



Shaw Environmental & Infrastructure, Inc.

RECEIVED APRIL 01, 2011

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

EBER0311082  
KB 4-5-11

**CERTIFICATE OF ANALYSIS**

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

April 1, 2011

This is the Certificate of Analysis for the following samples:

Shaw Project ID: Eberline Analytical  
Shaw Project Number: 139736  
Date Received by Lab: 03/21/2011  
Number of Samples: Two (2)  
Sample Type: Soil

**I. Introduction/Case Narrative**

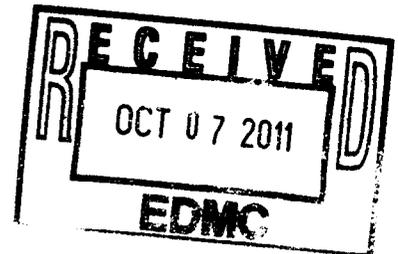
Two (2) soil samples were received by the Shaw Geotechnical Laboratory on March 21, 2011. The samples were submitted for determination of bulk density, moisture content, particle size and hydraulic conductivity /permeability as listed on the Chain of Custody/Sample Analysis Requests. The sample numbers for the received samples were B29CH5, and B29CH6

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

"I certify that this data package is in compliance with 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



## 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 .....	<b>ASTM D 2937</b>
Moisture Content .....	<b>ASTM D 2216</b>
Particle Size (sieve only) .....	<b>ASTM D 422</b>
Permeability of Granular Soils .....	<b>ASTM D 2434</b>
Permeability .....	<b>ASTM D 5084</b>

## 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 heterogeneous 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.
- 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**

Page 4 of 12  
Report No.: EBER0311082  
Mr. Michael Neely  
Client: CH2M Hill Plateau Remediation Company  
Shaw Project Name: Eberline Analytical  
Shaw Project No.: 139736

**Shaw**  
**Geotechnical Laboratory**  
**Knoxville, TN**  
**(865) 690-3211**

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**SAMPLE NUMBER CROSS-REFERENCE LIST**

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<b>Lab Sample ID</b>	<b>Client Sample ID</b>	<b>MATRIX</b>
<b>SEK 5631</b>	<b>B29CH5</b>	<b>SOIL</b>
<b>SEK 5632</b>	<b>B29CH6</b>	<b>SOIL</b>

**Appendix B**  
**Data Results**





**PARTICLE-SIZE DISTRIBUTION**  
**ASTM D 422**

Project Name Eberine

Field Sample No. B29CH5

Project No. 139736.14400000

Lab Sample No. SEK 5631

Moisture Content = 6.0%

**SIEVE ANALYSIS**

C O A R S E	Sieve No.	Diameter mm	Percent Finer
	3"	75.000	100.0%
	1.5"	37.500	86.4%
	0.75"	19.000	65.3%
	0.375"	9.500	50.4%
	#4	4.750	41.4%
	#10	2.000	34.9%

F I N E	Sieve No.	Diameter mm	Percent Finer
	#20	0.850	31.1%
	#40	0.425	17.6%
	#60	0.250	9.8%
	#100	0.149	6.8%
	#140	0.106	5.6%
	#200	0.075	4.7%

58.6% Gravel

36.8% Sand

4.7% Silt/Clay

**PARTICLE-SIZE DISTRIBUTION**  
**ASTM D 422**

Project Name Eberine

Field Sample No. B29CH6

Project No. 139736.14600000

Lab Sample No. SEK 5632

Moisture Content = 26.0%

**SIEVE ANALYSIS**

C O A R S E	Sieve No.	Diameter mm	Percent Finer
	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%

F I N E	Sieve No.	Diameter mm	Percent Finer
	#20	0.850	87.9%
	#40	0.425	80.2%
	#60	0.250	75.1%
	#100	0.149	66.7%
	#140	0.106	58.1%
	#200	0.075	48.7%

0.0% Gravel

51.3% Sand

48.7% Silt/Clay

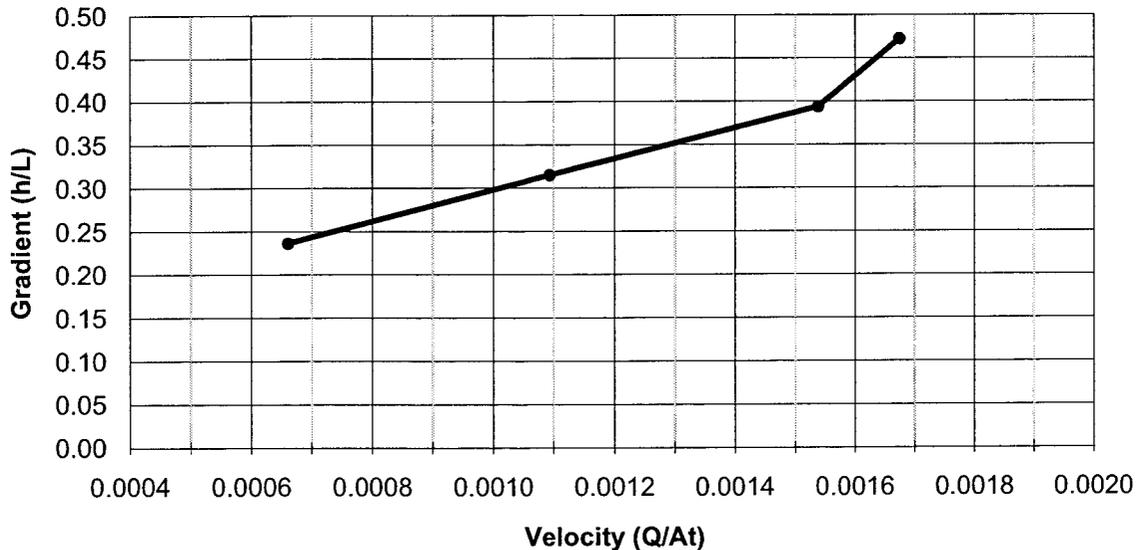
**HYDRAULIC CONDUCTIVITY / PERMEABILITY**  
**ASTM D 2434**

PROJECT NAME:	Lionville	CLIENT SAMPLE NO.	B29CH5
PROJECT NO.	139736	LAB SAMPLE NO.	SEK 5631
Specimen diameter, cm	6.35	Void ratio	0.38
Specimen length, cm	12.31		
Wet weight of specimen, g.	791.02	Specific gravity of solids, assumed	2.80
Specimen cross-sect. area, cm <sup>2</sup>	31.67		
Water content, %	0.35	Permeant Fluid	Tap Water
Wet unit weight, pcf	126.7	Material Used	-3/8 inch
Dry unit weight, pcf	126.2		

Trial no.	Head, h	Q, cm <sup>3</sup>	Time, sec	Q/At	h/L	Temp, °C	k, cm/s
1	1.5	64	3060	0.000660	0.236	23.0	2.60E-03
2	2.0	27	780	0.00109	0.315	23.5	3.20E-03
3	2.5	38	780	0.00154	0.394	23.0	3.64E-03
4	3.0	35	660	0.00167	0.472	23.0	3.30E-03

**Coefficient of Permeability, cm/s**                      **3.64E-03**

**Velocity vs. Hydraulic Gradient**

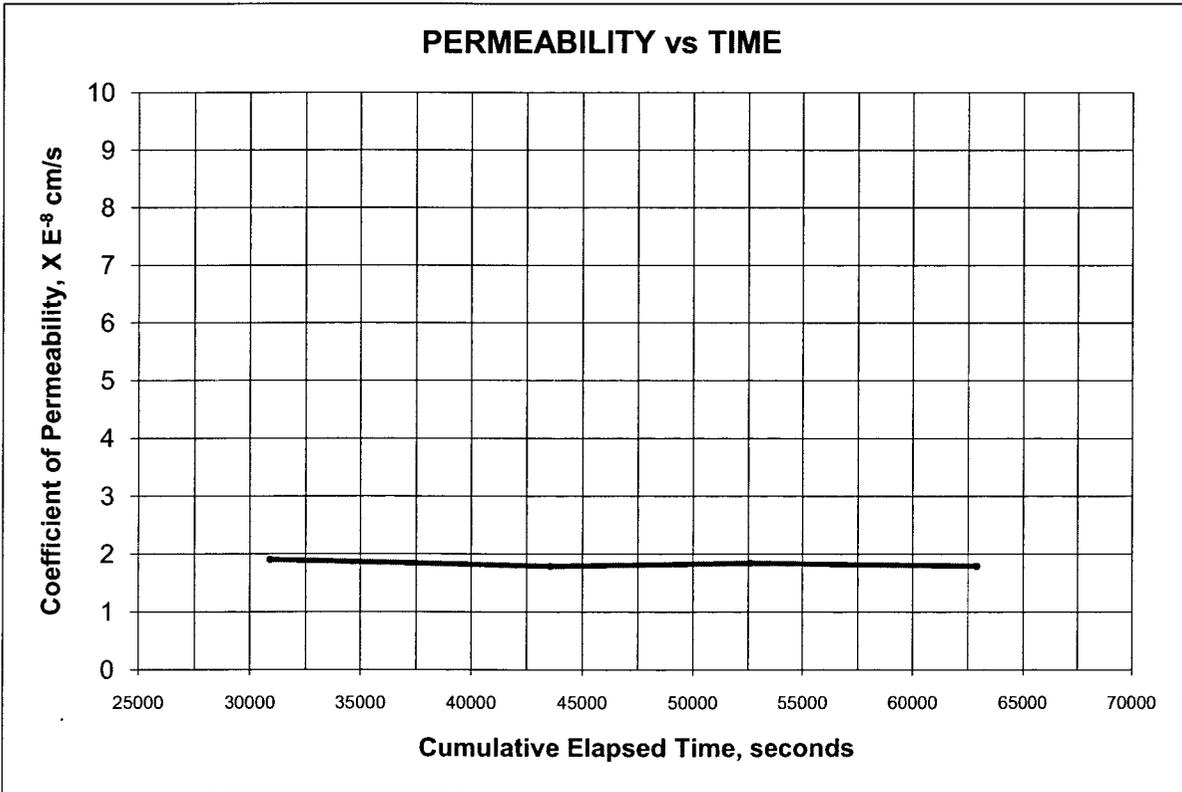


**HYDRAULIC CONDUCTIVITY / PERMEABILITY**  
**ASTM D 5084**

PROJECT NAME: Eberline	CLIENT SAMPLE NO. B29CH6
PROJECT NO. 139736.1450000	LAB SAMPLE NO. SEK 5632

	INITIAL	FINAL	
Specimen diameter, cm	7.37		
Specimen length, cm	10.29		Hydraulic gradient
Wet weight of specimen, g.	872.66		20.5
Specimen cross-sect. area, cm <sup>2</sup>	42.70		Min. consolidation stress, psi
Water content, %	26.0		2.0
Wet unit weight, pcf	124.0		Max. consolidation stress, psi
Dry unit weight, pcf	98.4		5.0
Est. degree of saturation, %	101.2	101.2	Total backpressure, psi
Specific gravity of solids, assumed	2.65		40.0
			Permeant Fluid
			Deaired Tap Water

**Coefficient of Permeability, cm/s**      **1.8E-06**



**Appendix C**  
**Chain of Custody Records**

CH2M Hill Plateau Remediation Company

COLLECTOR: BAILEY

SAMPLING LOCATION: C7640 (199-H3-10); I-015

ICE CHEST NO.: GWS-223-1

SHIPPED TO: Shaw Group

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

COMPANY CONTACT: RADLOFF, AW

TELEPHONE NO.: 376-4554

PROJECT COORDINATOR: RADLOFF, AW

PRICE CODE: 8N

AIR QUALITY:

DATA TURNAROUND: 30 Days/30 Days

PROJECT DESIGNATION: 100 Area Remedial Investigation/Feasibility Analysis - 100-HR-3 - Sediment

FIELD LOGBOOK NO.: HNFN-491-14/21

ACTUAL SAMPLE DEPTH: 53.1 - 55.4

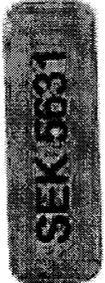
COA: 3001.10ES10

BILL OF LADING/AJR BILL NO.: 7968 8422 1007

SEE PTR: @ 6 lbs

METHOD OF SHIPMENT: FEDERAL EXPRESS

COMPANY CONTACT	TELEPHONE NO.	PROJECT COORDINATOR	PRICE CODE	AIR QUALITY	METHOD OF SHIPMENT
RADLOFF, AW	376-4554	RADLOFF, AW	8N	<input type="checkbox"/>	FEDERAL EXPRESS
PROJECT DESIGNATION	FIELD LOGBOOK NO.	ACTUAL SAMPLE DEPTH	COA	BILL OF LADING/AJR BILL NO.	SEE PTR
100 Area Remedial Investigation/Feasibility Analysis - 100-HR-3 - Sediment	HNFN-491-14/21	53.1 - 55.4	3001.10ES10	7968 8422 1007	@ 6 lbs
OFFSITE PROPERTY NO.	SEE PTR	PRESERVATION	HOLDING TIME	TYPE OF CONTAINER	NO. OF CONTAINER(S)
		None	None	Liner	1
VOLUME	SAMPLE ANALYSIS	SAMPLE DATE	SAMPLE TIME	SPECIAL HANDLING AND/OR STORAGE	MATRIX*
1000ml	SEE ITEM (1) IN SPECIAL INSTRUCTIONS	3-16-11	1325	SOIL	



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CHAIN OF POSSESSION

RELINQUISHED BY/REMOVED FROM	DATE/TIME	SIGN/PRINT NAMES	RECEIVED BY/STORED IN	DATE/TIME
JR BAILEY / JWB	3-16-11 / 1500		MOYB SSU R1	3-16-11 / 1800
Mc 4/3 SSU R1	3-15-11 / 0700		Thomas, J. Walker	3-18-11 / 0700
RELINQUISHED BY/REMOVED FROM	DATE/TIME		RECEIVED BY/STORED IN	DATE/TIME
Thomas, J. Walker	3-18-11 / 1700		FedEx	
RELINQUISHED BY/REMOVED FROM	DATE/TIME		RECEIVED BY/STORED IN	DATE/TIME
RELINQUISHED BY/REMOVED FROM	DATE/TIME		RECEIVED BY/STORED IN	DATE/TIME
RELINQUISHED BY/REMOVED FROM	DATE/TIME		RECEIVED BY/STORED IN	DATE/TIME
RELINQUISHED BY/REMOVED FROM	DATE/TIME		RECEIVED BY/STORED IN	DATE/TIME

SPECIAL INSTRUCTIONS

\*\* The 100 Area S&GRP Characterization and Monitoring Sampling and Analysis GKI applies to this SAF.

(1) Bulk Density - D2937; Saturated Hydraulic Conductivity; Permeability - D2434; Particle Size (Dry Sieve) - D422;

LABORATORY SECTION: RECEIVED BY: [Signature]

FINAL SAMPLE DISPOSITION: RECEIVED BY: R50

TITLE: ORIGINAL

DATE/TIME: 3-21-11 @ 1000

DISPOSED BY: [Signature]

DATE/TIME: [Blank]

CH2M Hill Plateau Remediation Company

COLLECTOR: BAILEY

SAMPLING LOCATION: C7640 (199-H3-10); I-016

ICE CHEST NO.: GWS-223-1

SHIPPED TO: Shaw Group

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

COMPANY CONTACT: RADLOFF, AW

TELEPHONE NO.: 376-4554

PROJECT COORDINATOR: RADLOFF, AW

PRICE CODE: F10-214-079

PRICE CODE: 5C

AIR QUALITY: DATA TURNAROUND 15 Days/15 Days

METHOD OF SHIPMENT: FEDERAL EXPRESS

SAF NO.: F10-214

COA: 300110ES10

BILL OF LADING/AIR BILL NO.: SEE PTR 7968 8622 1007

PROJECT DESIGNATION: 100 Area Remedial Investigation/Feasibility Analysis - 100-HR-3 - Sediment

ACTUAL SAMPLE DEPTH: 55.7' - 58.2'

FIELD LOGBOOK NO.: HNF-N-491-14/22

OFFSITE PROPERTY NO.: SEE PTR

MATRIX*	None	None	None
PRESERVATION	None	None	None
HOLDING TIME	None	None	None
TYPE OF CONTAINER	Liner	Moisture Resistant Cont	1
NO. OF CONTAINER(S)	1	1000ml	200ml
VOLUME	SEE ITEM (1) IN SPECIAL INSTRUCTIONS		
SAMPLE ANALYSIS			
SAMPLE DATE	3-17-11	3-17-11	3-17-11
SAMPLE TIME	0920		



@ 6 lbs.

14

15 of 15

**SPECIAL INSTRUCTIONS**

\*\* The 100 Area S&GRP Characterization and Monitoring Sampling and Analysis GKI applies to this SAF.

(1) Bulk Density - D2937; Saturated Hydraulic Conductivity; Permeability - D2434; Particle Size (Dry Sieve) - D422;

ORIGINA

RELINQUISHED BY/REMOVED FROM	DATE/TIME	SIGN/PRINT NAMES	RECEIVED BY/STORED IN	DATE/TIME
DR BAILEY/JFB	3-17-11 1100		MOYIB SSO PI	3-17-11 1100
MA 413 SSO RI	3-15-11 0700		Thomas W. Williams	3-15-11 0700
RELINQUISHED BY/REMOVED FROM	DATE/TIME		RECEIVED BY/STORED IN	DATE/TIME
Thomas W. Williams	3-15-11 1400		Felix	
RELINQUISHED BY/REMOVED FROM	DATE/TIME		RECEIVED BY/STORED IN	DATE/TIME
RELINQUISHED BY/REMOVED FROM	DATE/TIME		RECEIVED BY/STORED IN	DATE/TIME
RELINQUISHED BY/REMOVED FROM	DATE/TIME		RECEIVED BY/STORED IN	DATE/TIME
RELINQUISHED BY/REMOVED FROM	DATE/TIME		RECEIVED BY/STORED IN	DATE/TIME

LABORATORY SECTION: Received by [Signature]

FINAL SAMPLE DISPOSITION: R50

TITLE: R50

DATE/TIME: 3-21-11 @ 1000

DISPOSED BY:

A-6003-618 (REV 2)