examining Solid Waste, Physical/Chemical Methods*, 3rd ed., Nov 1986 (EPA SW-846). Annual Book of ASTM Standards, Section 4, Construction, Volume 04.08, *Soil and Rock (I)*, and Volume 04.09, *Soil and Rock (II)*, 2008. Shaw Environmental and Infrastructure, Standard Operating Procedures.

Bulk Density ..... **ASTM D 2937**
Moisture Content of Soil and Rock ..... **ASTM D 2216**
Particle size ..... **ASTM D 422**
Permeability ..... **ASTM D 5084**

III. Quality Control

Quality control checks such as duplicates and spikes (QC samples), are not normally applicable to geotechnical testing. This is due largely to the inability of obtaining samples with known characteristics, the heterogenous nature of the samples, and quality control procedures built-in to the analytical method.

QC measures to ensure accuracy and precision of test results include the following:

- 100% verification of all numerical results - raw data entries, transcriptions and calculations entered by lab technicians are checked, recalculated and verified. Most data calculations are performed by computer programs.

- Data validation through test reasonableness - summaries of all test results for individual reports are reviewed to determine the overall reasonableness of data and to determine the presence of any data that may be considered outliers.

- Quality control procedures are built into most standardized geotechnical procedures. For example, liquid limit and plastic limit analyses call for re-analyses and specify acceptance criteria.

- Routine instrument calibration - instruments, gauges and equipment used in testing are calibrated on a routine basis. All instrument calibration follows ASTM or manufacturer guidelines.

- Maintenance of all past calibration records - calibration records and certification documents of all instruments, gauges and equipment are updated routinely and maintained in the Quality Control Coordinators Quality/Operations files.

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- Certified and trained personnel - all technicians are trained in the application of standard laboratory procedures for geotechnical analyses as well as the quality assurance measures implemented by Shaw.

- Quantitative analyses frequently used in geotechnical/physical testing programs do not use QC tools common to wet chemistry or radiochemistry laboratories. Measures not employed in the analysis of samples reported in this report include: laboratory control samples (LCS), blanks, matrix spikes (MS), duplicate analyses, dilutions, digestions, correction factors, surrogate sample analyses, detection limit determinations, control charts, and/or tentatively identified compounds (TICs).

IV. Data Qualification

None

Appendix A
Sample Cross-Reference List

Report No.: EBER1010024
Mr. Michael Neely
Client: CH2M Hill Plateau Remediation Company
Shaw Project Name: Eberline Analytical
Shaw Project No.: 139736

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SAMPLE NUMBER CROSS-REFERENCE LIST

Lab Sample ID	Client Sample ID	MATRIX
SEK 4905	**B26FB7**	**SOIL**
SEK 4906	**B26HR6**	**SOIL**

Appendix B
Data Results

Report No.: EBER1010024
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BULK DENSITY/DRY DENSITY
ASTM D 2937

PROJECT NAME: **Eberline Analytical**

PROJECT NUMBER: **139736.07000000**

LAB SAMPLE NUMBER	CLIENT SAMPLE NUMBER	AVERAGE LENGTH, inches	AVERAGE DIAMETER, inches*	WET WEIGHT, grams	MOISTURE CONTENT, %	BULK DENSITY, pcf	DRY DENSITY, pcf
SEK 4905	B26FB7	6.0033	3.7892	2149.29	26.2	121.0	95.9
SEK 4906	B26HR6	5.6046	3.7097	2025.00	25.6	127.4	101.4

Moisture content calculated by ASTM D 2216 based on sample dry weight.
Bulk density is the weight of wet sample divided by the volume of the wet sample (as-received).
Dry density is the weight of the dry sample solids divided by the volume of the original sample.

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MOISTURE CONTENT
ASTM D 2216

PROJECT NAME
Eberline Hanford

PROJECT NUMBER
139736.07000000

LAB SAMPLE NO.	CLIENT SAMPLE NO.	MOISTURE, % ASTM D 2216	MOISTURE , % SW846	SOLIDS, % SW846
SEK 4905	B26FB7	25.4	20.2	79.8
SEK 4706	B26HR6	25.1	20.1	79.9

ASTM D 2216 results are based on dry sample weight.
SW846 results are based on wet sample weight.
Solids content is determined by subtracting the SW846 moisture (%) from 100.

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PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
Eberline
Project No.
139736

Client Sample No.
B26FB7
Lab Sample No.
SEK 4905

Specific Gravity = 2.65
assumed

Moisture Content = 26.2%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	99.9%
	#60	0.250	99.7%
	#100	0.149	99.5%
	#140	0.106	99.3%
	#200	0.075	98.9%

0.0% Gravel 1.10% Sand 98.9% Silt/Clay

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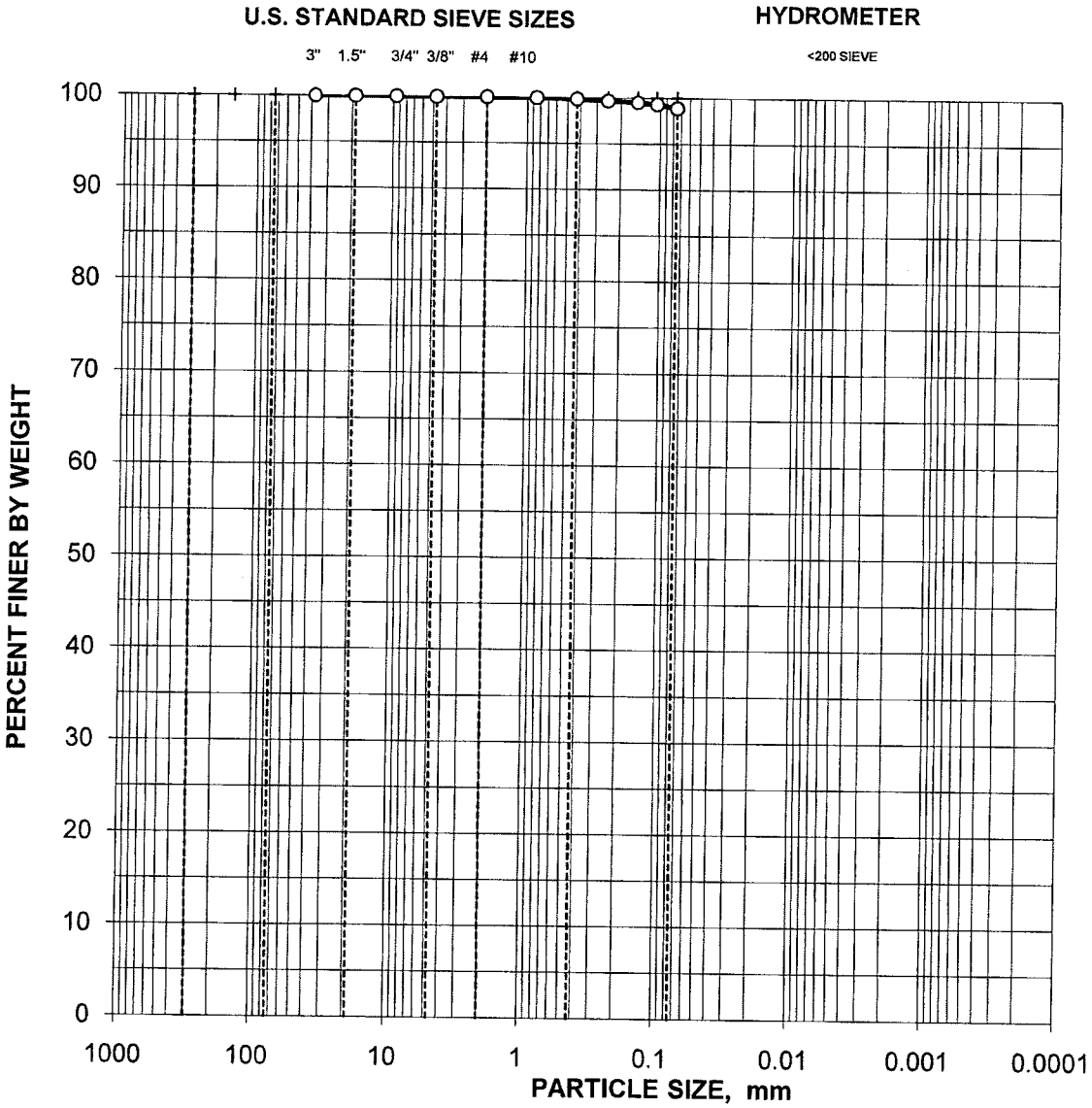
Eberline



CLIENT SAMPLE NO.: B26FB7 **LAB SAMPLE NO.:** SEK 4905

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

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Shaw Project No.: 139736

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PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
Eberline
Project No.
139736

Client Sample No.
B26HR6
Lab Sample No.
SEK 4906

Specific Gravity = 2.65
assumed

Moisture Content = 25.6%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.8%
	#40	0.425	99.5%
	#60	0.250	99.3%
	#100	0.149	95.8%
	#140	0.106	83.9%
	#200	0.075	67.0%

0.0% Gravel 33.0% Sand 67.0% Silt/Clay

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Shaw Project No.: 139736

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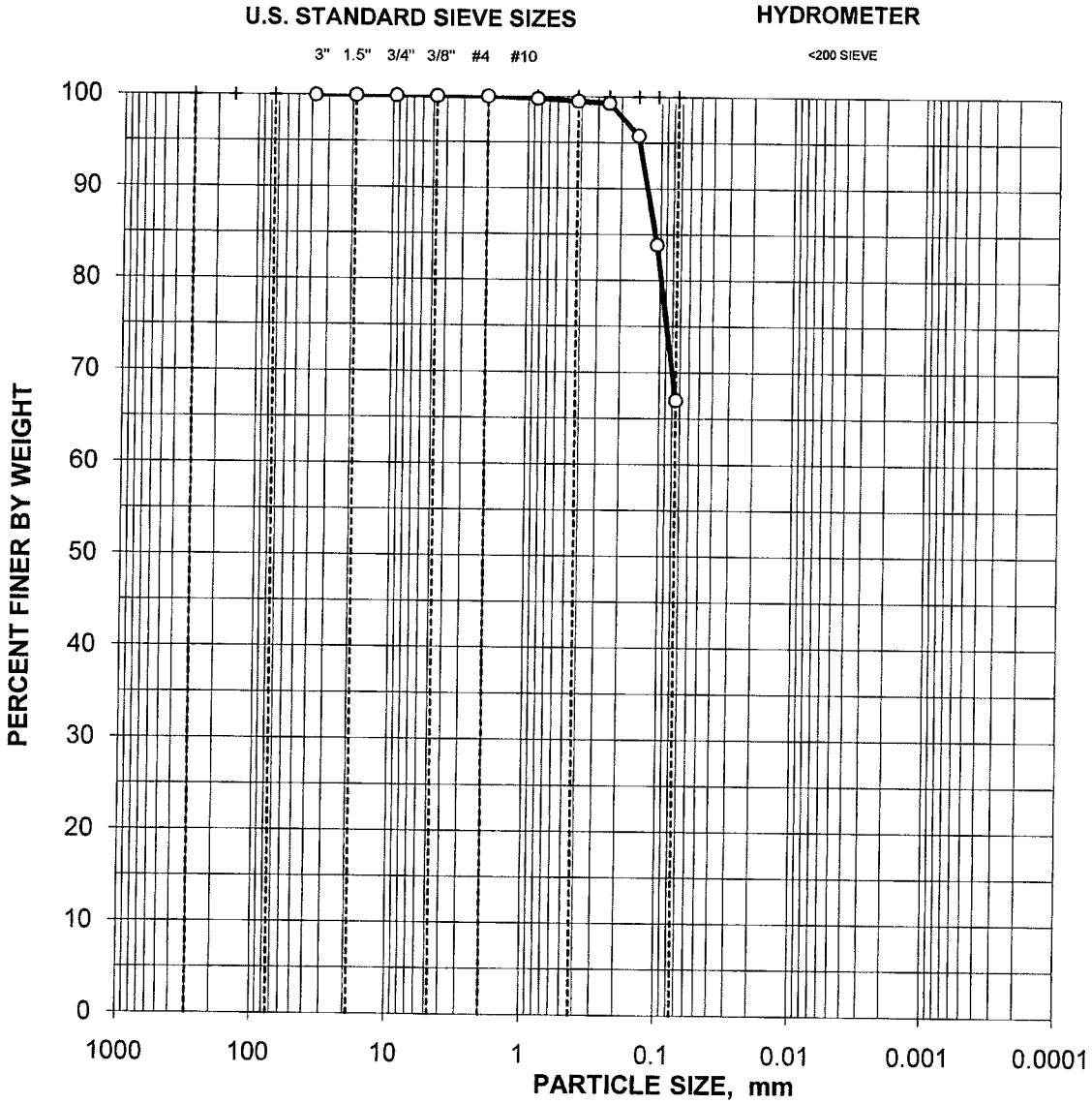
Eberline



CLIENT SAMPLE NO.: B26HR6 **LAB SAMPLE NO.:** SEK 4906

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

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Shaw Project Name: Eberline Analytical
Shaw Project No.: 139736

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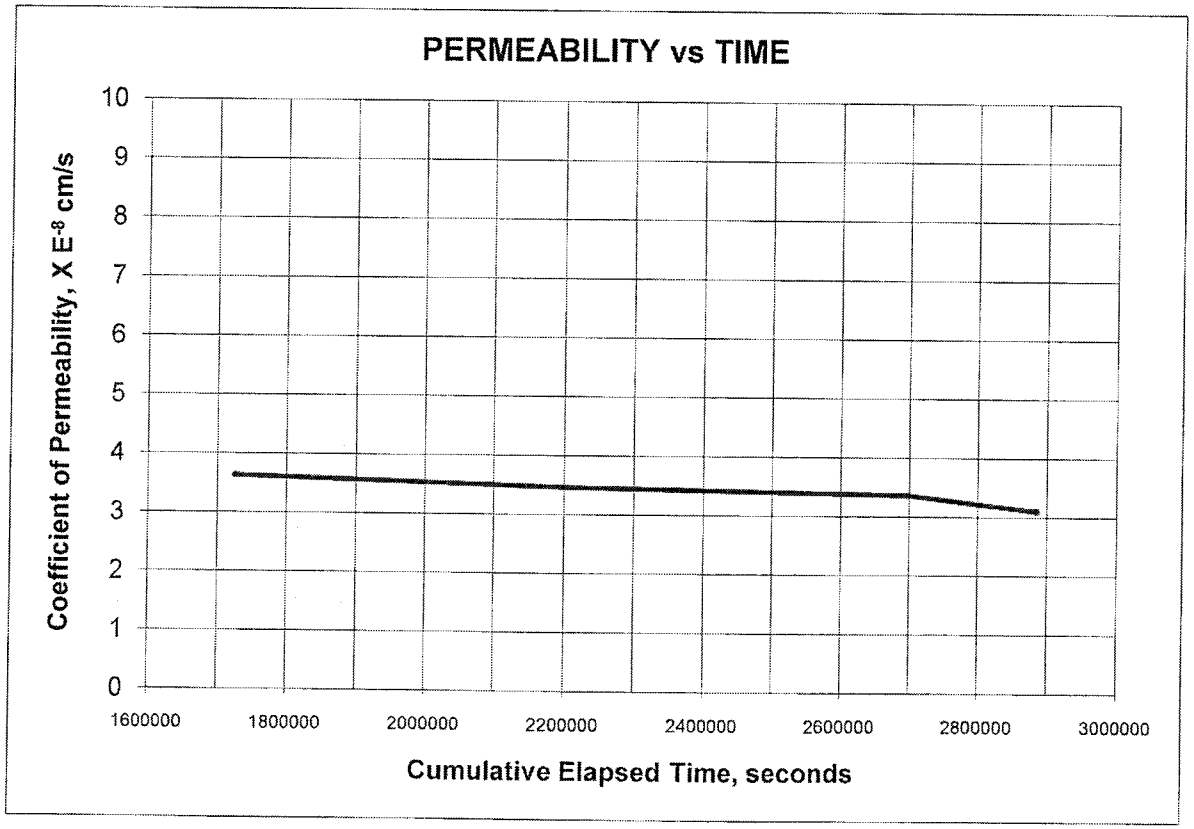
HYDRAULIC CONDUCTIVITY / PERMEABILITY
ASTM D 5084

PROJECT NAME: Eberline Analytical
PROJECT NO. 139736.07000000
CLIENT SAMPLE NO. B26FB7
LAB SAMPLE NO. SEK 4905

	INITIAL	FINAL
Specimen diameter, cm	4.99	
Specimen length, cm	10.50	
Wet weight of specimen, g.	402.67	
Specimen cross-sect. area, cm^2	19.54	
Water content, %	26.2	
Wet unit weight, pcf	122.5	
Dry unit weight, pcf	97.1	
Est. degree of saturation, %	98.6	98.6
Specific gravity of solids, assume	2.65	

Hydraulic gradient	26.8
Min. consolidation stress, psi	2.0
Max. consolidation stress, psi	8.0
Total backpressure, psi	69.0
Permeant Fluid	Deaired DI Water

Coefficient of Permeability, cm/s 3.4E-08



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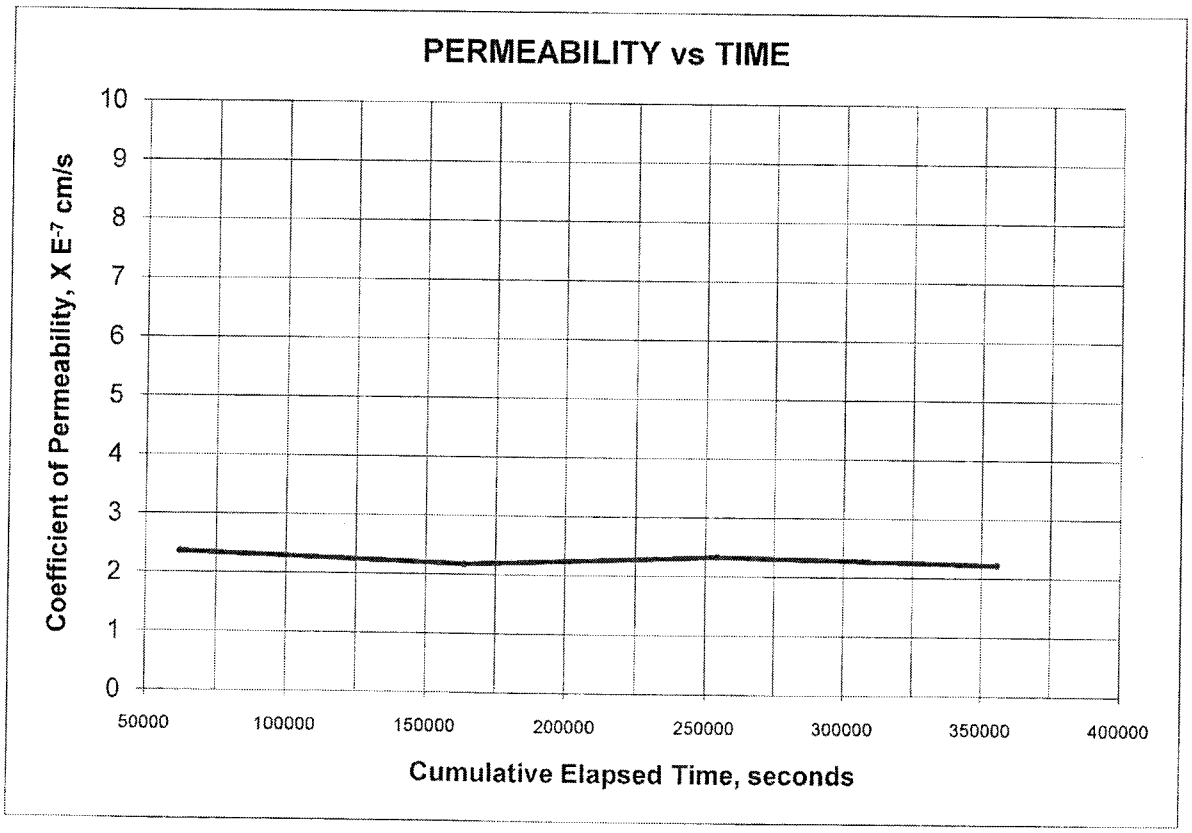
HYDRAULIC CONDUCTIVITY / PERMEABILITY
ASTM D 5084

PROJECT NAME: Eberline Analytical
PROJECT NO. 139736.07000000
CLIENT SAMPLE NO.
LAB SAMPLE NO. SEK 4906

	INITIAL	FINAL
Specimen diameter, cm	4.90	
Specimen length, cm	10.17	
Wet weight of specimen, g.	380.98	
Specimen cross-sect. area, cm^2	18.85	
Water content, %	25.6	
Wet unit weight, pcf	124.1	
Dry unit weight, pcf	98.8	
Est. degree of saturation, %	100.7	100.7
Specific gravity of solids, assume	2.65	

Hydraulic gradient	34.6
Min. consolidation stress, psi	2.0
Max. consolidation stress, psi	7.0
Total backpressure, psi	73.0
Permeant Fluid	Deaired DI Water

Coefficient of Permeability, cm/s 2.2E-07



Appendix C
Chain of Custody Records

CH2MHill Plateau Remediation Company

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

F10-225-001 PAGE 1 OF 1

COLLECTOR: Bailey

COMPANY CONTACT: DALE DYEKMAN | TELEPHONE NO.: 373-2530

PROJECT COORDINATOR: DYEKMAN, DL

PRICE CODE: 8N | DATA TURNAROUND: 45 Days / 45 Days

AIR QUALITY: ☐

SAMPLING LOCATION: C7508 (199-B8-9); BOTTOM OF AQUIFER

PROJECT DESIGNATION: 100 Area Remedial Investigation/Feasibility Analysis - 100-BC Soils

SAF NO.: F10-225

ICE CHEST NO.: GWS-236-1

FIELD LOGBOOK NO.: HNF-N-507-9 PG 63 | ACTUAL SAMPLE DEPTH: 212.0-214.5 FT

COA: 300078ES10

METHOD OF SHIPMENT: FEDERAL EXPRESS

SHIPPED TO: Shaw Group

OFFSITE PROPERTY NO.: SEE PTR

BILL OF LADING/AIR BILL NO.: SEE PTR 793846765187

@6.5 lbs. for disposal

MATRIX*
A=Air
DL=Drum Liquids
DS=Drum Solids
L=Liquid
O=Oil
S=Soil
SE=Sediment
T=Tissue
V=Vegetation
W=Water
WI=Wipe
X=Other

POSSIBLE SAMPLE HAZARDS/ REMARKS
Contains Radioactive Material at concentrations that may or may not be regulated for transportation per 49 CFR / IATA Dangerous Goods Regulations but are not releasable per DOE Order 5400.5 (1990/1993)

SPECIAL HANDLING AND/OR STORAGE

PRESERVATION	None	None
HOLDING TIME	6 Months	None
TYPE OF CONTAINER	Liner	Moisture Resistant Cont
NO. OF CONTAINER(S)	1	1
VOLUME	1000g	700g
SAMPLE ANALYSIS	SEE ITEM (1) IN SPECIAL INSTRUCTIONS	Moisture Content D2216;

SAMPLE NO.	MATRIX*	SAMPLE DATE	SAMPLE TIME			
B26FB7	SOIL	8-23-10	0800	X	X	SEK 4905

CHAIN OF POSSESSION / SIGN/ PRINT NAMES

RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME
JK Bailey JKB	8-23-10/1145	mc413 SSOR21 8-23-10	8-23-10/1145
SSO-R1	8/24/10 0910	Brittain Brittain	8/24/10 0910
Brittain Brittain	8/24/10 14:00	FED EX	

SPECIAL INSTRUCTIONS

** Physical Properties laboratory: Conduct the hydraulic conductivity test (ASTM 5084 or 2434) as appropriate to the sample matrix.
(1) Permeability - D2434 {Hydraulic Conductivity}; Bulk Density - D2937; Particle Size (Dry Sieve) - D422; Saturated Hydraulic Conductivity {Hydraulic Conductivity};

ORIGINAL

LABORATORY SECTION — RECEIVED BY: [signature] — TITLE: R50 — DATE/TIME: 8/25/10 - @1100

FINAL SAMPLE DISPOSITION — DISPOSAL METHOD: — DISPOSED BY: — DATE/TIME:

CH2MHill Plateau Remediation Company

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

F10-225-002 | PAGE 1 OF 1

COLLECTOR: Bailey

COMPANY CONTACT: DALE DYEKMAN | TELEPHONE NO.: 373-2530 | PROJECT COORDINATOR: DYEKMAN, DL | PRICE CODE: 8N | DATA TURNAROUND: 45 Days / 45 Days

SAMPLING LOCATION: C7508 (199-88-9); FIVE FEET INTO RUM

PROJECT DESIGNATION: 100 Area Remedial Investigation/Feasibility Analysis - 100-BC Soils | SAF NO.: F10-225 | AIR QUALITY: ☐

ICE CHEST NO.: GWS-236-1

FIELD LOGBOOK NO.: HNF-N-507-9 PG#63 | ACTUAL SAMPLE DEPTH: 217.0-219.5 Ft | COA: 300078ES10 | METHOD OF SHIPMENT: FEDERAL EXPRESS

SHIPPED TO: Shaw Group

OFFSITE PROPERTY NO.: SEE PTR | BILL OF LADING/AIR BILL NO.: SEE PTR 793846765187

16

@ 6.1 lbs. for disposal.

MATRIX*
A=Air
DL=Drum Liquids
DS=Drum Solids
L=Liquid
O=Oil
S=Soil
SE=Sediment
T=Tissue
V=Vegetation
W=Water
WI=Wipe
X=Other

POSSIBLE SAMPLE HAZARDS/ REMARKS
Contains Radioactive Material at concentrations that may or may not be regulated for transportation per 49 CFR / IATA Dangerous Goods Regulations but are not releasable per DOE Order 5400.5 (1990/1993)

SPECIAL HANDLING AND/OR STORAGE

PRESERVATION				None	None		
HOLDING TIME				6 Months	None		
TYPE OF CONTAINER				Liner	Moisture Resistant Cont.		
NO. OF CONTAINER(S)				1	1		
VOLUME				1000g	200g		
SAMPLE ANALYSIS				SEE ITEM (1) IN SPECIAL INSTRUCTIONS	Moisture Content - D2216;		
SAMPLE NO.	**MATRIX***	**SAMPLE DATE**	**SAMPLE TIME**				
B26HR6	SOIL	8-23-10	1030	X	X		

SEK 4906

CHAIN OF POSSESSION

RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME
[illegible]	8-23-10 / 1145	MO413 SSUR21 Dab 8/24/10	8-23-10 / 1145
SSU-R1	8/24/10 0900	[illegible]	8/24/10 0900
[illegible]	8/24/10 1400	FED EX	

SIGN/ PRINT NAMES

SPECIAL INSTRUCTIONS

** Physical Properties laboratory: Conduct the hydraulic conductivity test (ASTM 5084 or 2434) as appropriate to the sample matrix.
(1) Permeability - D2434 {Hydraulic Conductivity}; Bulk Density - D2937; Particle Size (Dry Sieve) - D422; Saturated Hydraulic Conductivity {Hydraulic Conductivity};

ORIGINAL

LABORATORY SECTION	**RECEIVED BY**		**TITLE**	**DATE/TIME**
	[illegible]		R50	8-26-10 / @1100
FINAL SAMPLE DISPOSITION	**DISPOSAL METHOD**		**DISPOSED BY**	**DATE/TIME**