

Laboratory Report for Dwyer Engineering LLC

Project: Crescent Junction

September 9, 2020



Daniel B. Stephens & Associates, Inc.

4400 Alameda Blvd. NE, Suite C • Albuquerque, New Mexico 87113



September 9, 2020

Steve Dwyer
Dwyer Engineering LLC
1813 Stagecoach Rd SE
Albuquerque, NM 87123
(505) 270-0215

Re: DBS&A Laboratory Report for the Dwyer Engineering, LLC, Crescent Junction Project

Dear Mr. Dwyer:

Enclosed is the report for the Dwyer Engineering LLC, Crescent Junction project samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Dwyer Engineering, LLC and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.
SOIL TESTING & RESEARCH LABORATORY

Adam Bland
Laboratory Operations Manager

Enclosure

Daniel B. Stephens & Associates, Inc.
Soil Testing & Research Laboratory

4400 Alameda Blvd. NE, Suite C
Albuquerque, NM 87113

505-889-7752
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Summaries



Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties ¹			Saturated Hydraulic Conductivity ²			Moisture Characteristics ³								Particle Size ⁴			Specific Gravity ⁵		Air Perm- eability	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K _{unsat}	DS	WS	H	F	C			
1. Excavated Test Pit Alluvium 1'-5'																X	X				X	X
1. Excavated Test Pit Alluvium 1'-5' (90%)	X	X				X	X	X		X	X			X								
2. Mix, Borrow Face Phase 3C																X	X				X	X
2. Mix, Borrow Face Phase 3C (90%)	X	X				X				X	X			X								
3. Interim Cover Mix																X	X				X	X
3. Interim Cover Mix (90%)	X	X				X				X	X			X								
4. Open Test Pit, Alluvium 1'-10'																X	X				X	X
4. Open Test Pit, Alluvium 1'-10' (90%)	X	X				X				X	X			X								
5. Radon Barrier #1																X	X				X	X
5. Radon Barrier #1 (90%)	X	X				X				X	X			X								
6. Radon Barrier #2																X	X				X	X
6. Radon Barrier #2 (90%)	X	X				X				X	X			X								

¹ G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

² CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

³ HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, K_{unsat} = Calculated Unsaturated Hydraulic Conductivity

⁴ DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

⁵ F = Fine (<4.75mm), C = Coarse (>4.75mm)



Notes

Sample Receipt:

Six samples, each as a mostly full 5-gallon bucket sealed with a lid, were hand-delivered on July 13, 2020. All samples were received in good order.

Sample Preparation and Testing Notes:

Each of samples was subjected to standard proctor compaction testing, particle size analysis and Atterberg limits testing.

A portion of each sample was remolded into a testing ring to target 90% of the respective maximum dry bulk density at the respective optimum moisture content, based on the standard proctor compaction test results. Each of these remolded sub-samples was subjected to initial properties analysis, saturation, and the hanging column and pressure chamber portions of the moisture retention testing. Secondary sub-samples were also prepared, using the same target remold parameters. The secondary sub-samples were then extruded from the testing ring and subjected to saturated hydraulic conductivity testing via the flexible wall method. Separate sub-samples were obtained for the dewpoint potentiometer and relative humidity chamber portions of the moisture retention testing

The actual percentage of maximum dry bulk density achieved was added to each sub-sample ID.

Based on the proctor compaction method, material larger than 4.75mm was removed from the sample material prior to compaction and remolding. Oversize correction calculations are presented if the fraction removed was greater than 5% of the bulk sample mass.

Porosity calculations are based on the use of an assumed specific gravity value of 2.76.



Summary of Sample Preparation/Volume Changes

Sample Number	Proctor Data		Target Remold Parameters ¹			Actual Remold Data			Volume Change Post Saturation ²			Volume Change Post Drying Curve ³		
	Opt. Moist. Cont.	Max. Dry Density	Moist. Cont.	Dry Bulk Density	% of Max. Density	Moist. Cont.	Dry Bulk Density	% of Max. Density	Dry Bulk Density	% Volume Change	% of Max. Density	Dry Bulk Density	% Volume Change	% of Max. Density
	(%, g/g)	(g/cm ³)	(%, g/g)	(g/cm ³)	(%)	(%, g/g)	(g/cm ³)	(%)	(g/cm ³)	(%)	(%)	(g/cm ³)	(%)	(%)
1. Excavated Test Pit Alluvium 1'-5' (89.8%)	13.4	1.90	13.4	1.71	90%	13.7	1.70	89.8%	1.70	---	89.8%	1.70	---	89.8%
2. Mix, Borrow Face Phase 3C (89.4%)	13.4	1.90	13.4	1.71	90%	14.4	1.70	89.4%	1.70	---	89.4%	1.70	---	89.4%
3. Interim Cover Mix (90.5%)	13.3	1.90	13.3	1.71	90%	12.8	1.72	90.5%	1.72	---	90.5%	1.72	---	90.5%
4. Open Test Pit, Alluvium 1'-10' (89.0%)	13.3	1.88	13.3	1.69	90%	14.6	1.67	89.0%	1.67	---	89.0%	1.67	---	89.0%
5. Radon Barrier #1 (90.0%)	16.4	1.80	16.4	1.62	90%	16.4	1.62	90.0%	1.57	+3.38%	87.1%	1.60	+1.42%	88.8%
6. Radon Barrier #2 (90.1%)	16.5	1.79	16.5	1.61	90%	16.3	1.61	90.1%	1.60	+1.08%	89.2%	1.60	+0.65%	89.5%

¹Target Remold Parameters: 90% of maximum dry density at optimum moisture content based on standard proctor compaction test results.

²Volume Change Post Saturation: Volume change measurements were obtained after saturated hydraulic conductivity testing.

³Volume Change Post Drying Curve: Volume change measurements were obtained throughout hanging column and pressure plate testing. The 'Volume Change Post Drying Curve' values represent the final sample dimensions after the last pressure plate point.

Notes:

"+" indicates sample swelling, "-" indicates sample settling, and "---" indicates no volume change occurred.



**Summary of Initial Moisture Content, Dry Bulk Density
Wet Bulk Density and Calculated Porosity**

Sample Number	Moisture Content				Dry Bulk Density (g/cm ³)	Wet Bulk Density (g/cm ³)	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm ³ /cm ³)	Gravimetric (%, g/g)	Volumetric (%, cm ³ /cm ³)			
1. Excavated Test Pit Alluvium 1'-5' (90%)	NA	NA	13.7	23.3	1.70	1.93	38.3
2. Mix, Borrow Face Phase 3C (90%)	NA	NA	14.4	24.5	1.70	1.94	38.5
3. Interim Cover Mix (90%)	NA	NA	12.8	21.9	1.72	1.93	37.9
4. Open Test Pit, Alluvium 1'-10' (90%)	NA	NA	14.6	24.4	1.67	1.91	39.5
5. Radon Barrier #1 (90%)	NA	NA	16.4	26.6	1.62	1.89	41.1
6. Radon Barrier #2 (90%)	NA	NA	16.3	26.4	1.61	1.88	41.5

NA = Not analyzed

--- = This sample was not remolded



Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K _{sat} (cm/sec)	Oversize Corrected K _{sat} (cm/sec)	Method of Analysis	
			Constant Head Flexible Wall	Falling Head Flexible Wall
1. Excavated Test Pit Alluvium 1'-5' (89.8%)	1.1E-04	---		X
2. Mix, Borrow Face Phase 3C (89.4%)	1.7E-04	---		X
3. Interim Cover Mix (90.5%)	2.8E-04	2.7E-04		X
4. Open Test Pit, Alluvium 1'-10' (89.0%)	1.5E-04	---		X
5. Radon Barrier #1 (90.0%)	3.2E-06	---		X
6. Radon Barrier #2 (90.1%)	2.1E-05	---		X

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



**Summary of Moisture Characteristics
of the Initial Drainage Curve**

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm ³ /cm ³)
1. Excavated Test Pit Alluvium 1'-5' (89.8%)	0	37.5
	16	37.3
	37	37.2
	98	33.0
	337	25.6
	86887	7.3
	331741	4.5
	848426	4.6
2. Mix, Borrow Face Phase 3C (89.4%)	0	38.5
	16	38.0
	37	37.7
	98	31.0
	337	25.1
	84134	7.4
	247913	4.9
	848426	4.2
3. Interim Cover Mix (90.5%)	0	37.2
	18	35.9
	53	31.2
	121	27.6
	337	19.4
	121662	6.7
	370901	4.3
	848426	4.9

Volume adjustments are applicable at this matric potential (see data sheet for this sample).



**Summary of Moisture Characteristics
of the Initial Drainage Curve (Continued)**

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm ³ /cm ³)
4. Open Test Pit, Alluvium 1'-10' (89.0%)	0	41.4
	16	40.2
	37	39.9
	98	36.7
	337	31.1
	65675	7.0
	224152	4.6
	848426	4.2
5. Radon Barrier #1 (90.0%)	0	42.4 #
	18	41.7 #
	53	39.5 #
	121	36.8 #
	337	34.7 #
	109425	9.9 #
	366516	5.9 #
	848426	5.7 #
6. Radon Barrier #2 (90.1%)	0	42.4 #
	18	42.2 #
	53	40.0 #
	121	36.6 #
	337	34.6 #
	145831	8.7 #
	379774	5.7 #
	848426	5.3 #

Volume adjustments are applicable at this matric potential (see data sheet for this sample).



Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	α (cm ⁻¹)	N (dimensionless)	θ_r (% vol)	θ_s (% vol)	Oversize Corrected	
					θ_r (% vol)	θ_s (% vol)
1. Excavated Test Pit Alluvium 1'-5' (89.8%)	0.0085	1.3505	3.03	37.99	---	---
2. Mix, Borrow Face Phase 3C (89.4%)	0.0148	1.2785	1.61	39.15	---	---
3. Interim Cover Mix (90.5%)	0.0168	1.4153	4.32	37.25	4.17	35.97
4. Open Test Pit, Alluvium 1'-10' (89.0%)	0.0059	1.3171	1.06	40.94	---	---
5. Radon Barrier #1 (90.0%)	0.0053	1.2373	0.00	41.71	---	---
6. Radon Barrier #2 (90.1%)	0.0056	1.2439	0.00	42.03	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



Summary of Particle Size Characteristics

Sample Number	d ₁₀ (mm)	d ₅₀ (mm)	d ₆₀ (mm)	C _u	C _c	Method	ASTM Classification	USDA Classification
1. Excavated Test Pit Alluvium 1'-5'	0.0032	0.037	0.052	16	0.33	WS/H	Silty clay with sand (CL-ML)s	Silt Loam
2. Mix, Borrow Face Phase 3C	0.0048	0.043	0.056	12	0.27	WS/H	Silt with sand (ML)s	Silt Loam
3. Interim Cover Mix	0.0046	0.036	0.054	12	0.14	WS/H	Sandy silty clay s(CL-ML)	Silt Loam
4. Open Test Pit, Alluvium 1'-10'	0.0044	0.045	0.056	13	0.58	WS/H	Silt with sand (ML)s	Sandy Loam
5. Radon Barrier #1	0.0016	0.0044	0.0080	5.0	0.45	WS/H	Lean clay (CL)	Silt Loam
6. Radon Barrier #2	0.0015	0.0046	0.0082	5.5	0.29	WS/H	Lean clay (CL)	Silty Clay Loam

d₅₀ = Median particle diameter

Est = Reported values for d₁₀, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d₁₀ diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

[†] Greater than 10% of sample is coarse material



Percent Gravel, Sand, Silt and Clay*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
1. Excavated Test Pit Alluvium 1'-5'	3.7	25.6	67.2	3.6
2. Mix, Borrow Face Phase 3C	1.9	26.8	66.8	4.5
3. Interim Cover Mix	5.4	26.1	64.3	4.2
4. Open Test Pit, Alluvium 1'-10'	0.1	26.8	68.2	4.8
5. Radon Barrier #1	0.8	5.3	76.4	17.5
6. Radon Barrier #2	0.7	3.9	62.5	32.9

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.



Summary of Atterberg Tests

Sample Number	Liquid Limit	Plastic Limit	Plasticity Index	Classification
1. Excavated Test Pit Alluvium 1'	22	18	4	CL-ML
2. Mix, Borrow Face Phase 3C	---	---	---	ML
3. Interim Cover Mix	24	18	6	CL-ML
4. Open Test Pit, Alluvium 1'-10	---	---	---	ML
5. Radon Barrier #1	37	19	18	CL
6. Radon Barrier #2	36	17	19	CL

--- = Soil requires visual-manual classification due to non-plasticity



Summary of Proctor Compaction Tests

Sample Number	Measured		Oversize Corrected	
	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm ³)	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm ³)
1. Excavated Test Pit Alluvium 1'-5'	13.4	1.90	---	---
2. Mix, Borrow Face Phase 3C	13.4	1.90	---	---
3. Interim Cover Mix	13.3	1.90	12.6	1.93
4. Open Test Pit, Alluvium 1'-10'	13.3	1.88	---	---
5. Radon Barrier #1	16.4	1.80	---	---
6. Radon Barrier #2	16.5	1.79	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable

Initial Properties



**Summary of Initial Moisture Content, Dry Bulk Density
Wet Bulk Density and Calculated Porosity**

Sample Number	Moisture Content				Dry Bulk Density (g/cm ³)	Wet Bulk Density (g/cm ³)	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm ³ /cm ³)	Gravimetric (%, g/g)	Volumetric (%, cm ³ /cm ³)			
1. Excavated Test Pit Alluvium 1'-5' (90%)	NA	NA	13.7	23.3	1.70	1.93	38.3
2. Mix, Borrow Face Phase 3C (90%)	NA	NA	14.4	24.5	1.70	1.94	38.5
3. Interim Cover Mix (90%)	NA	NA	12.8	21.9	1.72	1.93	37.9
4. Open Test Pit, Alluvium 1'-10' (90%)	NA	NA	14.6	24.4	1.67	1.91	39.5
5. Radon Barrier #1 (90%)	NA	NA	16.4	26.6	1.62	1.89	41.1
6. Radon Barrier #2 (90%)	NA	NA	16.3	26.4	1.61	1.88	41.5

NA = Not analyzed

--- = This sample was not remolded



Daniel B. Stephens & Associates, Inc.

**Data for Initial Moisture Content,
Bulk Density, Porosity, and Percent Saturation**

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 1. Excavated Test Pit Alluvium 1'-5' (89.8%)
Project Name: Crescent Junction
Date Sampled: NA

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	NA	17-Jul-20
<i>Field weight* of sample (g):</i>		561.89
<i>Tare weight, ring (g):</i>		130.69
<i>Tare weight, pan/plate (g):</i>		0.00
<i>Tare weight, other (g):</i>		0.00
<i>Dry weight of sample (g):</i>		379.30
<i>Sample volume (cm³):</i>		222.91
<i>Assumed particle density (g/cm³):</i>		2.76
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>		13.7
<i>Volumetric Moisture Content (% vol):</i>		23.3
<i>Dry bulk density (g/cm³):</i>		1.70
<i>Wet bulk density (g/cm³):</i>		1.93
<i>Calculated Porosity (% vol):</i>		38.3
<i>Percent Saturation:</i>		60.7
<hr/>		
<i>Laboratory analysis by:</i>		D. O'Dowd
<i>Data entered by:</i>		D. O'Dowd
<i>Checked by:</i>		J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



Daniel B. Stephens & Associates, Inc.

**Data for Initial Moisture Content,
Bulk Density, Porosity, and Percent Saturation**

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 2. Mix, Borrow Face Phase 3C (89.4%)
Project Name: Crescent Junction
Date Sampled: 7/7/20

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	NA	17-Jul-20
<i>Field weight* of sample (g):</i>		565.63
<i>Tare weight, ring (g):</i>		127.98
<i>Tare weight, pan/plate (g):</i>		0.00
<i>Tare weight, other (g):</i>		0.00
<i>Dry weight of sample (g):</i>		382.51
<i>Sample volume (cm³):</i>		225.21
<i>Assumed particle density (g/cm³):</i>		2.76
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>		14.4
<i>Volumetric Moisture Content (% vol):</i>		24.5
<i>Dry bulk density (g/cm³):</i>		1.70
<i>Wet bulk density (g/cm³):</i>		1.94
<i>Calculated Porosity (% vol):</i>		38.5
<i>Percent Saturation:</i>		63.7
<hr/>		
<i>Laboratory analysis by:</i>	D. O'Dowd	
<i>Data entered by:</i>	D. O'Dowd	
<i>Checked by:</i>	J. Hines	

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



Daniel B. Stephens & Associates, Inc.

**Data for Initial Moisture Content,
Bulk Density, Porosity, and Percent Saturation**

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 3. Interim Cover Mix (90.5%)
Project Name: Crescent Junction
Date Sampled: NA

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	NA	17-Jul-20
<i>Field weight* of sample (g):</i>		565.95
<i>Tare weight, ring (g):</i>		137.52
<i>Tare weight, pan/plate (g):</i>		0.00
<i>Tare weight, other (g):</i>		0.00
<i>Dry weight of sample (g):</i>		379.90
<i>Sample volume (cm³):</i>		221.48
<i>Assumed particle density (g/cm³):</i>		2.76
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>		12.8
<i>Volumetric Moisture Content (% vol):</i>		21.9
<i>Dry bulk density (g/cm³):</i>		1.72
<i>Wet bulk density (g/cm³):</i>		1.93
<i>Calculated Porosity (% vol):</i>		37.9
<i>Percent Saturation:</i>		57.9
<hr/>		
<i>Laboratory analysis by:</i>	D. O'Dowd	
<i>Data entered by:</i>	D. O'Dowd	
<i>Checked by:</i>	J. Hines	

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 4. Open Test Pit, Alluvium 1'-10' (89.0%)
Project Name: Crescent Junction
Date Sampled: NA

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	NA	17-Jul-20
<i>Field weight* of sample (g):</i>		558.73
<i>Tare weight, ring (g):</i>		132.89
<i>Tare weight, pan/plate (g):</i>		0.00
<i>Tare weight, other (g):</i>		0.00
<i>Dry weight of sample (g):</i>		371.55
<i>Sample volume (cm³):</i>		222.39
<i>Assumed particle density (g/cm³):</i>		2.76
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>		14.6
<i>Volumetric Moisture Content (% vol):</i>		24.4
<i>Dry bulk density (g/cm³):</i>		1.67
<i>Wet bulk density (g/cm³):</i>		1.91
<i>Calculated Porosity (% vol):</i>		39.5
<i>Percent Saturation:</i>		61.9
<hr/>		
<i>Laboratory analysis by:</i>		D. O'Dowd
<i>Data entered by:</i>		D. O'Dowd
<i>Checked by:</i>		J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



Daniel B. Stephens & Associates, Inc.

**Data for Initial Moisture Content,
Bulk Density, Porosity, and Percent Saturation**

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 5. Radon Barrier #1 (90.0%)
Project Name: Crescent Junction
Date Sampled: NA

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	NA	17-Jul-20
<i>Field weight* of sample (g):</i>		549.97
<i>Tare weight, ring (g):</i>		126.14
<i>Tare weight, pan/plate (g):</i>		0.00
<i>Tare weight, other (g):</i>		0.00
<i>Dry weight of sample (g):</i>		364.16
<i>Sample volume (cm³):</i>		224.20
<i>Assumed particle density (g/cm³):</i>		2.76
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>		16.4
<i>Volumetric Moisture Content (% vol):</i>		26.6
<i>Dry bulk density (g/cm³):</i>		1.62
<i>Wet bulk density (g/cm³):</i>		1.89
<i>Calculated Porosity (% vol):</i>		41.1
<i>Percent Saturation:</i>		64.7
<hr/>		
<i>Laboratory analysis by:</i>	D. O'Dowd	
<i>Data entered by:</i>	D. O'Dowd	
<i>Checked by:</i>	J. Hines	

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 6. Radon Barrier #2 (90.1%)
Project Name: Crescent Junction
Date Sampled: NA

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	NA	17-Jul-20
<i>Field weight* of sample (g):</i>		549.31
<i>Tare weight, ring (g):</i>		133.07
<i>Tare weight, pan/plate (g):</i>		0.00
<i>Tare weight, other (g):</i>		0.00
<i>Dry weight of sample (g):</i>		357.80
<i>Sample volume (cm³):</i>		221.62
<i>Assumed particle density (g/cm³):</i>		2.76
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>		16.3
<i>Volumetric Moisture Content (% vol):</i>		26.4
<i>Dry bulk density (g/cm³):</i>		1.61
<i>Wet bulk density (g/cm³):</i>		1.88
<i>Calculated Porosity (% vol):</i>		41.5
<i>Percent Saturation:</i>		63.5
<hr/>		
<i>Laboratory analysis by:</i>		D. O'Dowd
<i>Data entered by:</i>		D. O'Dowd
<i>Checked by:</i>		J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Saturated Hydraulic Conductivity



Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K _{sat} (cm/sec)	Oversize Corrected K _{sat} (cm/sec)	Method of Analysis	
			Constant Head Flexible Wall	Falling Head Flexible Wall
1. Excavated Test Pit Alluvium 1'-5' (89.8%)	1.1E-04	---		X
2. Mix, Borrow Face Phase 3C (89.4%)	1.7E-04	---		X
3. Interim Cover Mix (90.5%)	2.8E-04	2.7E-04		X
4. Open Test Pit, Alluvium 1'-10' (89.0%)	1.5E-04	---		X
5. Radon Barrier #1 (90.0%)	3.2E-06	---		X
6. Radon Barrier #2 (90.1%)	2.1E-05	---		X

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 1. Excavated Test Pit Alluvium 1'-5' (89.8%)
Project Name: Crescent Junction
Date Sampled: NA

Remolded or Initial Sample Properties

Initial Mass (g): 431.66
Diameter (cm): 6.119
Length (cm): 7.580
Area (cm²): 29.41
Volume (cm³): 222.91
Dry Density (g/cm³): 1.71
Dry Density (pcf): 106.5
Water Content (% g/g): 13.5
Water Content (% vol): 23.1
Void Ratio (e): 0.62
Porosity (% vol): 38.2
Saturation (%): 60.4

Post Permeation Sample Properties

Saturated Mass (g): 464.75
Dry Mass (g): 380.24
Diameter (cm): 6.157
Length (cm): 7.576
Deformation (%)**: 0.06
Area (cm²): 29.77
Volume (cm³): 225.55
Dry Density (g/cm³): 1.69
Dry Density (pcf): 105.2
Water Content (% g/g): 22.2
Water Content (% vol): 37.5
Void Ratio(e): 0.64
Porosity (% vol): 38.9
Saturation (%)*: 96.3

Test and Sample Conditions

Permeant liquid used: Tap Water
Sample Preparation: ☐ In situ sample, extruded
☒ Remolded Sample
Number of Lifts: 3
Split: #4
Percent Coarse Material (%): 3.7
Particle Density(g/cm³): 2.76 ☒ Assumed ☐ Measured
Cell pressure (PSI): 81.0
Influent pressure (PSI): 80.0
Effluent pressure (PSI): 80.0
Panel Used: ☐ G ☒ H ☐ I
Reading: ☐ Annulus ☒ Pipette
Date/Time
B-Value (% saturation) prior to test*: 1.00 7/21/20 1200
B-Value (% saturation) post to test: 1.00 7/22/20 1200

* Per ASTM D5084 percent saturation is ensured (B-Value \geq 95%) prior to testing, as post test saturation values may be exaggerated during depressurizing and sample removal.

**Percent Deformation: based on initial sample length and post permeation sample length.

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines



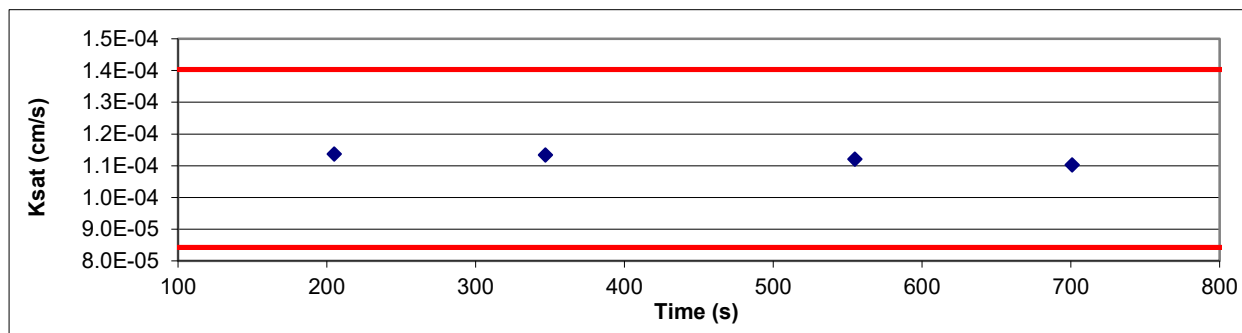
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Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 1. Excavated Test Pit Alluvium 1'-5' (89.8%)
Project Name: Crescent Junction
Date Sampled: NA

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient (ΔH/ΔL)	Average Flow (cm ³)	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k _{sat} T°C (cm/s)	k _{sat} Corrected (cm/s)
Test # 1:											
21-Jul-20	12:47:00	22.4	10.00	20.00	1.52	0.87	205	1.00	20%	1.20E-04	1.14E-04
21-Jul-20	12:50:25	22.4	11.00	19.00	1.22						
Test # 2:											
21-Jul-20	12:52:32	22.4	11.50	18.50	1.07	0.43	142	1.00	14%	1.20E-04	1.13E-04
21-Jul-20	12:54:54	22.4	12.00	18.00	0.91						
Test # 3:											
22-Jul-20	10:38:00	22.4	10.00	20.00	1.52	0.87	208	1.00	20%	1.19E-04	1.12E-04
22-Jul-20	10:41:28	22.4	11.00	19.00	1.22						
Test # 4:											
22-Jul-20	10:43:36	22.4	11.50	18.50	1.07	0.43	146	1.00	14%	1.17E-04	1.10E-04
22-Jul-20	10:46:02	22.4	12.00	18.00	0.91						

Average Ksat (cm/sec): 1.12E-04
Calculated Gravel Corrected Average Ksat (cm/sec): ---



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 8.42E-05

Ksat (+25%) (cm/s): 1.40E-04



Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 2. Mix, Borrow Face Phase 3C (89.4%)
Project Name: Crescent Junction
Date Sampled: NA

Remolded or Initial Sample Properties

Initial Mass (g): 436.69
Diameter (cm): 6.136
Length (cm): 7.616
Area (cm²): 29.57
Volume (cm³): 225.21
Dry Density (g/cm³): 1.70
Dry Density (pcf): 106.4
Water Content (% g/g): 13.7
Water Content (% vol): 23.4
Void Ratio (e): 0.62
Porosity (% vol): 38.2
Saturation (%): 61.2

Post Permeation Sample Properties

Saturated Mass (g): 468.23
Dry Mass (g): 383.97
Diameter (cm): 6.158
Length (cm): 7.610
Deformation (%)**: 0.08
Area (cm²): 29.78
Volume (cm³): 226.64
Dry Density (g/cm³): 1.69
Dry Density (pcf): 105.8
Water Content (% g/g): 21.9
Water Content (% vol): 37.2
Void Ratio(e): 0.63
Porosity (% vol): 38.6
Saturation (%)*: 96.3

Test and Sample Conditions

Permeant liquid used: Tap Water
Sample Preparation: ☐ In situ sample, extruded
☒ Remolded Sample
Number of Lifts: 3
Split: #4
Percent Coarse Material (%): 1.9
Particle Density(g/cm³): 2.76 ☒ Assumed ☐ Measured
Cell pressure (PSI): 81.0
Influent pressure (PSI): 80.0
Effluent pressure (PSI): 80.0
Panel Used: ☐ G ☐ H ☒ I
Reading: ☐ Annulus ☒ Pipette
Date/Time
B-Value (% saturation) prior to test*: 0.99 7/21/20 1203
B-Value (% saturation) post to test: 0.99 7/22/20 1203

* Per ASTM D5084 percent saturation is ensured (B-Value \geq 95%) prior to testing, as post test saturation values may be exaggerated during depressurizing and sample removal.

**Percent Deformation: based on initial sample length and post permeation sample length.

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines



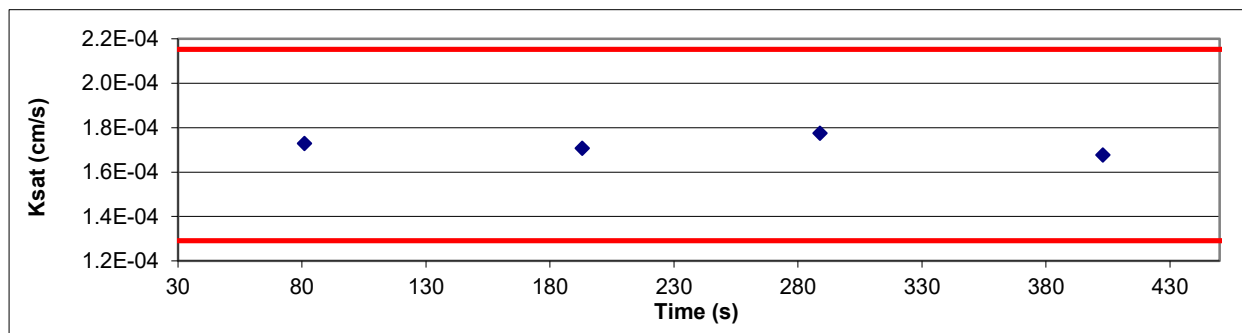
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Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 2. Mix, Borrow Face Phase 3C (89.4%)
Project Name: Crescent Junction
Date Sampled: NA

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient ($\Delta H/\Delta L$)	Average Flow (cm ³)	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k _{sat} T°C (cm/s)	k _{sat} Corrected (cm/s)
Test # 1:											
21-Jul-20	12:49:03	22.4	11.00	19.00	1.21	0.43	81	1.00	12%	1.83E-04	1.73E-04
21-Jul-20	12:50:24	22.4	11.50	18.50	1.06						
Test # 2:											
21-Jul-20	12:51:52	22.4	12.00	18.00	0.91	0.43	112	1.00	17%	1.81E-04	1.71E-04
21-Jul-20	12:53:44	22.4	12.50	17.50	0.76						
Test # 3:											
22-Jul-20	10:40:04	22.4	11.00	19.00	1.21	0.52	96	1.00	15%	1.88E-04	1.77E-04
22-Jul-20	10:41:40	22.4	11.60	18.40	1.03						
Test # 4:											
22-Jul-20	10:42:57	22.4	12.00	18.00	0.91	0.43	114	1.00	17%	1.78E-04	1.68E-04
22-Jul-20	10:44:51	22.4	12.50	17.50	0.76						

Average Ksat (cm/sec): 1.72E-04
Calculated Gravel Corrected Average Ksat (cm/sec): ---



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 1.29E-04

Ksat (+25%) (cm/s): 2.15E-04



Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 3. Interim Cover Mix (90.5%)
Project Name: Crescent Junction
Date Sampled: NA

Remolded or Initial Sample Properties

Initial Mass (g): 428.41
Diameter (cm): 6.097
Length (cm): 7.586
Area (cm²): 29.20
Volume (cm³): 221.48
Dry Density (g/cm³): 1.70
Dry Density (pcf): 106.4
Water Content (% g/g): 13.5
Water Content (% vol): 23.0
Void Ratio (e): 0.62
Porosity (% vol): 38.2
Saturation (%): 60.1

Post Permeation Sample Properties

Saturated Mass (g): 461.33
Dry Mass (g): 377.53
Diameter (cm): 6.138
Length (cm): 7.574
Deformation (%)**: 0.15
Area (cm²): 29.59
Volume (cm³): 224.13
Dry Density (g/cm³): 1.68
Dry Density (pcf): 105.2
Water Content (% g/g): 22.2
Water Content (% vol): 37.4
Void Ratio(e): 0.64
Porosity (% vol): 39.0
Saturation (%)*: 95.9

Test and Sample Conditions

Permeant liquid used: Tap Water
Sample Preparation: ☐ In situ sample, extruded
☒ Remolded Sample
Number of Lifts: 3
Split: #4
Percent Coarse Material (%): 5.4
Particle Density(g/cm³): 2.76 ☒ Assumed ☐ Measured
Cell pressure (PSI): 81.0
Influent pressure (PSI): 80.0
Effluent pressure (PSI): 80.0
Panel Used: ☒ G ☐ H ☐ I
Reading: ☐ Annulus ☒ Pipette
Date/Time
B-Value (% saturation) prior to test*: 0.99 7/21/20 1206
B-Value (% saturation) post to test: 0.99 7/22/20 1206

* Per ASTM D5084 percent saturation is ensured (B-Value \geq 95%) prior to testing, as post test saturation values may be exaggerated during depressurizing and sample removal.

**Percent Deformation: based on initial sample length and post permeation sample length.

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines



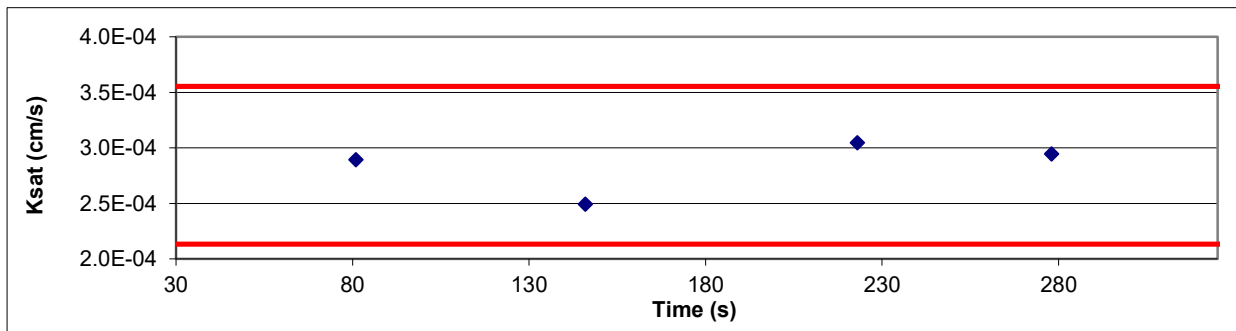
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Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 3. Interim Cover Mix (90.5%)
Project Name: Crescent Junction
Date Sampled: NA

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient (ΔH/ΔL)	Average Flow (cm ³)	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k _{sat} T°C (cm/s)	k _{sat} Corrected (cm/s)
Test # 1:											
21-Jul-20	12:48:00	22.4	10.00	20.00	1.52	0.87	81	1.00	20%	3.06E-04	2.89E-04
21-Jul-20	12:49:21	22.4	11.00	19.00	1.22						
Test # 2:											
21-Jul-20	12:50:10	22.4	11.50	18.50	1.07	0.43	65	1.00	14%	2.64E-04	2.49E-04
21-Jul-20	12:51:15	22.4	12.00	18.00	0.91						
Test # 3:											
22-Jul-20	10:25:00	22.4	10.00	20.00	1.52	0.87	77	1.00	20%	3.22E-04	3.04E-04
22-Jul-20	10:26:17	22.4	11.00	19.00	1.22						
Test # 4:											
22-Jul-20	10:27:03	22.4	11.50	18.50	1.07	0.43	55	1.00	14%	3.12E-04	2.94E-04
22-Jul-20	10:27:58	22.4	12.00	18.00	0.91						

Average Ksat (cm/sec): 2.84E-04
Calculated Gravel Corrected Average Ksat (cm/sec): 2.69E-04



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 2.13E-04

Ksat (+25%) (cm/s): 3.55E-04



Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 4. Open Test Pit, Alluvium 1'-10' (89.0%)
Project Name: Crescent Junction
Date Sampled: NA

Remolded or Initial Sample Properties

Initial Mass (g): 425.61
Diameter (cm): 6.118
Length (cm): 7.565
Area (cm²): 29.40
Volume (cm³): 222.39
Dry Density (g/cm³): 1.69
Dry Density (pcf): 105.3
Water Content (% g/g): 13.5
Water Content (% vol): 22.8
Void Ratio (e): 0.64
Porosity (% vol): 38.9
Saturation (%): 58.5

Post Permeation Sample Properties

Saturated Mass (g): 459.60
Dry Mass (g): 374.96
Diameter (cm): 6.157
Length (cm): 7.559
Deformation (%)**: 0.07
Area (cm²): 29.77
Volume (cm³): 225.07
Dry Density (g/cm³): 1.67
Dry Density (pcf): 104.0
Water Content (% g/g): 22.6
Water Content (% vol): 37.6
Void Ratio(e): 0.66
Porosity (% vol): 39.6
Saturation (%)*: 94.9

Test and Sample Conditions

Permeant liquid used: Tap Water
Sample Preparation: ☐ In situ sample, extruded
☒ Remolded Sample
Number of Lifts: 3
Split: #4
Percent Coarse Material (%): 0.1
Particle Density(g/cm³): 2.76 ☒ Assumed ☐ Measured
Cell pressure (PSI): 81.0
Influent pressure (PSI): 80.0
Effluent pressure (PSI): 80.0
Panel Used: ☐ A ☐ B ☒ C
Reading: ☐ Annulus ☒ Pipette
Date/Time
B-Value (% saturation) prior to test*: 0.99 7/21/20 1212
B-Value (% saturation) post to test: 1.00 7/22/20 1210

* Per ASTM D5084 percent saturation is ensured (B-Value \geq 95%) prior to testing, as post test saturation values may be exaggerated or skewed during depressurizing and sample removal.

**Percent Deformation: based on initial sample length and post permeation sample length.

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

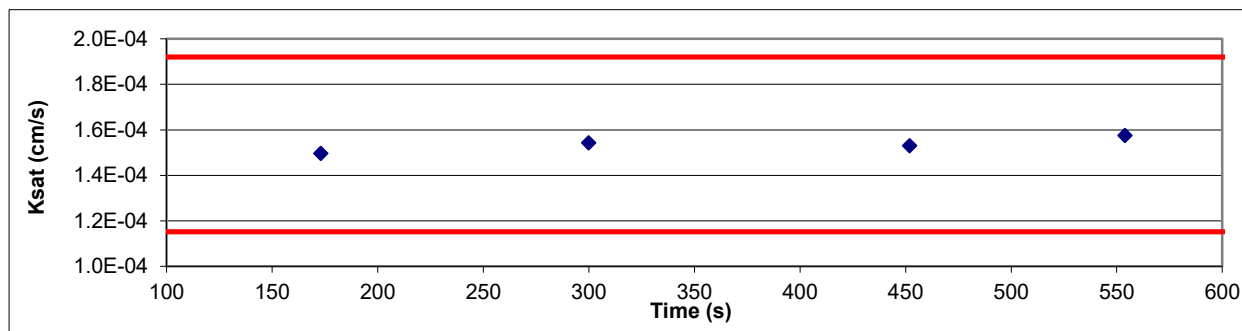


Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 4. Open Test Pit, Alluvium 1'-10' (89.0%)
Project Name: Crescent Junction
Date Sampled: NA

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient (ΔH/ΔL)	Average Flow (cm ³)	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k _{sat} T°C (cm/s)	k _{sat} Corrected (cm/s)
Test # 1:											
21-Jul-20	12:48:00	22.4	10.00	20.00	1.53	0.96	173	1.00	22%	1.58E-04	1.50E-04
21-Jul-20	12:50:53	22.4	11.10	18.90	1.19						
Test # 2:											
21-Jul-20	12:52:01	22.4	11.50	18.50	1.07	0.52	127	1.00	17%	1.63E-04	1.54E-04
21-Jul-20	12:54:08	22.4	12.10	17.90	0.89						
Test # 3:											
22-Jul-20	10:25:00	22.4	10.00	20.00	1.53	0.87	152	1.00	20%	1.62E-04	1.53E-04
22-Jul-20	10:27:32	22.4	11.00	19.00	1.22						
Test # 4:											
22-Jul-20	10:29:06	22.4	11.50	18.50	1.07	0.43	102	1.00	14%	1.67E-04	1.57E-04
22-Jul-20	10:30:48	22.4	12.00	18.00	0.92						

Average Ksat (cm/sec): 1.54E-04
Calculated Gravel Corrected Average Ksat (cm/sec): ---



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 1.15E-04

Ksat (+25%) (cm/s): 1.92E-04



Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 5. Radon Barrier #1 (90.0%)
Project Name: Crescent Junction
Date Sampled: NA

Remolded or Initial Sample Properties

Initial Mass (g): 265.11
Diameter (cm): 4.860
Length (cm): 7.605
Area (cm²): 18.55
Volume (cm³): 141.08
Dry Density (g/cm³): 1.61
Dry Density (pcf): 100.4
Water Content (% g/g): 16.9
Water Content (% vol): 27.1
Void Ratio (e): 0.72
Porosity (% vol): 41.7
Saturation (%): 65.0

Post Permeation Sample Properties

Saturated Mass (g): 284.74
Dry Mass (g): 226.85
Diameter (cm): 4.817
Length (cm): 7.542
Deformation (%)**: 0.84
Area (cm²): 18.22
Volume (cm³): 137.45
Dry Density (g/cm³): 1.65
Dry Density (pcf): 103.0
Water Content (% g/g): 25.5
Water Content (% vol): 42.1
Void Ratio(e): 0.67
Porosity (% vol): 40.2
Saturation (%)*: 104.8

Test and Sample Conditions

Permeant liquid used: Tap Water
Sample Preparation: ☐ In situ sample, extruded
☒ Remolded Sample
Number of Lifts: 3
Split: #4
Percent Coarse Material (%): 0.8
Particle Density(g/cm³): 2.76 ☒ Assumed ☐ Measured
Cell pressure (PSI): 83.0
Influent pressure (PSI): 80.0
Effluent pressure (PSI): 80.0
Panel Used: ☒ O ☐ P ☐ Q
Reading: ☐ Annulus ☒ Pipette
Date/Time
B-Value (% saturation) prior to test*: 1.00 9/2/20 1234
B-Value (% saturation) post to test: 1.00 9/3/20 945

* Per ASTM D5084 percent saturation is ensured (B-Value ≥ 95%) prior to testing, as post test saturation values may be exaggerated during depressurizing and sample removal.

**Percent Deformation: based on initial sample length and post permeation sample length.

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines



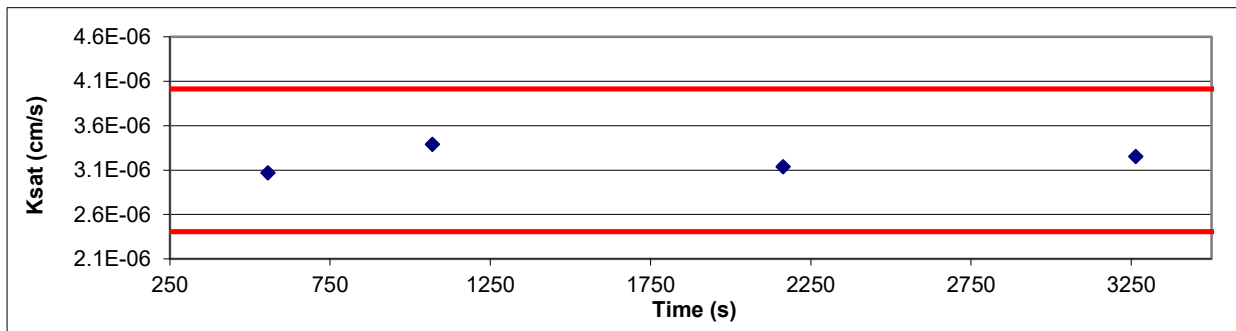
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Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 5. Radon Barrier #1 (90.0%)
Project Name: Crescent Junction
Date Sampled: NA

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient ($\Delta H/\Delta L$)	Average Flow (cm ³)	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k _{sat} T°C (cm/s)	k _{sat} Corrected (cm/s)
Test # 1:											
02-Sep-20	12:51:15	22.4	3.00	23.00	3.06	0.09	556	1.00	1%	3.25E-06	3.07E-06
02-Sep-20	13:00:31	22.4	3.10	22.90	3.03	0.09	556	1.00	1%	3.25E-06	3.07E-06
Test # 2:											
02-Sep-20	13:08:41	22.4	3.20	22.80	3.00	0.09	514	1.00	1%	3.59E-06	3.39E-06
02-Sep-20	13:17:15	22.4	3.30	22.70	2.97	0.09	514	1.00	1%	3.59E-06	3.39E-06
Test # 3:											
03-Sep-20	08:43:00	22.4	3.00	23.00	3.06	0.17	1094	1.00	2%	3.32E-06	3.14E-06
03-Sep-20	09:01:14	22.4	3.20	22.80	3.00	0.17	1094	1.00	2%	3.32E-06	3.14E-06
Test # 4:											
03-Sep-20	09:18:10	22.4	3.40	22.60	2.94	0.17	1100	1.00	2%	3.44E-06	3.25E-06
03-Sep-20	09:36:30	22.4	3.60	22.40	2.88	0.17	1100	1.00	2%	3.44E-06	3.25E-06

Average Ksat (cm/sec): 3.21E-06
Calculated Gravel Corrected Average Ksat (cm/sec): ---



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 2.41E-06

Ksat (+25%) (cm/s): 4.01E-06



Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 6. Radon Barrier #2 (90.1%)
Project Name: Crescent Junction
Date Sampled: NA

Remolded or Initial Sample Properties

Initial Mass (g): 263.69
Diameter (cm): 4.870
Length (cm): 7.607
Area (cm²): 18.63
Volume (cm³): 141.70
Dry Density (g/cm³): 1.59
Dry Density (pcf): 99.3
Water Content (% g/g): 17.0
Water Content (% vol): 27.1
Void Ratio (e): 0.74
Porosity (% vol): 42.4
Saturation (%): 63.9

Post Permeation Sample Properties

Saturated Mass (g): 283.94
Dry Mass (g): 225.34
Diameter (cm): 4.818
Length (cm): 7.602
Deformation (%)**: 0.07
Area (cm²): 18.23
Volume (cm³): 138.60
Dry Density (g/cm³): 1.63
Dry Density (pcf): 101.5
Water Content (% g/g): 26.0
Water Content (% vol): 42.3
Void Ratio(e): 0.70
Porosity (% vol): 41.1
Saturation (%)*: 102.9

Test and Sample Conditions

Permeant liquid used: Tap Water
Sample Preparation: ☐ In situ sample, extruded
☒ Remolded Sample
Number of Lifts: 3
Split: #4
Percent Coarse Material (%): 0.7
Particle Density(g/cm³): 2.76 ☒ Assumed ☐ Measured
Cell pressure (PSI): 83.0
Influent pressure (PSI): 80.0
Effluent pressure (PSI): 80.0
Panel Used: ☐ O ☐ P ☒ Q
Reading: ☐ Annulus ☒ Pipette
Date/Time
B-Value (% saturation) prior to test*: 1.00 9/2/20 1230
B-Value (% saturation) post to test: 1.00 9/3/20 947

* Per ASTM D5084 percent saturation is ensured (B-Value \geq 95%) prior to testing, as post test saturation values may be exaggerated during depressurizing and sample removal.

**Percent Deformation: based on initial sample length and post permeation sample length.

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines



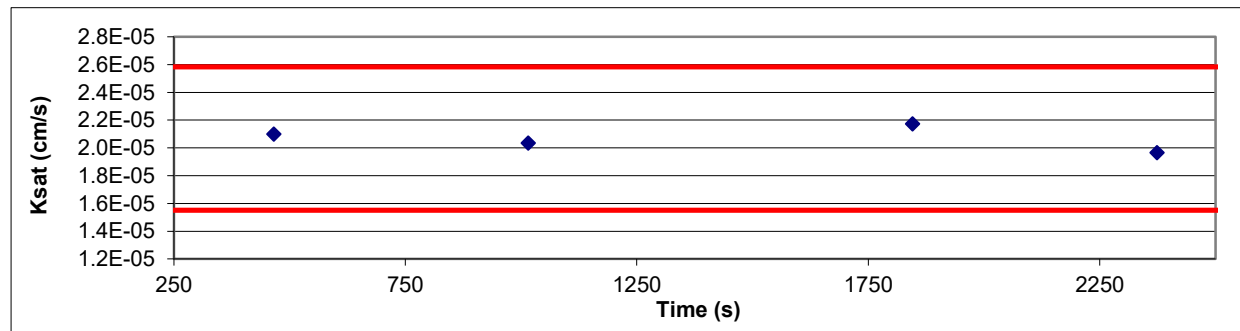
Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 6. Radon Barrier #2 (90.1%)
Project Name: Crescent Junction
Date Sampled: NA

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient ($\Delta H/\Delta L$)	Average Flow (cm ³)	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k _{sat} T°C (cm/s)	k _{sat} Corrected (cm/s)
Test # 1:											
02-Sep-20	13:10:03	22.4	4.00	22.00	2.73	0.43	466	1.00	6%	2.22E-05	2.10E-05
02-Sep-20	13:17:49	22.4	4.50	21.50	2.58						
Test # 2:											
02-Sep-20	13:28:06	22.4	5.10	20.90	2.40	0.43	550	1.00	6%	2.15E-05	2.03E-05
02-Sep-20	13:37:16	22.4	5.60	20.40	2.25						
Test # 3:											
03-Sep-20	08:43:00	22.4	3.00	23.00	3.04	0.87	830	1.00	10%	2.30E-05	2.17E-05
03-Sep-20	08:56:50	22.4	4.00	22.00	2.73						
Test # 4:											
03-Sep-20	09:05:00	22.4	4.50	21.50	2.58	0.43	528	1.00	6%	2.08E-05	1.96E-05
03-Sep-20	09:13:48	22.4	5.00	21.00	2.43						

Average Ksat (cm/sec): 2.07E-05
Calculated Gravel Corrected Average Ksat (cm/sec): ---



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 1.55E-05

Ksat (+25%) (cm/s): 2.58E-05

Moisture Retention Characteristics



Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
1. Excavated Test Pit Alluvium 1'-5' (89.8%)	0	37.5
	16	37.3
	37	37.2
	98	33.0
	337	25.6
	86887	7.3
	331741	4.5
	848426	4.6
2. Mix, Borrow Face Phase 3C (89.4%)	0	38.5
	16	38.0
	37	37.7
	98	31.0
	337	25.1
	84134	7.4
	247913	4.9
	848426	4.2
3. Interim Cover Mix (90.5%)	0	37.2
	18	35.9
	53	31.2
	121	27.6
	337	19.4
	121662	6.7
	370901	4.3
	848426	4.9

Volume adjustments are applicable at this matric potential (see data sheet for this sample).



**Summary of Moisture Characteristics
of the Initial Drainage Curve (Continued)**

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm ³ /cm ³)
4. Open Test Pit, Alluvium 1'-10' (89.0%)	0	41.4
	16	40.2
	37	39.9
	98	36.7
	337	31.1
	65675	7.0
	224152	4.6
	848426	4.2
5. Radon Barrier #1 (90.0%)	0	42.4 #
	18	41.7 #
	53	39.5 #
	121	36.8 #
	337	34.7 #
	109425	9.9 #
	366516	5.9 #
	848426	5.7 #
6. Radon Barrier #2 (90.1%)	0	42.4 #
	18	42.2 #
	53	40.0 #
	121	36.6 #
	337	34.6 #
	145831	8.7 #
	379774	5.7 #
	848426	5.3 #

Volume adjustments are applicable at this matric potential (see data sheet for this sample).



Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	α (cm ⁻¹)	N (dimensionless)	θ_r (% vol)	θ_s (% vol)	Oversize Corrected	
					θ_r (% vol)	θ_s (% vol)
1. Excavated Test Pit Alluvium 1'-5' (89.8%)	0.0085	1.3505	3.03	37.99	---	---
2. Mix, Borrow Face Phase 3C (89.4%)	0.0148	1.2785	1.61	39.15	---	---
3. Interim Cover Mix (90.5%)	0.0168	1.4153	4.32	37.25	4.17	35.97
4. Open Test Pit, Alluvium 1'-10' (89.0%)	0.0059	1.3171	1.06	40.94	---	---
5. Radon Barrier #1 (90.0%)	0.0053	1.2373	0.00	41.71	---	---
6. Radon Barrier #2 (90.1%)	0.0056	1.2439	0.00	42.03	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



Daniel B. Stephens & Associates, Inc.

Moisture Retention Data
Hanging Column / Pressure Plate
 (Soil-Water Characteristic Curve)

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 1. Excavated Test Pit Alluvium 1'-5' (89.8%)
Project Name: Crescent Junction
Date Sampled: NA

Dry wt. of sample (g): 379.30
Tare wt., ring (g): 130.69
Tare wt., screen & clamp (g): 25.22
Initial sample volume (cm³): 222.91
Initial dry bulk density (g/cm³): 1.70
Assumed particle density (g/cm³): 2.76
Initial calculated total porosity (%): 38.35

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content [†] (% vol)
<i>Hanging column:</i>	21-Jul-20	12:00	618.80	0	37.50
	28-Jul-20	14:50	618.28	16.0	37.27
	4-Aug-20	10:30	618.04	37.0	37.16
	11-Aug-20	10:45	608.84	98.0	33.03
<i>Pressure plate:</i>	20-Aug-20	14:30	592.24	337	25.58

Volume Adjusted Data¹

	Matric Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calculated Porosity (%)
<i>Hanging column:</i>	0.0	---	---	---	---
	16.0	---	---	---	---
	37.0	---	---	---	---
	98.0	---	---	---	---
<i>Pressure plate:</i>	337	---	---	---	---

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

[†] Assumed density of water is 1.0 g/cm³

[‡] Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd
Data entered by: A. Bland
Checked by: J. Hines



Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: 1. Excavated Test Pit Alluvium 1'-5' (89.8%)

Initial sample bulk density (g/cm³): 1.70

Fraction of test sample used (<2.00mm fraction) (%): 95.37

Dry weight* of dew point potentiometer sample (g): 171.89

Tare weight, jar (g): 111.81

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)
Dew point potentiometer:	28-Jul-20	14:08	174.58	86887	7.27
	24-Jul-20	9:54	173.54	331741	4.46

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	86887	---	---	---	---
	331741	---	---	---	---

Dry weight* of relative humidity box sample (g): 80.90

Tare weight (g): 45.72

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)
Relative humidity box:	24-Jul-20	12:00	81.90	848426	4.60

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Relative humidity box:	848426	---	---	---	---

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

* Weight including tares

[†] Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm³.

[‡] Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D.O'Dowd/D. O'Dowd

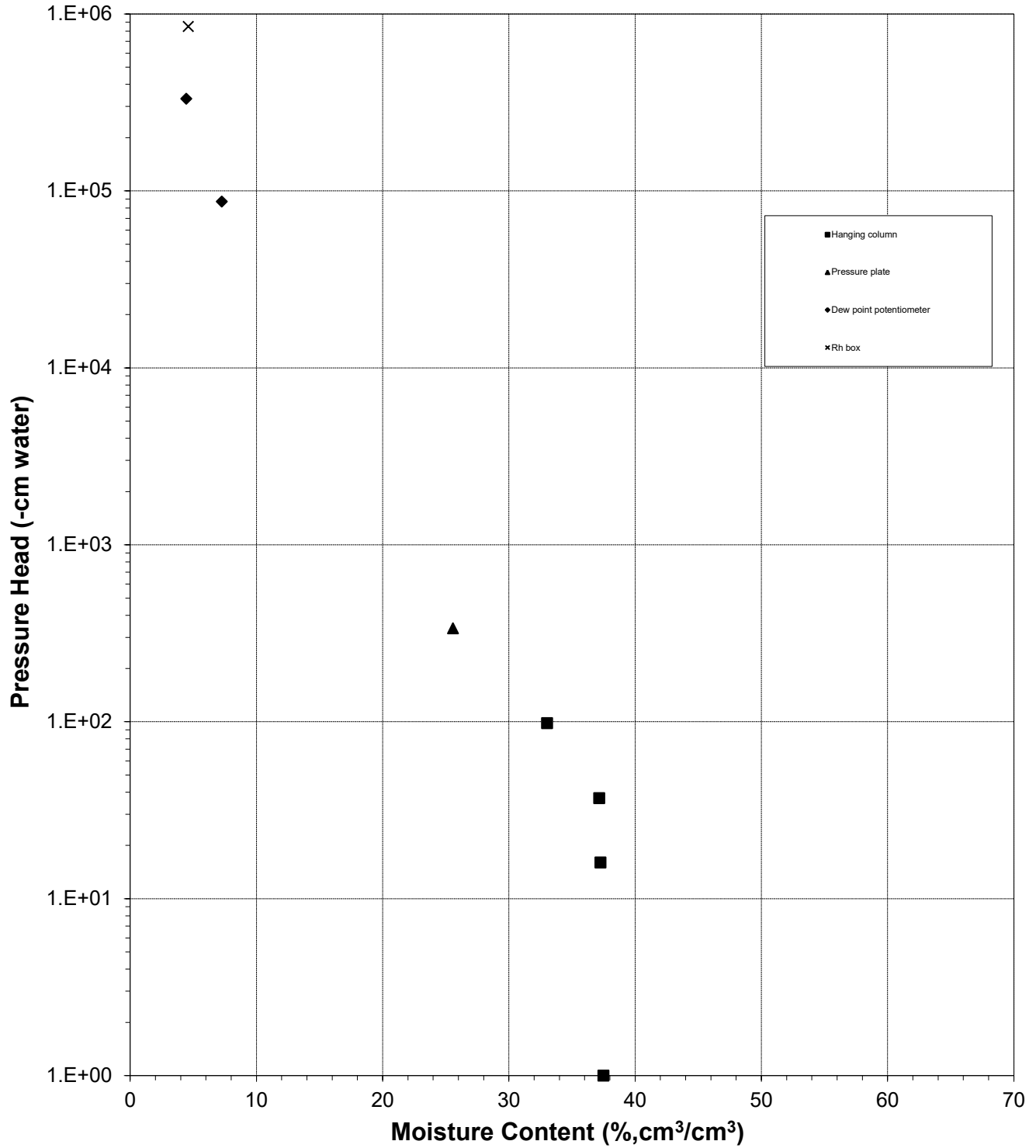
Data entered by: A. Bland

Checked by: J. Hines



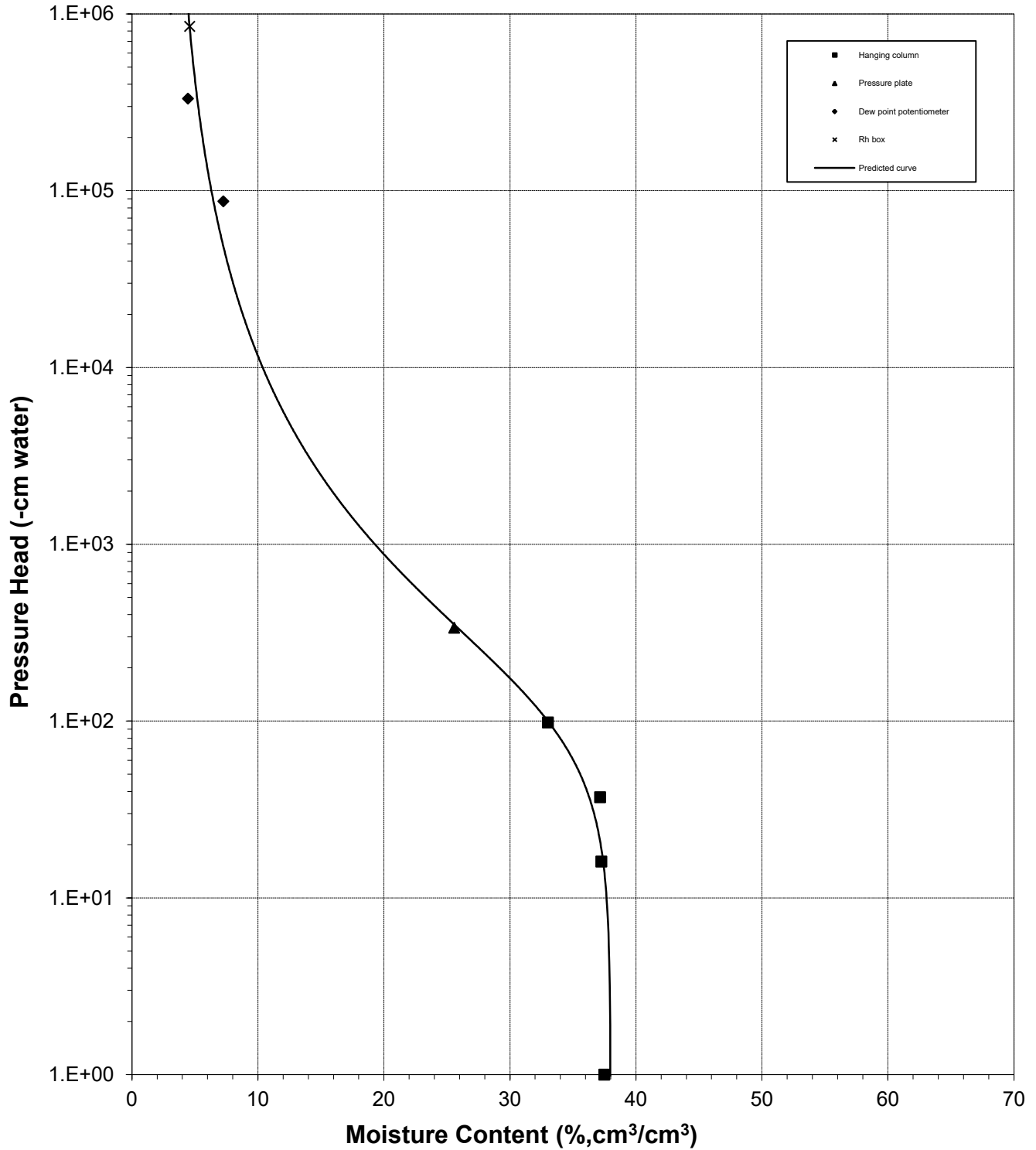
Water Retention Data Points

Sample Number: 1. Excavated Test Pit Alluvium 1'-5' (89.8%)





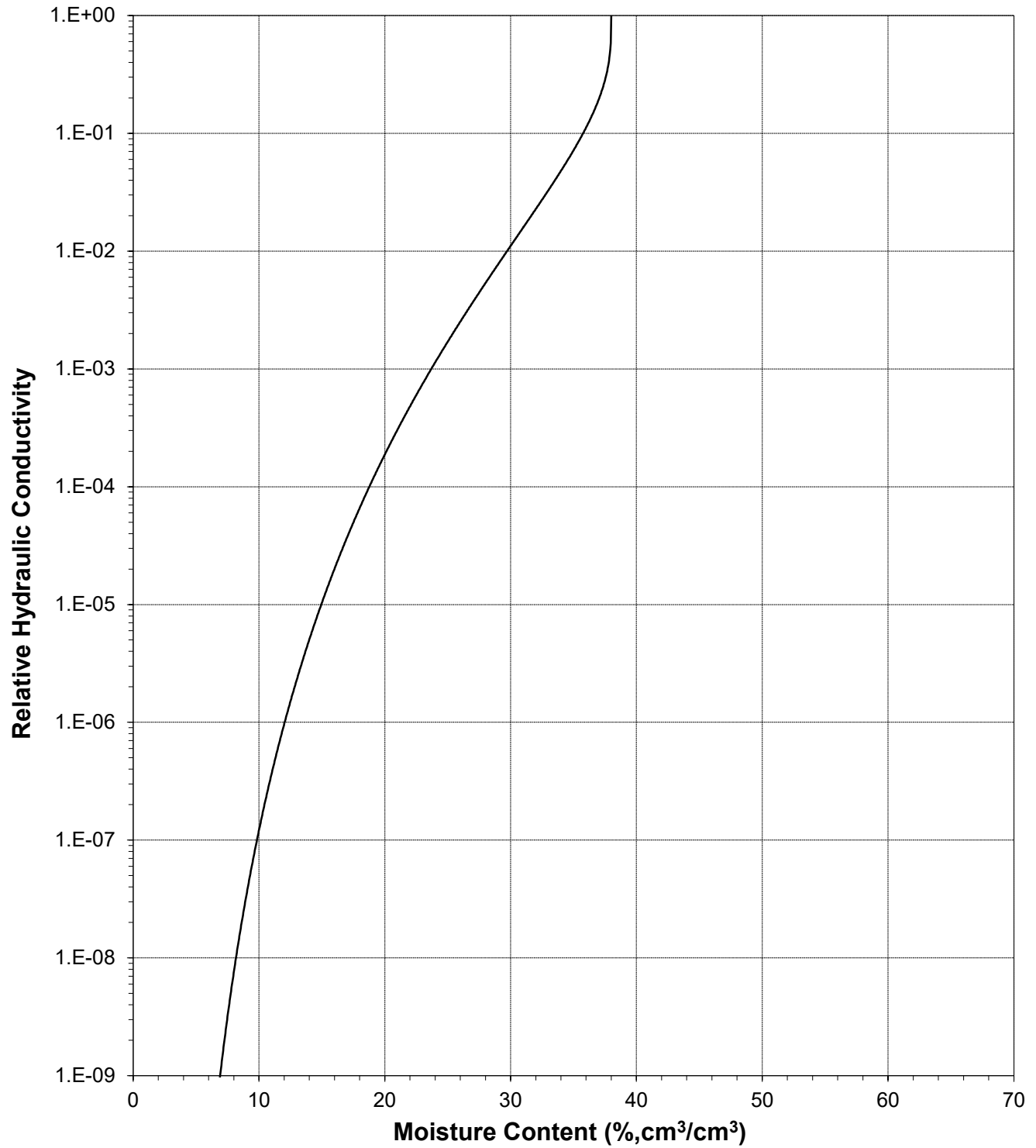
Predicted Water Retention Curve and Data Points
Sample Number: 1. Excavated Test Pit Alluvium 1'-5' (89.8%)





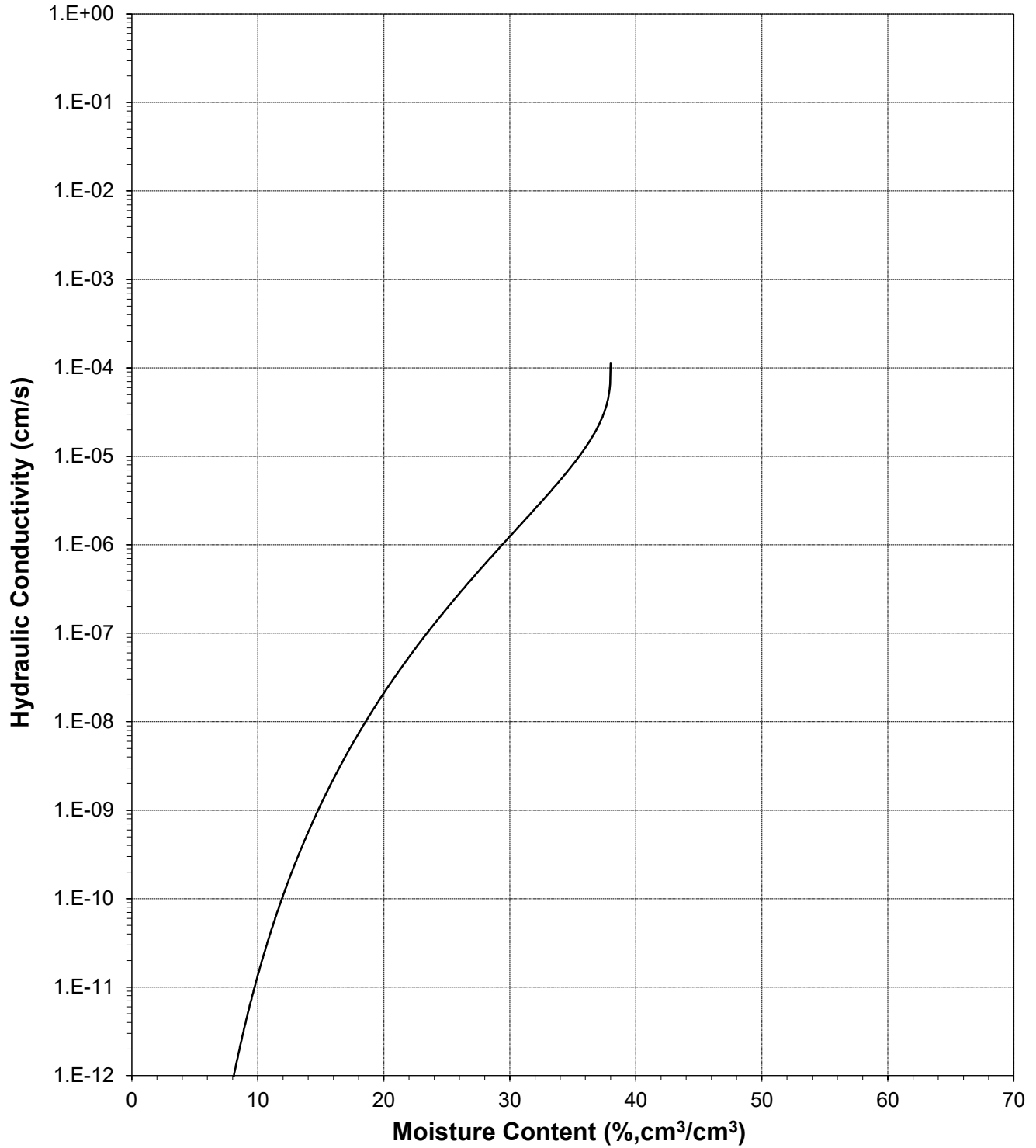
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: 1. Excavated Test Pit Alluvium 1'-5' (89.8%)





Plot of Hydraulic Conductivity vs Moisture Content
Sample Number: 1. Excavated Test Pit Alluvium 1'-5' (89.8%)

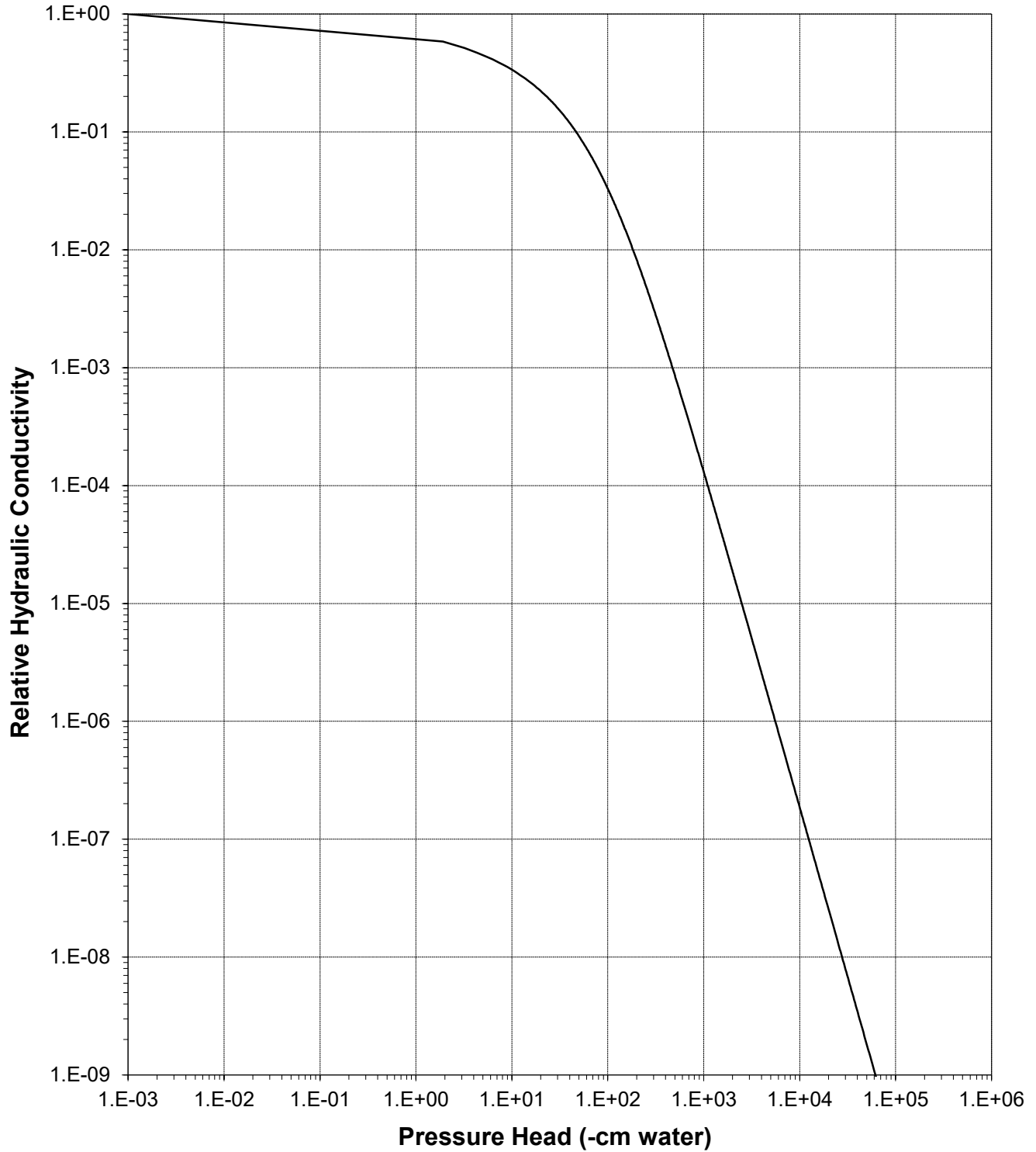




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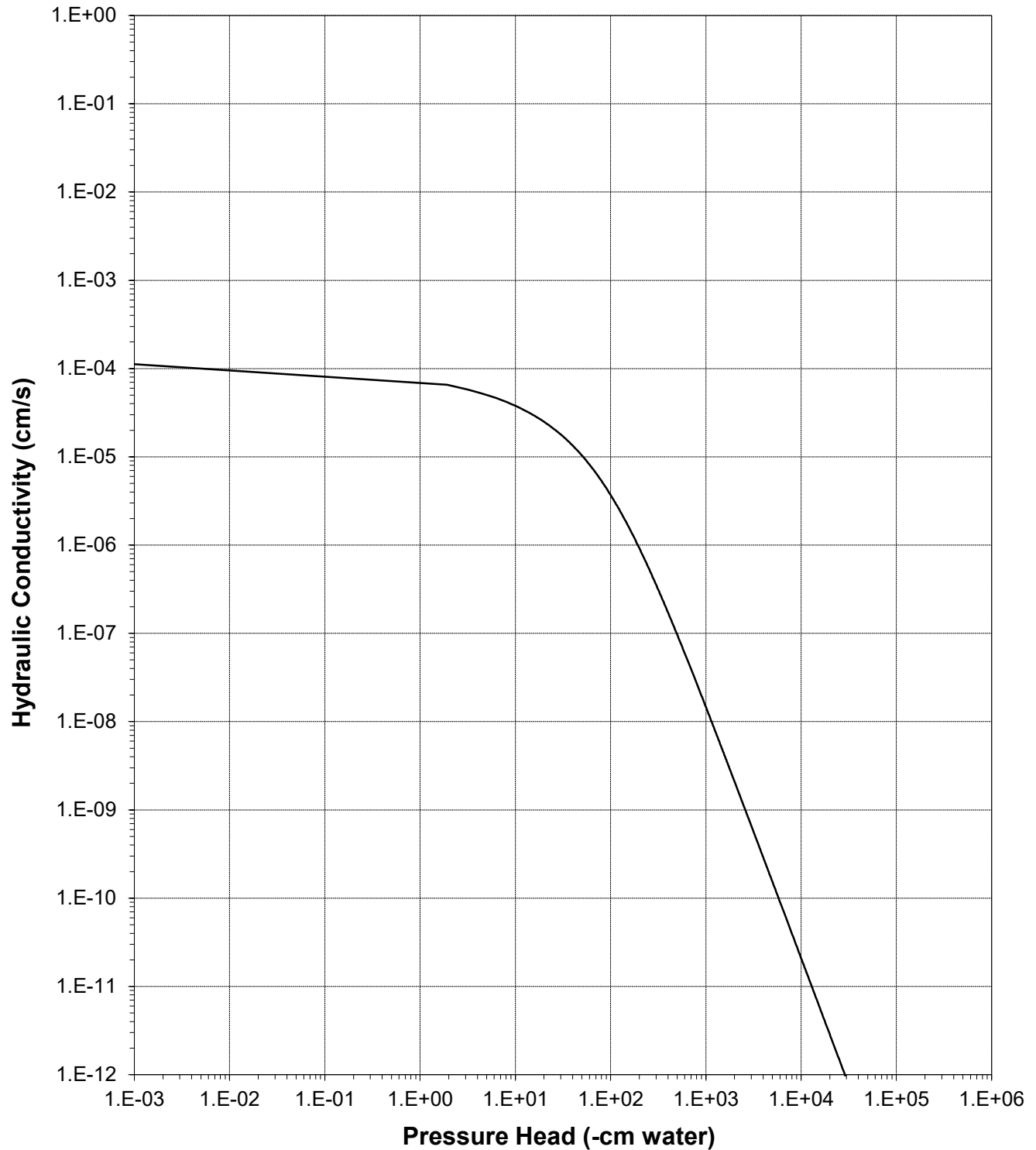
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: 1. Excavated Test Pit Alluvium 1'-5' (89.8%)





Plot of Hydraulic Conductivity vs Pressure Head
Sample Number: 1. Excavated Test Pit Alluvium 1'-5' (89.8%)





Oversize Correction Data Sheet

Job Name: Dwyer Engineering LLC
 Job Number: DB20.1167.00
 Sample Number: 1. Excavated Test Pit Alluvium 1'-5' (89.8%)
 Project Name: Crescent Junction
 Date Sampled: NA

Split (3/4", 3/8", #4): #4

	Coarse Fraction*	Fines Fraction**	Composite
Subsample Mass (g):	3.68	96.32	100.00
Mass Fraction (%):	3.68	96.32	100.00
<i>Initial Sample θ_i</i>			
Bulk Density (g/cm ³):	2.76	1.70	1.73
Calculated Porosity (% vol):	0.00	38.35	37.47
Volume of Solids (cm ³):	1.33	34.90	36.23
Volume of Voids (cm ³):	0.00	21.71	21.71
Total Volume (cm ³):	1.33	56.61	57.94
Volumetric Fraction (%):	2.30	97.70	100.00
Initial Moisture Content (% vol):	0.00	23.28	---
<i>Saturated Sample θ_s</i>			
Bulk Density (g/cm ³):	2.76	1.70	1.73
Calculated Porosity (% vol):	0.00	38.35	37.47
Volume of Solids (cm ³):	1.33	34.90	36.23
Volume of Voids (cm ³):	0.00	21.71	21.71
Total Volume (cm ³):	1.33	56.61	57.94
Volumetric Fraction (%):	2.30	97.70	100.00
Saturated Moisture Content (% vol):	0.00	37.99	---
<i>Residual Sample θ_r</i>			
Bulk Density (g/cm ³):	2.76	1.70	1.73
Calculated Porosity (% vol):	0.00	38.35	37.47
Volume of Solids (cm ³):	1.33	34.90	36.23
Volume of Voids (cm ³):	0.00	21.71	21.71
Total Volume (cm ³):	1.33	56.61	57.94
Volumetric Fraction (%):	2.30	97.70	100.00
Residual Moisture Content (% vol):	0.00	3.03	---
Ksat (cm/sec):	NM	1.1E-04	---

* = Porosity and moisture content of coarse fraction assumed to be zero.

** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.

NM = Not measured

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: A. Bland

Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

Moisture Retention Data
Hanging Column / Pressure Plate
 (Soil-Water Characteristic Curve)

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 2. Mix, Borrow Face Phase 3C (89.4%)
Project Name: Crescent Junction
Date Sampled: 7/7/20

Dry wt. of sample (g): 382.51
Tare wt., ring (g): 127.98
Tare wt., screen & clamp (g): 25.38
Initial sample volume (cm³): 225.21
Initial dry bulk density (g/cm³): 1.70
Assumed particle density (g/cm³): 2.76
Initial calculated total porosity (%): 38.46

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content [†] (% vol)
<i>Hanging column:</i>	21-Jul-20	12:00	622.59	0	38.51
	28-Jul-20	14:50	621.42	16.0	37.99
	4-Aug-20	10:30	620.68	37.0	37.66
	11-Aug-20	10:45	605.72	98.0	31.02
<i>Pressure plate:</i>	20-Aug-20	14:30	592.40	337	25.10

Volume Adjusted Data¹

	Matric Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calculated Porosity (%)
<i>Hanging column:</i>	0.0	---	---	---	---
	16.0	---	---	---	---
	37.0	---	---	---	---
	98.0	---	---	---	---
<i>Pressure plate:</i>	337	---	---	---	---

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

[†] Assumed density of water is 1.0 g/cm³

[‡] Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd
Data entered by: A. Bland
Checked by: J. Hines



Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: 2. Mix, Borrow Face Phase 3C (89.4%)

Initial sample bulk density (g/cm³): 1.70

Fraction of test sample used (<2.00mm fraction) (%): 96.08

Dry weight* of dew point potentiometer sample (g): 173.48

Tare weight, jar (g): 114.74

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)
Dew point potentiometer:	28-Jul-20	14:15	176.16	84134	7.45
	24-Jul-20	10:01	175.25	247913	4.92

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	84134	---	---	---	---
	247913	---	---	---	---

Dry weight* of relative humidity box sample (g): 66.91

Tare weight (g): 43.25

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)
Relative humidity box:	24-Jul-20	12:00	67.52	848426	4.22

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Relative humidity box:	848426	---	---	---	---

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "----" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

[†] Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm³.

[‡] Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D.O'Dowd/D. O'Dowd

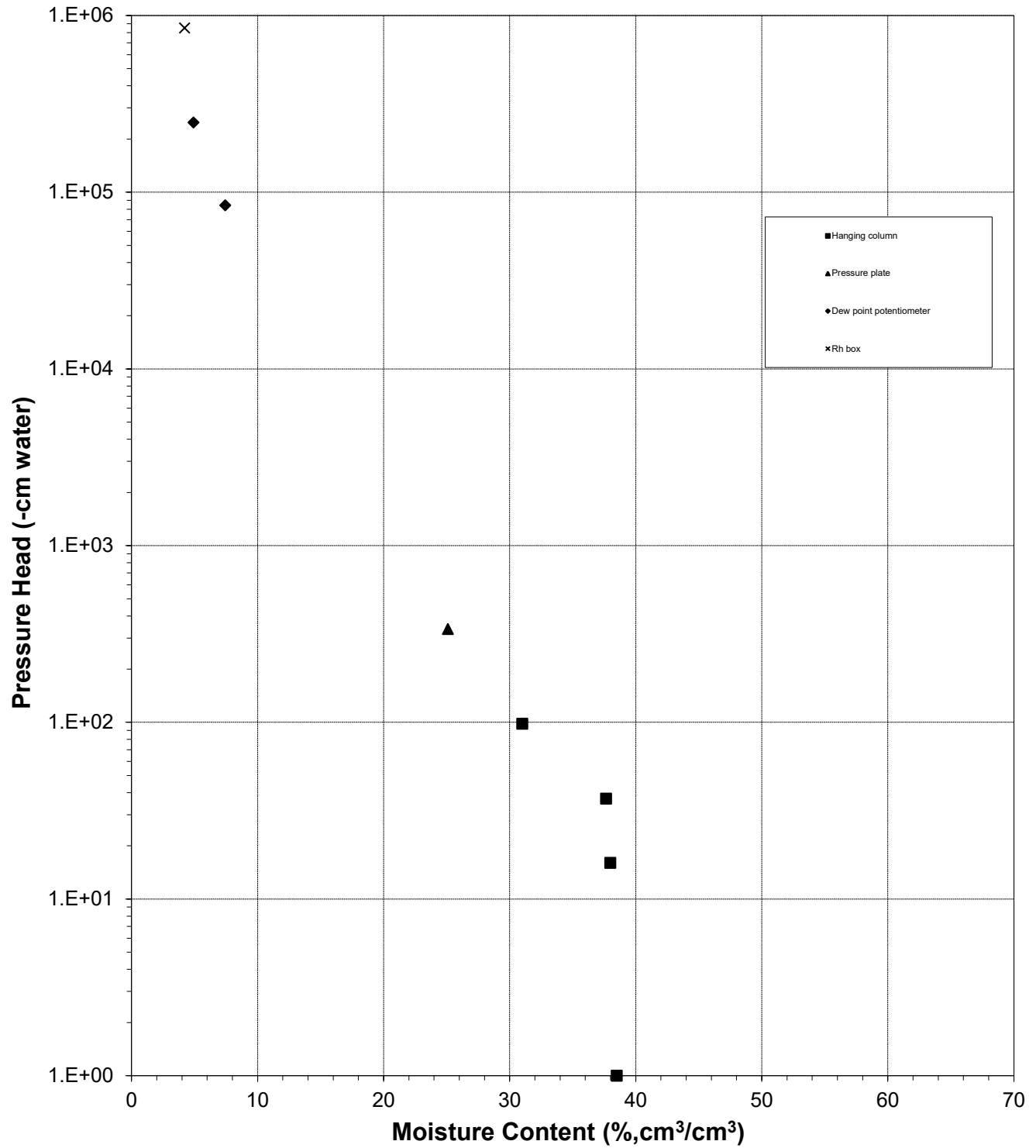
Data entered by: A. Bland

Checked by: J. Hines



Water Retention Data Points

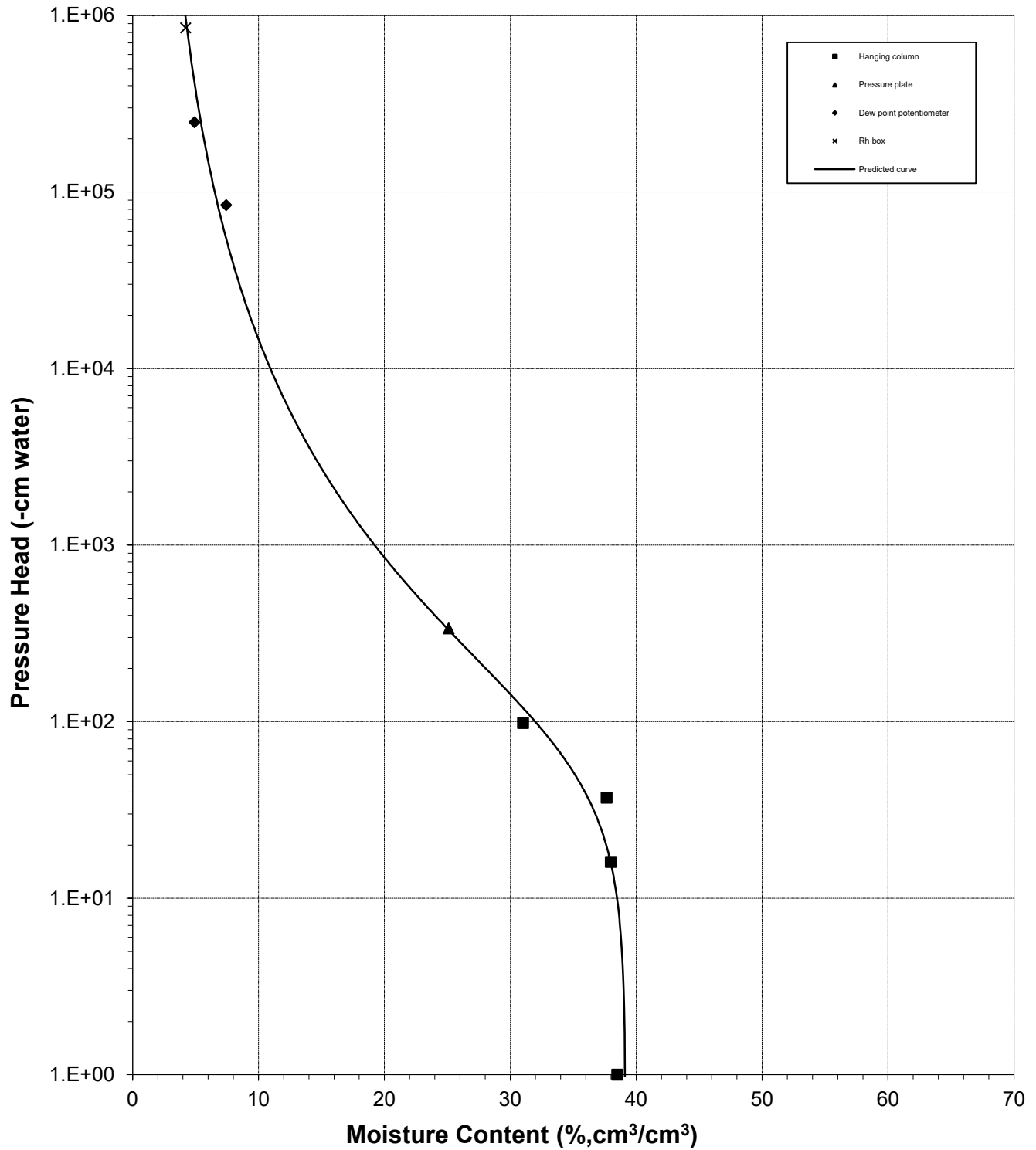
Sample Number: 2. Mix, Borrow Face Phase 3C (89.4%)





Predicted Water Retention Curve and Data Points

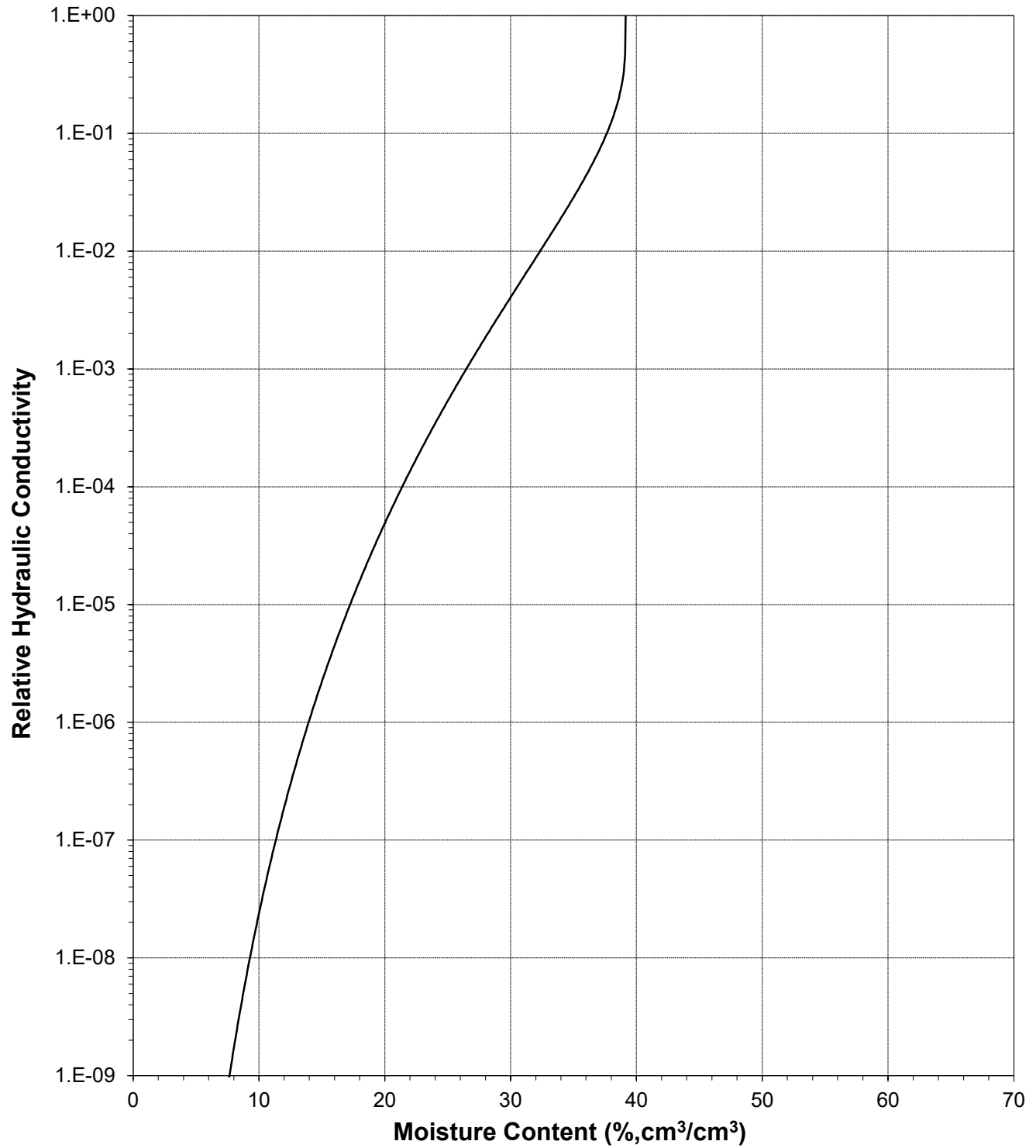
Sample Number: 2. Mix, Borrow Face Phase 3C (89.4%)





Plot of Relative Hydraulic Conductivity vs Moisture Content

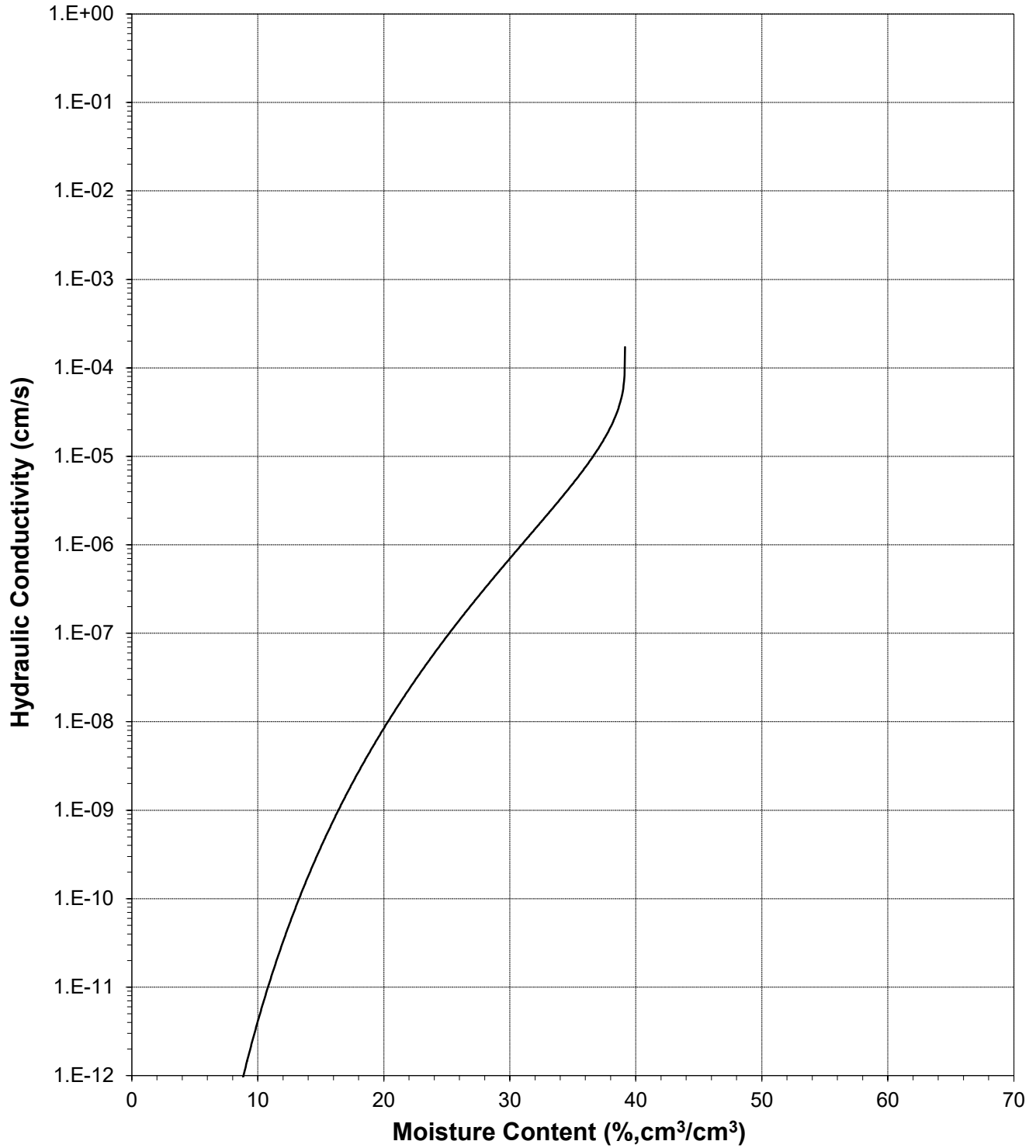
Sample Number: 2. Mix, Borrow Face Phase 3C (89.4%)





Plot of Hydraulic Conductivity vs Moisture Content

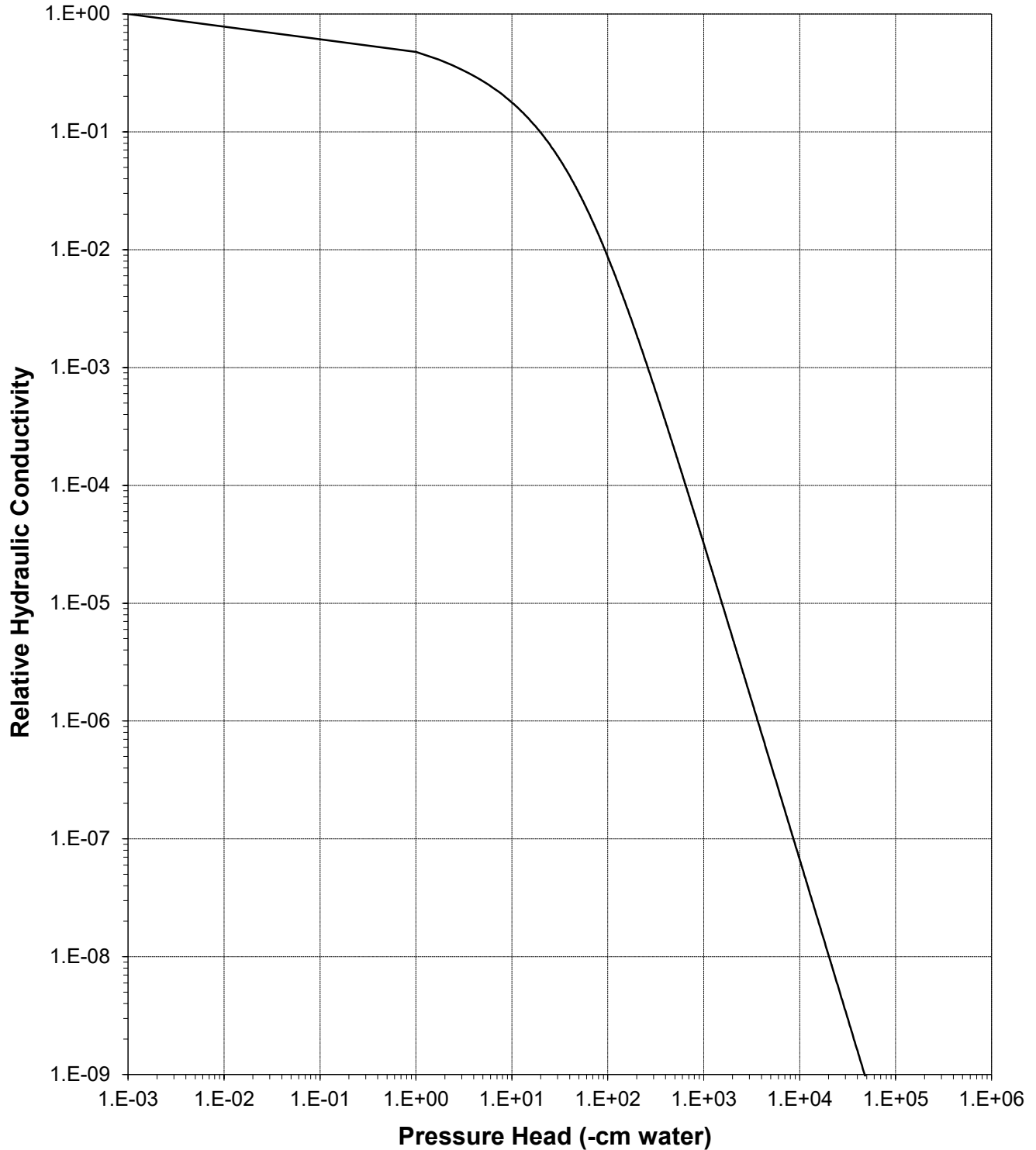
Sample Number: 2. Mix, Borrow Face Phase 3C (89.4%)





Plot of Relative Hydraulic Conductivity vs Pressure Head

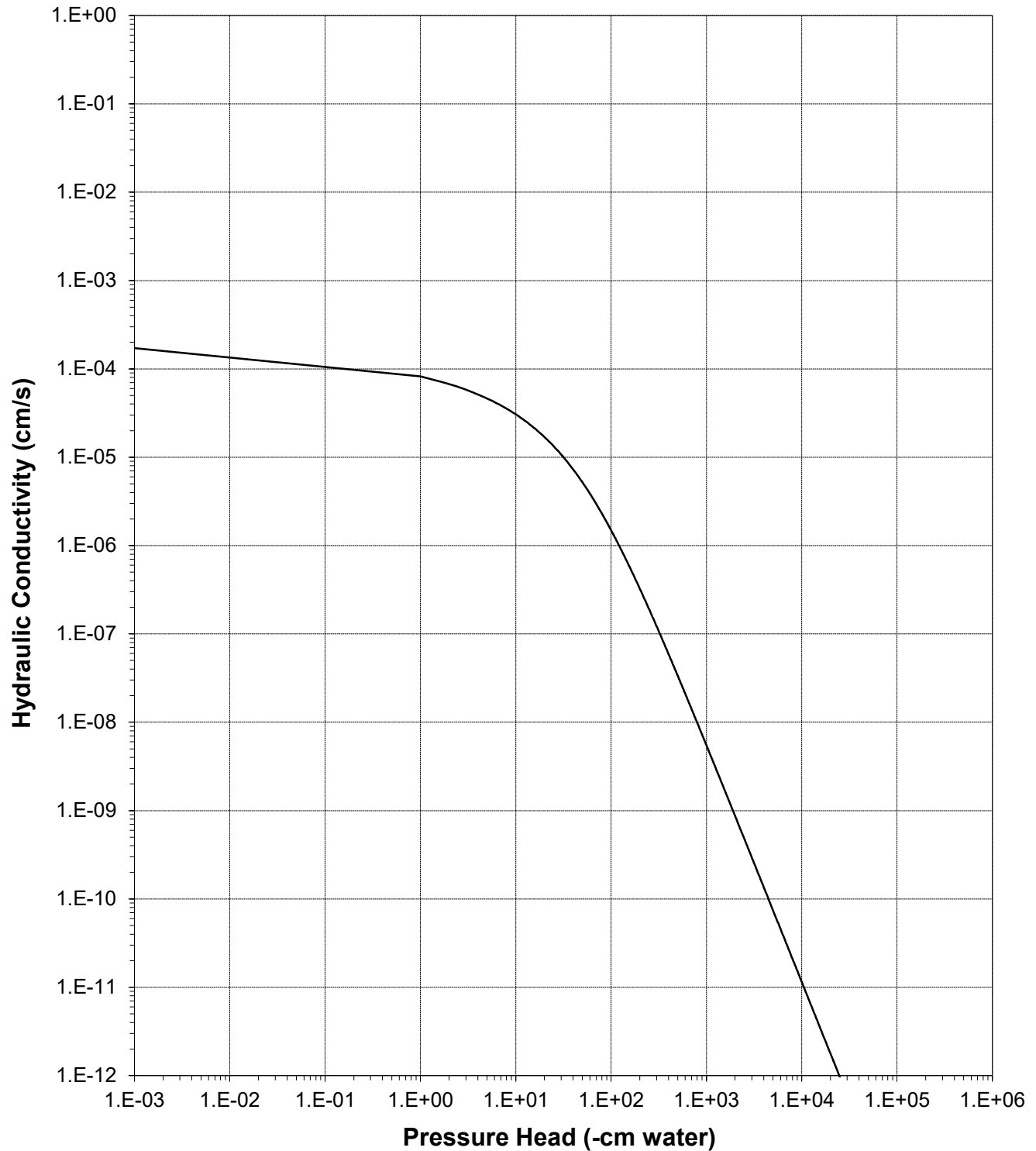
Sample Number: 2. Mix, Borrow Face Phase 3C (89.4%)





Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 2. Mix, Borrow Face Phase 3C (89.4%)





Daniel B. Stephens & Associates, Inc.

Oversize Correction Data Sheet

Job Name: Dwyer Engineering LLC
 Job Number: DB20.1167.00
 Sample Number: 2. Mix, Borrow Face Phase 3C (89.4%)
 Project Name: Crescent Junction
 Date Sampled: 7/7/20

Split (3/4", 3/8", #4): #4

	<u>Coarse Fraction*</u>	<u>Fines Fraction**</u>	<u>Composite</u>
Subsample Mass (g):	1.93	98.07	100.00
Mass Fraction (%):	1.93	98.07	100.00
<i>Initial Sample θ_i</i>			
Bulk Density (g/cm ³):	2.76	1.70	1.71
Calculated Porosity (% vol):	0.00	38.46	38.00
Volume of Solids (cm ³):	0.70	35.53	36.23
Volume of Voids (cm ³):	0.00	22.21	22.21
Total Volume (cm ³):	0.70	57.74	58.44
Volumetric Fraction (%):	1.20	98.80	100.00
Initial Moisture Content (% vol):	0.00	24.48	---
<i>Saturated Sample θ_s</i>			
Bulk Density (g/cm ³):	2.76	1.70	1.71
Calculated Porosity (% vol):	0.00	38.46	38.00
Volume of Solids (cm ³):	0.70	35.53	36.23
Volume of Voids (cm ³):	0.00	22.21	22.21
Total Volume (cm ³):	0.70	57.74	58.44
Volumetric Fraction (%):	1.20	98.80	100.00
Saturated Moisture Content (% vol):	0.00	39.15	---
<i>Residual Sample θ_r</i>			
Bulk Density (g/cm ³):	2.76	1.70	1.71
Calculated Porosity (% vol):	0.00	38.46	38.00
Volume of Solids (cm ³):	0.70	35.53	36.23
Volume of Voids (cm ³):	0.00	22.21	22.21
Total Volume (cm ³):	0.70	57.74	58.44
Volumetric Fraction (%):	1.20	98.80	100.00
Residual Moisture Content (% vol):	0.00	1.61	---
<i>Ksat (cm/sec):</i>			
	NM	1.7E-04	---

* = Porosity and moisture content of coarse fraction assumed to be zero.

** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.

NM = Not measured

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: A. Bland

Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

Moisture Retention Data
Hanging Column / Pressure Plate
 (Soil-Water Characteristic Curve)

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 3. Interim Cover Mix (90.5%)
Project Name: Crescent Junction
Date Sampled: NA

Dry wt. of sample (g): 379.90
Tare wt., ring (g): 137.52
Tare wt., screen & clamp (g): 27.00
Initial sample volume (cm³): 221.48
Initial dry bulk density (g/cm³): 1.72
Assumed particle density (g/cm³): 2.76
Initial calculated total porosity (%): 37.85

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content [†] (% vol)
<i>Hanging column:</i>	21-Jul-20	12:00	626.87	0	37.23
	28-Jul-20	15:00	623.85	18.0	35.86
	4-Aug-20	10:30	613.46	53.0	31.17
	11-Aug-20	10:45	605.46	121.0	27.56
<i>Pressure plate:</i>	20-Aug-20	14:30	587.40	337	19.41

Volume Adjusted Data¹

	Matric Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calculated Porosity (%)
<i>Hanging column:</i>	0.0	---	---	---	---
	18.0	---	---	---	---
	53.0	---	---	---	---
	121.0	---	---	---	---
<i>Pressure plate:</i>	337	---	---	---	---

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

[†] Assumed density of water is 1.0 g/cm³

[‡] Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd
Data entered by: A. Bland
Checked by: J. Hines



Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: 3. Interim Cover Mix (90.5%)

Initial sample bulk density (g/cm³): 1.72

Fraction of test sample used (<2.00mm fraction) (%): 92.15

Dry weight* of dew point potentiometer sample (g): 177.13

Tare weight, jar (g): 112.56

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)
Dew point potentiometer:	28-Jul-20	14:22	179.88	121662	6.73
	24-Jul-20	10:10	178.89	370901	4.31

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	121662	---	---	---	---
	370901	---	---	---	---

Dry weight* of relative humidity box sample (g): 87.06

Tare weight (g): 45.83

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)
Relative humidity box:	24-Jul-20	12:00	88.35	848426	4.93

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Relative humidity box:	848426	---	---	---	---

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "----" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

[†] Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm³.

[‡] Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

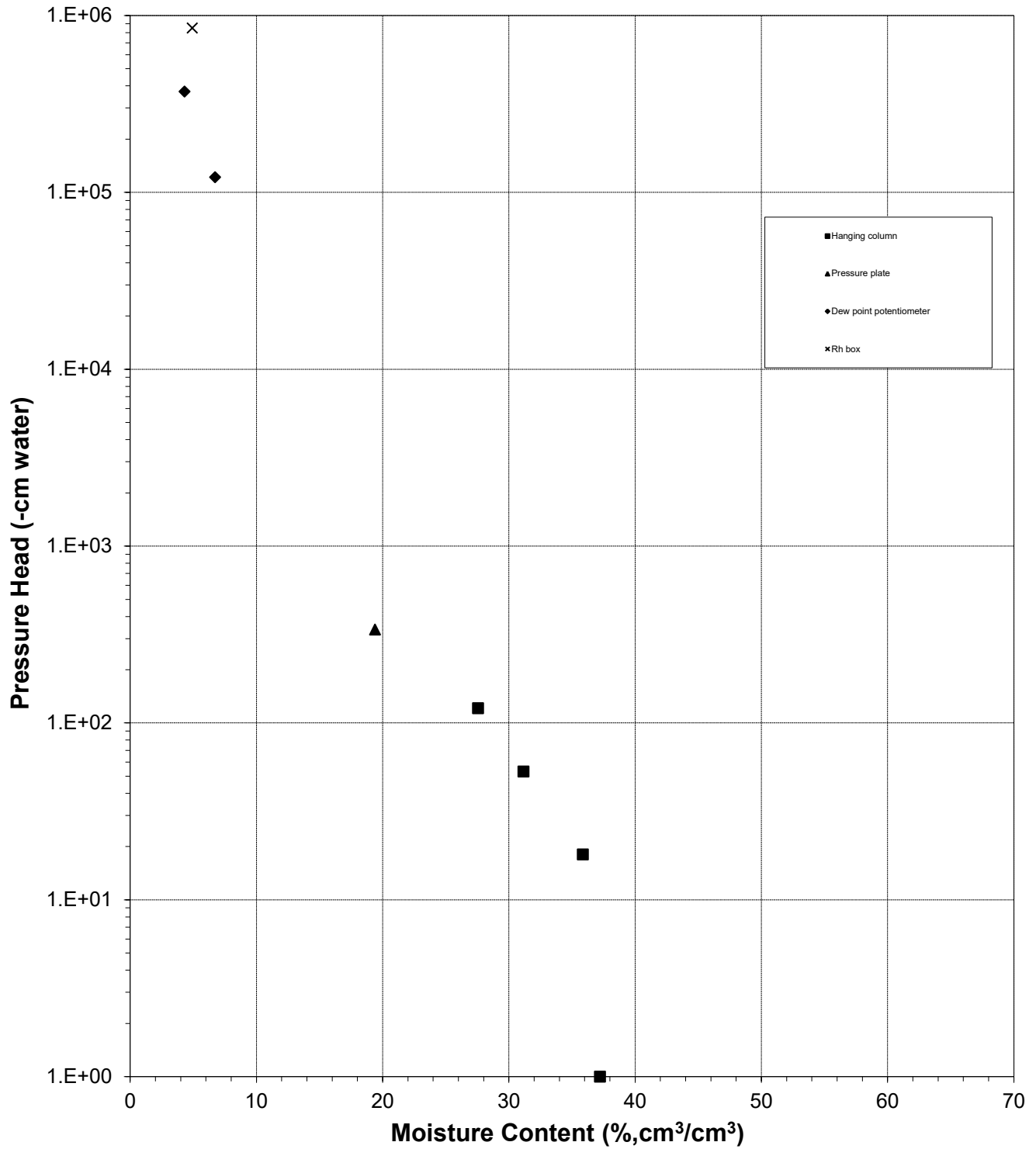
Laboratory analysis by: D.O'Dowd/D. O'Dowd

Data entered by: A. Bland

Checked by: J. Hines



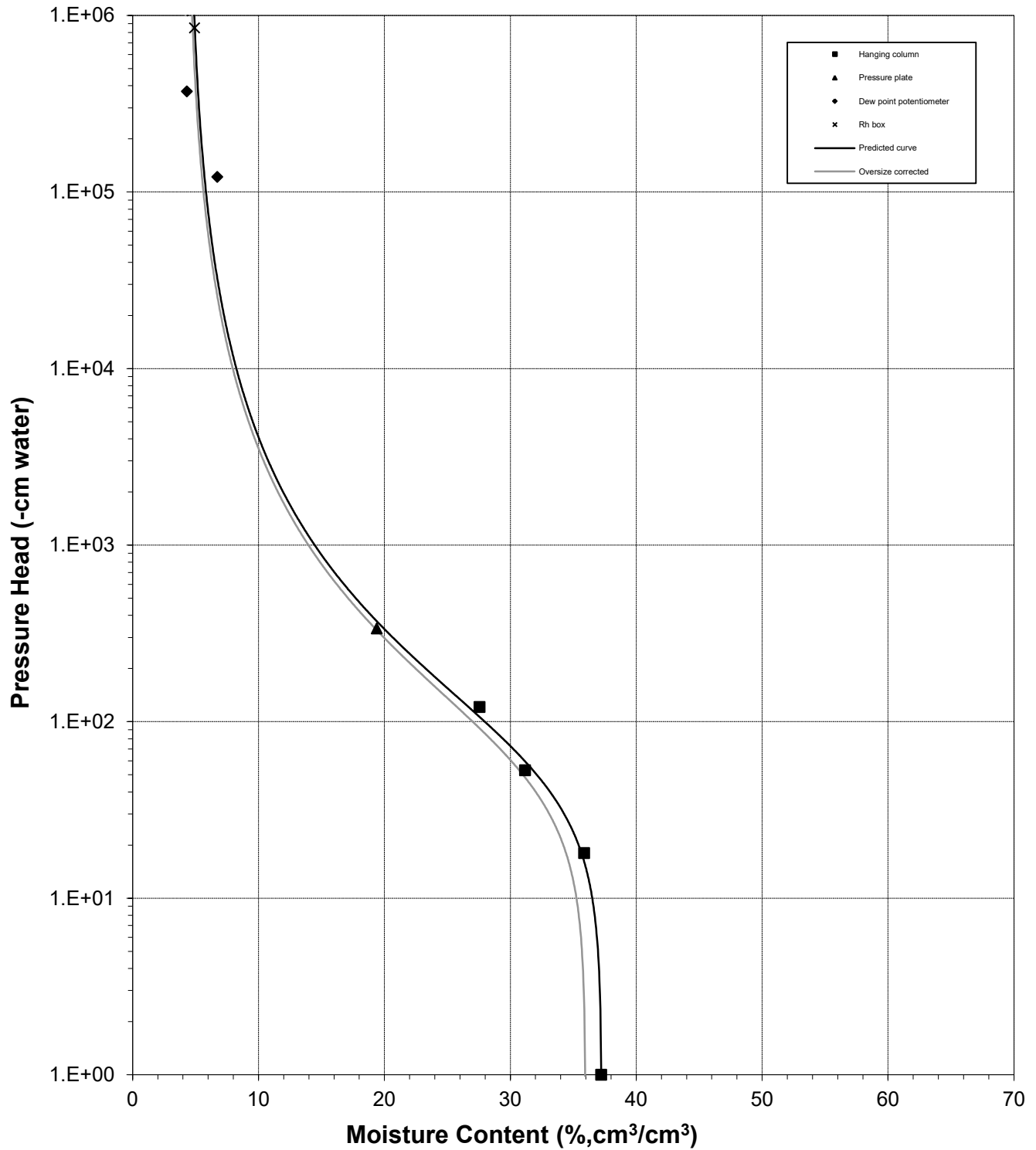
Water Retention Data Points
Sample Number: 3. Interim Cover Mix (90.5%)





Predicted Water Retention Curve and Data Points

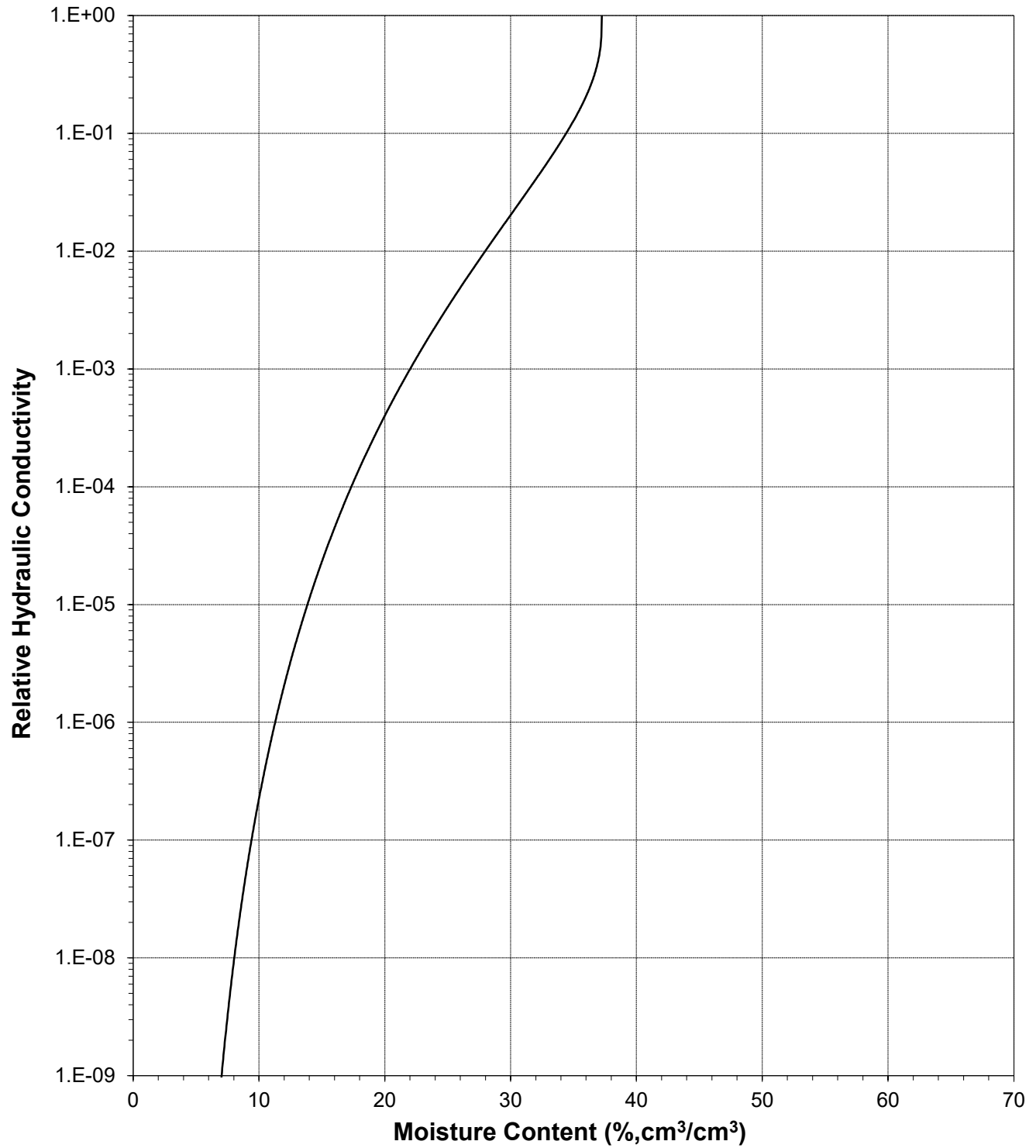
Sample Number: 3. Interim Cover Mix (90.5%)





Plot of Relative Hydraulic Conductivity vs Moisture Content

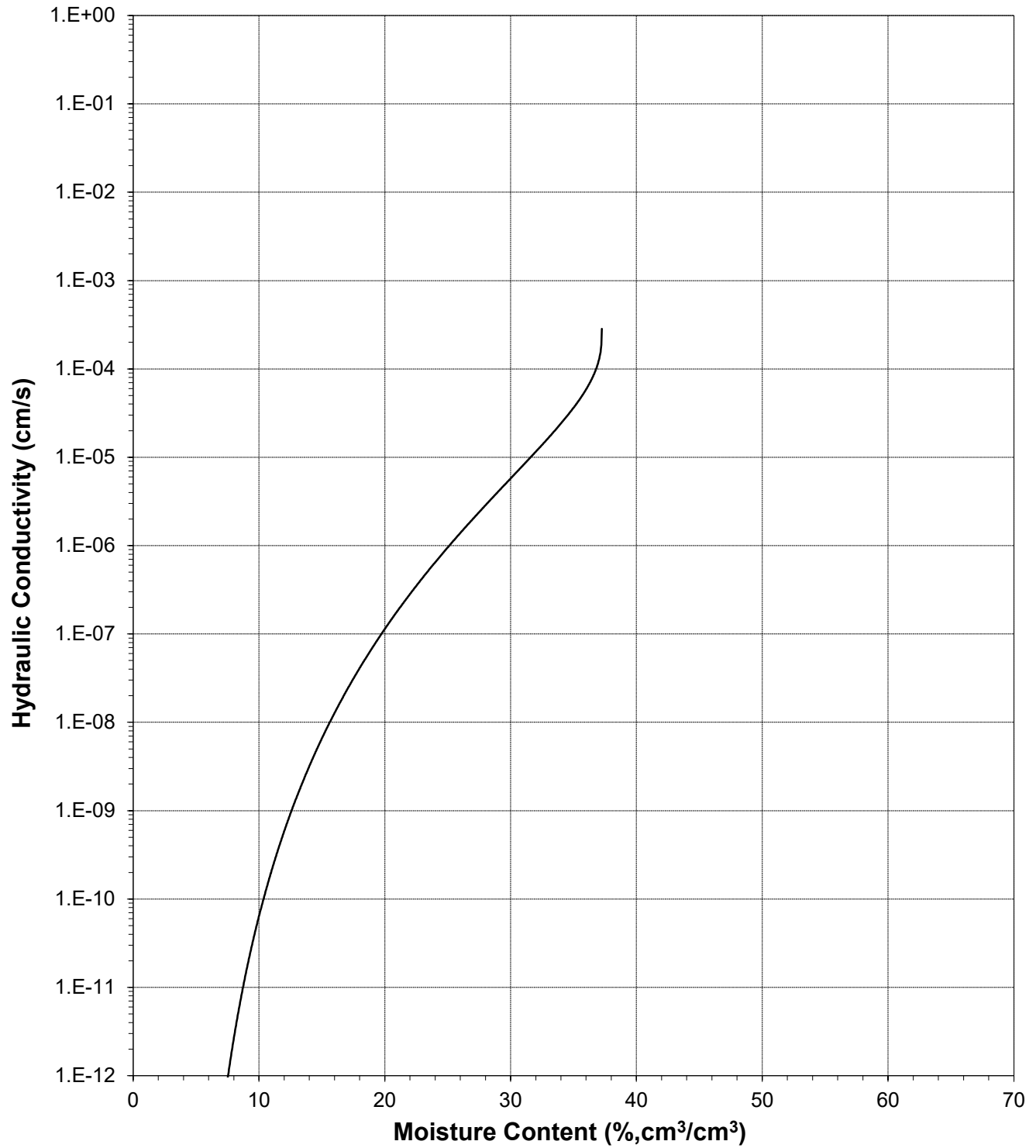
Sample Number: 3. Interim Cover Mix (90.5%)





Plot of Hydraulic Conductivity vs Moisture Content

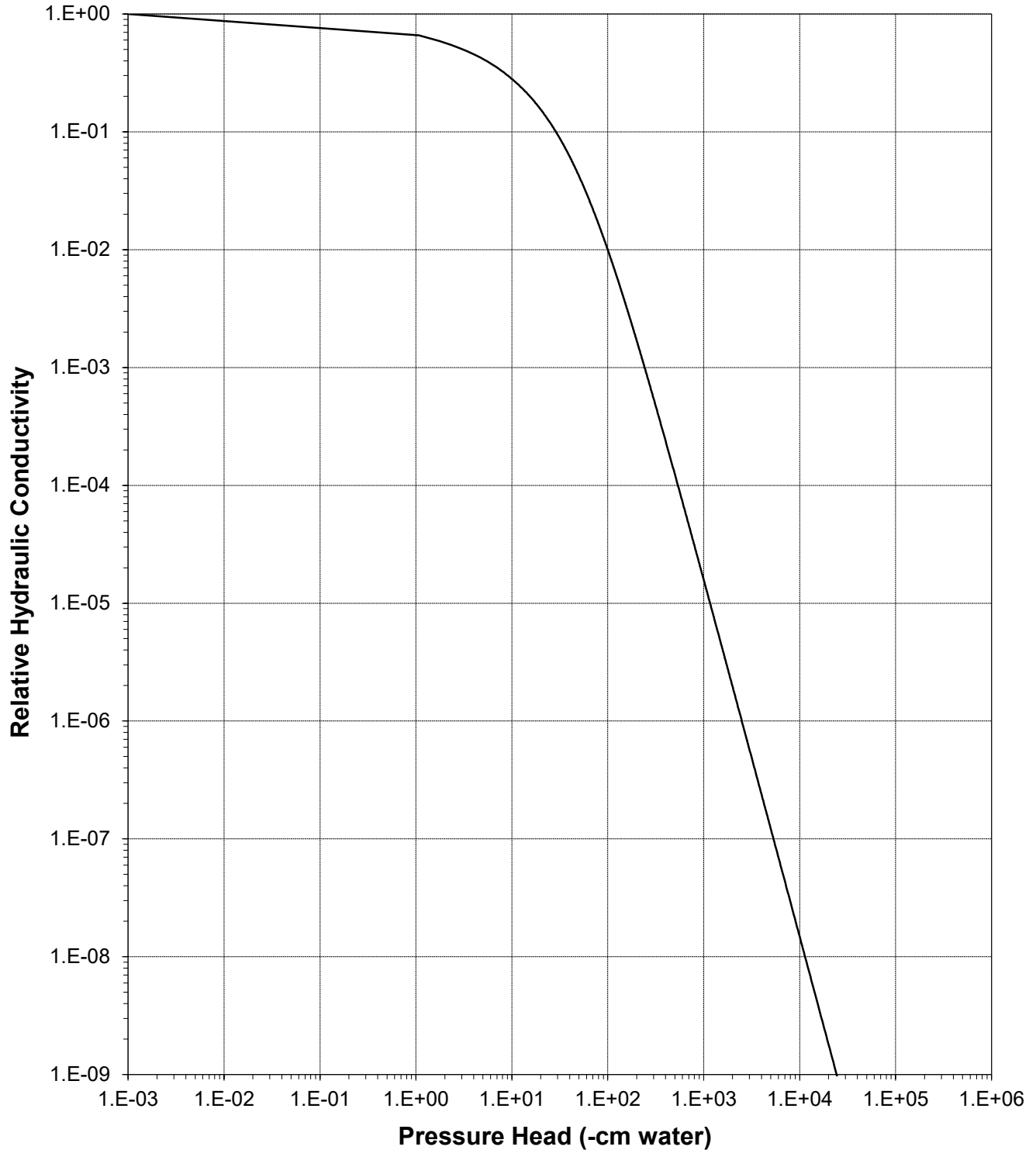
Sample Number: 3. Interim Cover Mix (90.5%)





Plot of Relative Hydraulic Conductivity vs Pressure Head

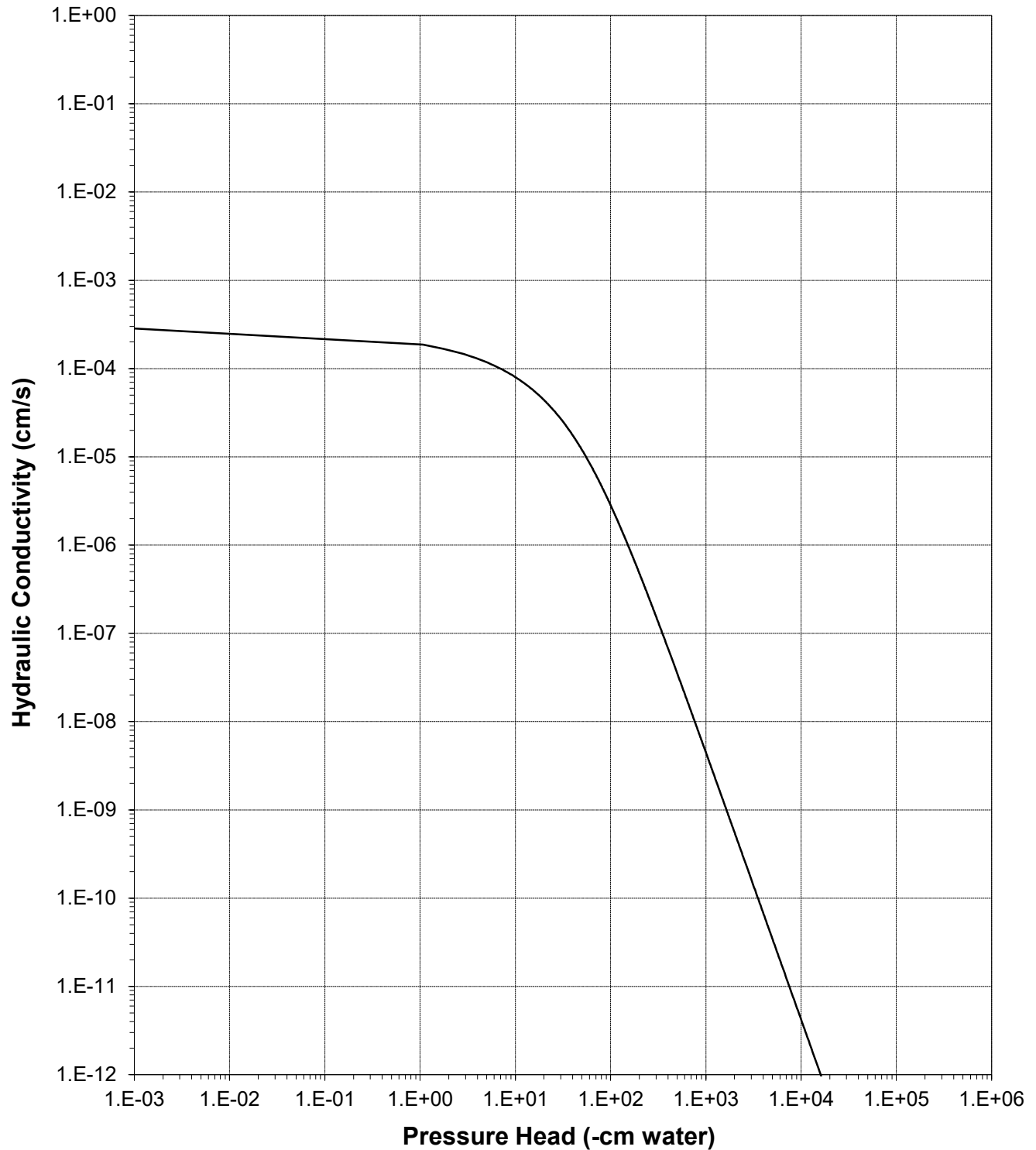
Sample Number: 3. Interim Cover Mix (90.5%)





Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 3. Interim Cover Mix (90.5%)





Oversize Correction Data Sheet

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 3. Interim Cover Mix (90.5%)
Project Name: Crescent Junction
Date Sampled: NA

Split (3/4", 3/8", #4): #4

	Coarse Fraction*	Fines Fraction**	Composite
Subsample Mass (g):	5.42	94.58	100.00
Mass Fraction (%):	5.42	94.58	100.00
<i>Initial Sample θ_i</i>			
Bulk Density (g/cm ³):	2.76	1.72	1.75
Calculated Porosity (% vol):	0.00	37.85	36.55
Volume of Solids (cm ³):	1.96	34.27	36.23
Volume of Voids (cm ³):	0.00	20.87	20.87
Total Volume (cm ³):	1.96	55.14	57.10
Volumetric Fraction (%):	3.44	96.56	100.00
Initial Moisture Content (% vol):	0.00	21.91	21.16
<i>Saturated Sample θ_s</i>			
Bulk Density (g/cm ³):	2.76	1.72	1.75
Calculated Porosity (% vol):	0.00	37.85	36.55
Volume of Solids (cm ³):	1.96	34.27	36.23
Volume of Voids (cm ³):	0.00	20.87	20.87
Total Volume (cm ³):	1.96	55.14	57.10
Volumetric Fraction (%):	3.44	96.56	100.00
Saturated Moisture Content (% vol):	0.00	37.25	35.97
<i>Residual Sample θ_r</i>			
Bulk Density (g/cm ³):	2.76	1.72	1.75
Calculated Porosity (% vol):	0.00	37.85	36.55
Volume of Solids (cm ³):	1.96	34.27	36.23
Volume of Voids (cm ³):	0.00	20.87	20.87
Total Volume (cm ³):	1.96	55.14	57.10
Volumetric Fraction (%):	3.44	96.56	100.00
Residual Moisture Content (% vol):	0.00	4.32	4.17
Ksat (cm/sec):	NM	2.8E-04	2.7E-04

* = Porosity and moisture content of coarse fraction assumed to be zero.

** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.

NM = Not measured

Laboratory analysis by: D. O'Dowd

Data entered by: A. Bland

Checked by: J. Hines



Moisture Retention Data
Hanging Column / Pressure Plate
 (Soil-Water Characteristic Curve)

Job Name: Dwyer Engineering LLC
 Job Number: DB20.1167.00
 Sample Number: 4. Open Test Pit, Alluvium 1'-10' (89.0%)
 Project Name: Crescent Junction
 Date Sampled: NA

Dry wt. of sample (g): 371.55
 Tare wt., ring (g): 132.89
 Tare wt., screen & clamp (g): 26.39
 Initial sample volume (cm³): 222.39
 Initial dry bulk density (g/cm³): 1.67
 Assumed particle density (g/cm³): 2.76
 Initial calculated total porosity (%): 39.47

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content [†] (% vol)
<i>Hanging column:</i>	21-Jul-20	12:00	622.94	0	41.42
	28-Jul-20	15:00	620.27	16.0	40.22
	4-Aug-20	10:30	619.47	37.0	39.86
	11-Aug-20	10:45	612.49	98.0	36.72
<i>Pressure plate:</i>	20-Aug-20	14:30	599.89	337	31.05

Volume Adjusted Data¹

	Matric Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calculated Porosity (%)
<i>Hanging column:</i>	0.0	---	---	---	---
	16.0	---	---	---	---
	37.0	---	---	---	---
	98.0	---	---	---	---
<i>Pressure plate:</i>	337	---	---	---	---

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

[†] Assumed density of water is 1.0 g/cm³

[‡] Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd
Data entered by: A. Bland
Checked by: J. Hines



Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: 4. Open Test Pit, Alluvium 1'-10' (89.0%)

Initial sample bulk density (g/cm³): 1.67

Fraction of test sample used (<2.00mm fraction) (%): 99.82

Dry weight* of dew point potentiometer sample (g): 179.76

Tare weight, jar (g): 115.18

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)
Dew point potentiometer:	28-Jul-20	14:28	182.49	65675	7.05
	24-Jul-20	10:11	181.55	224152	4.62

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	65675	---	---	---	---
	224152	---	---	---	---

Dry weight* of relative humidity box sample (g): 83.89

Tare weight (g): 43.04

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)
Relative humidity box:	24-Jul-20	12:00	84.93	848426	4.25

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Relative humidity box:	848426	---	---	---	---

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "----" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

[†] Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm³.

[‡] Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D.O'Dowd/D. O'Dowd

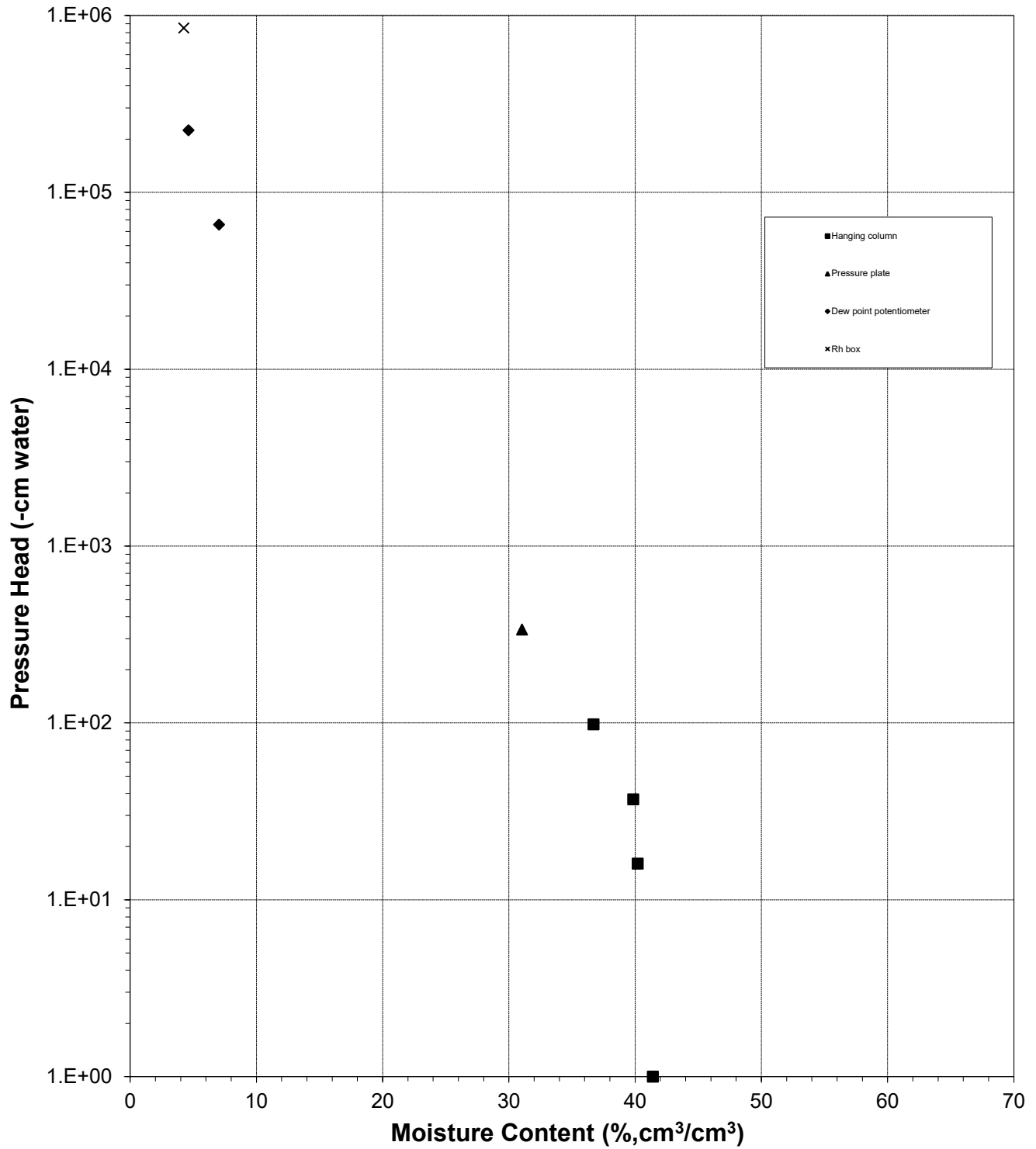
Data entered by: A. Bland

Checked by: J. Hines



Water Retention Data Points

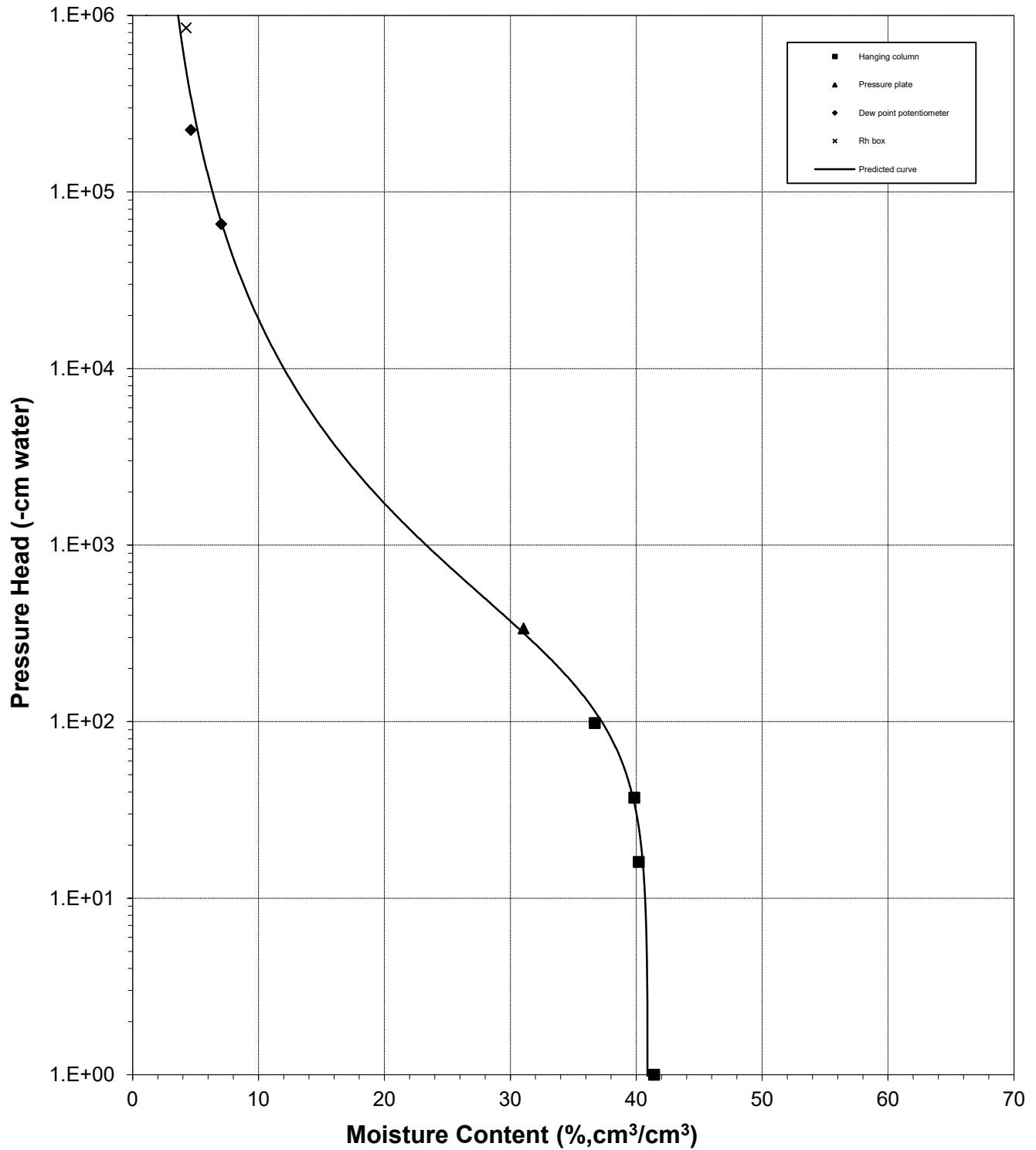
Sample Number: 4. Open Test Pit, Alluvium 1'-10' (89.0%)





Predicted Water Retention Curve and Data Points

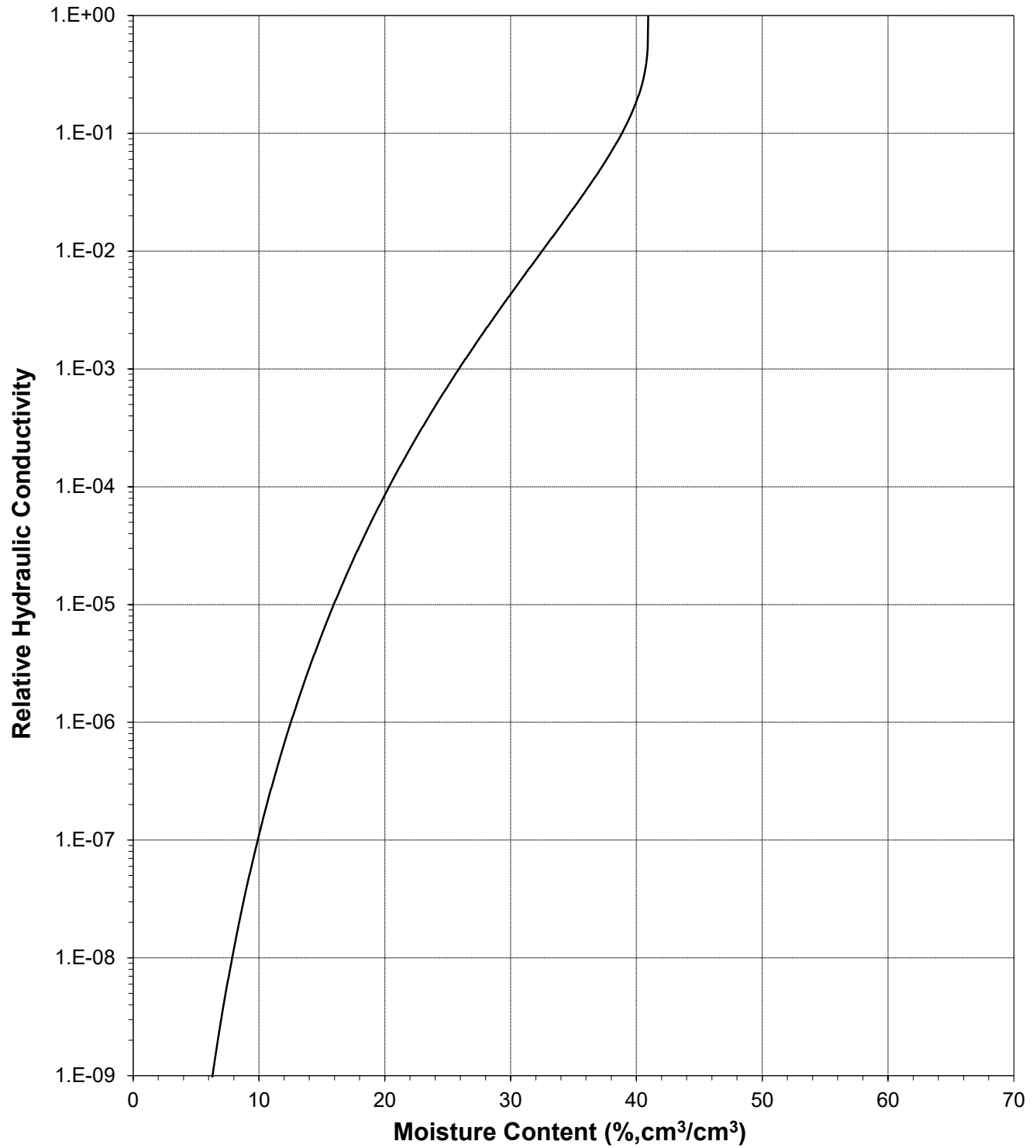
Sample Number: 4. Open Test Pit, Alluvium 1'-10' (89.0%)





Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: 4. Open Test Pit, Alluvium 1'-10' (89.0%)

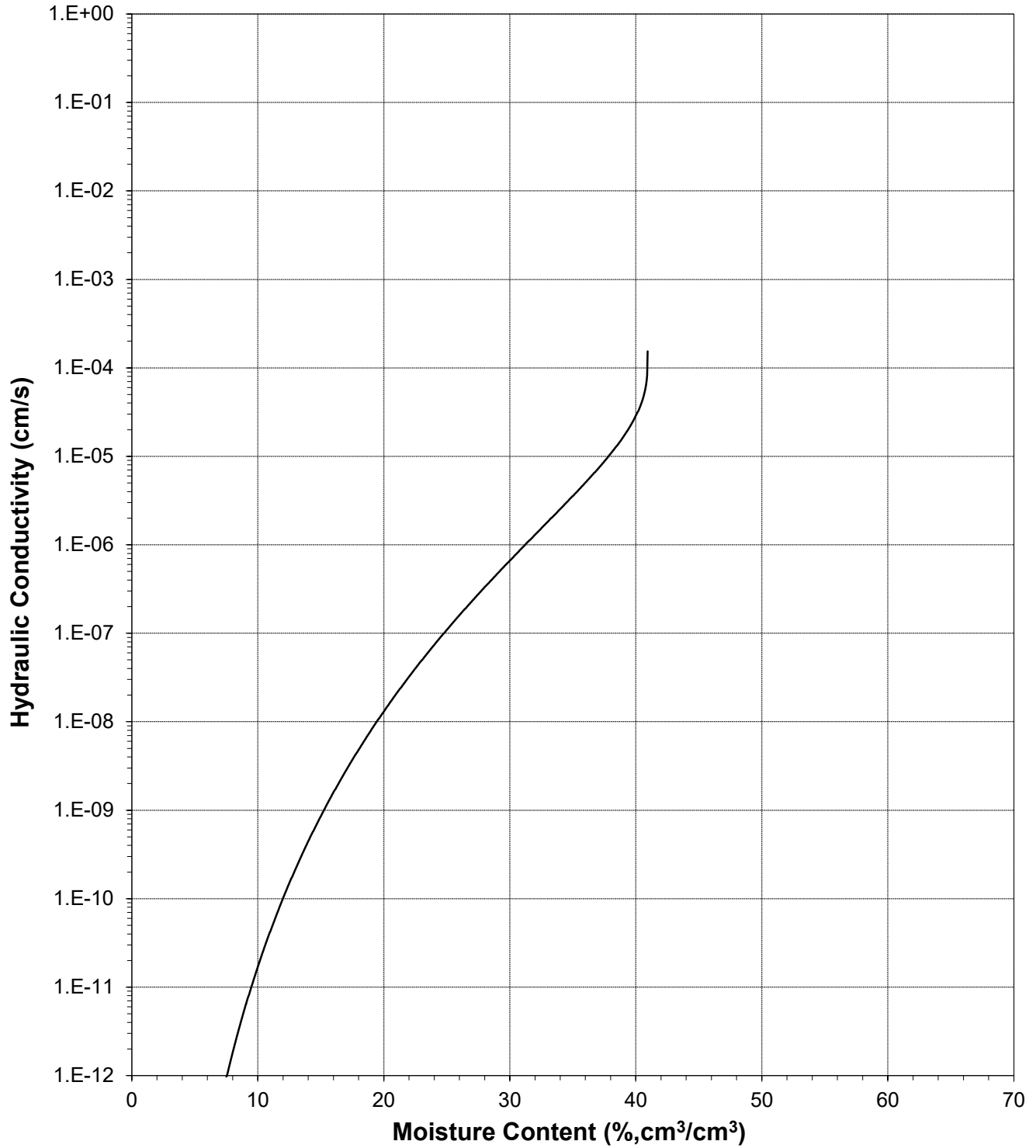




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Plot of Hydraulic Conductivity vs Moisture Content

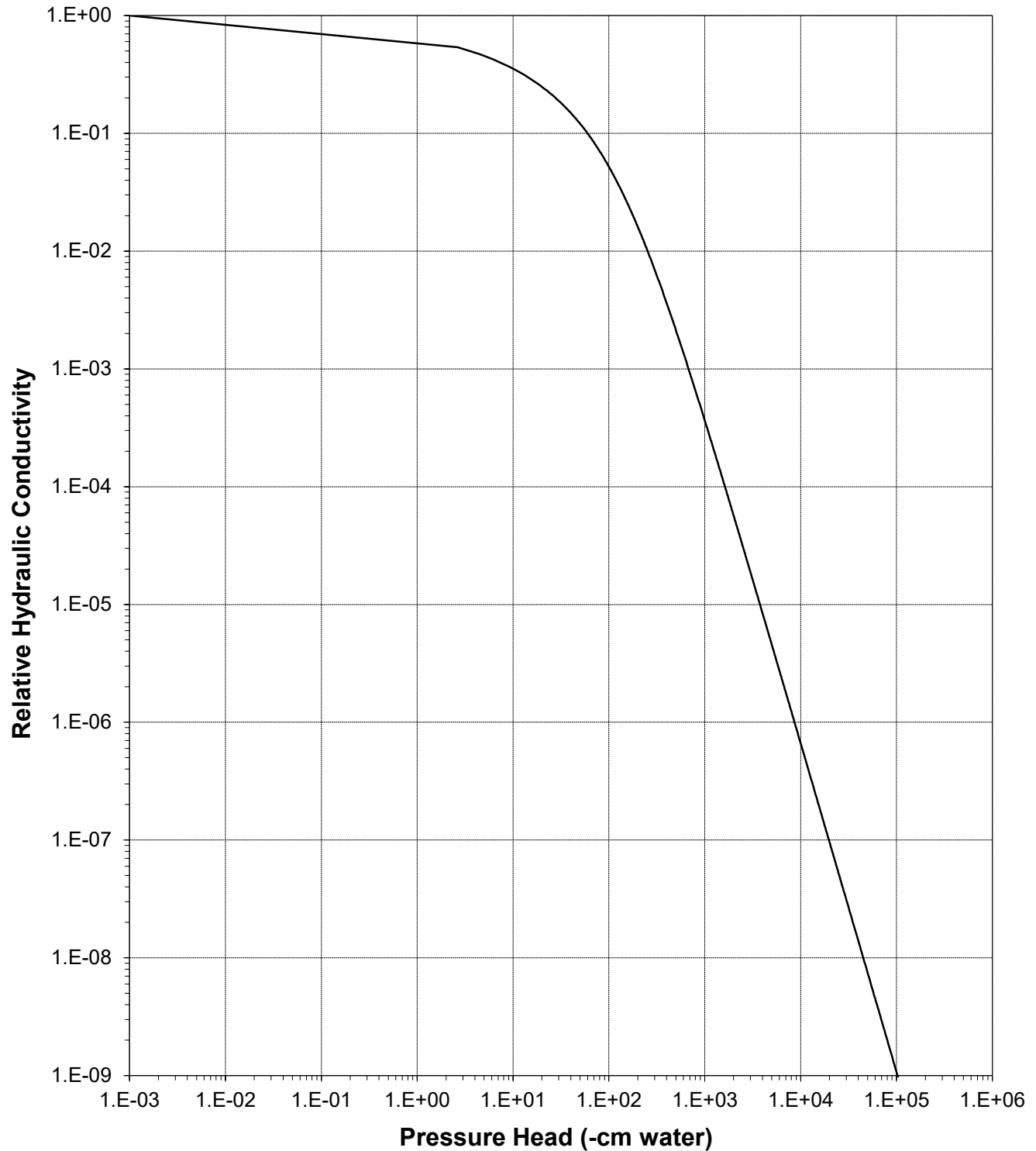
Sample Number: 4. Open Test Pit, Alluvium 1'-10' (89.0%)





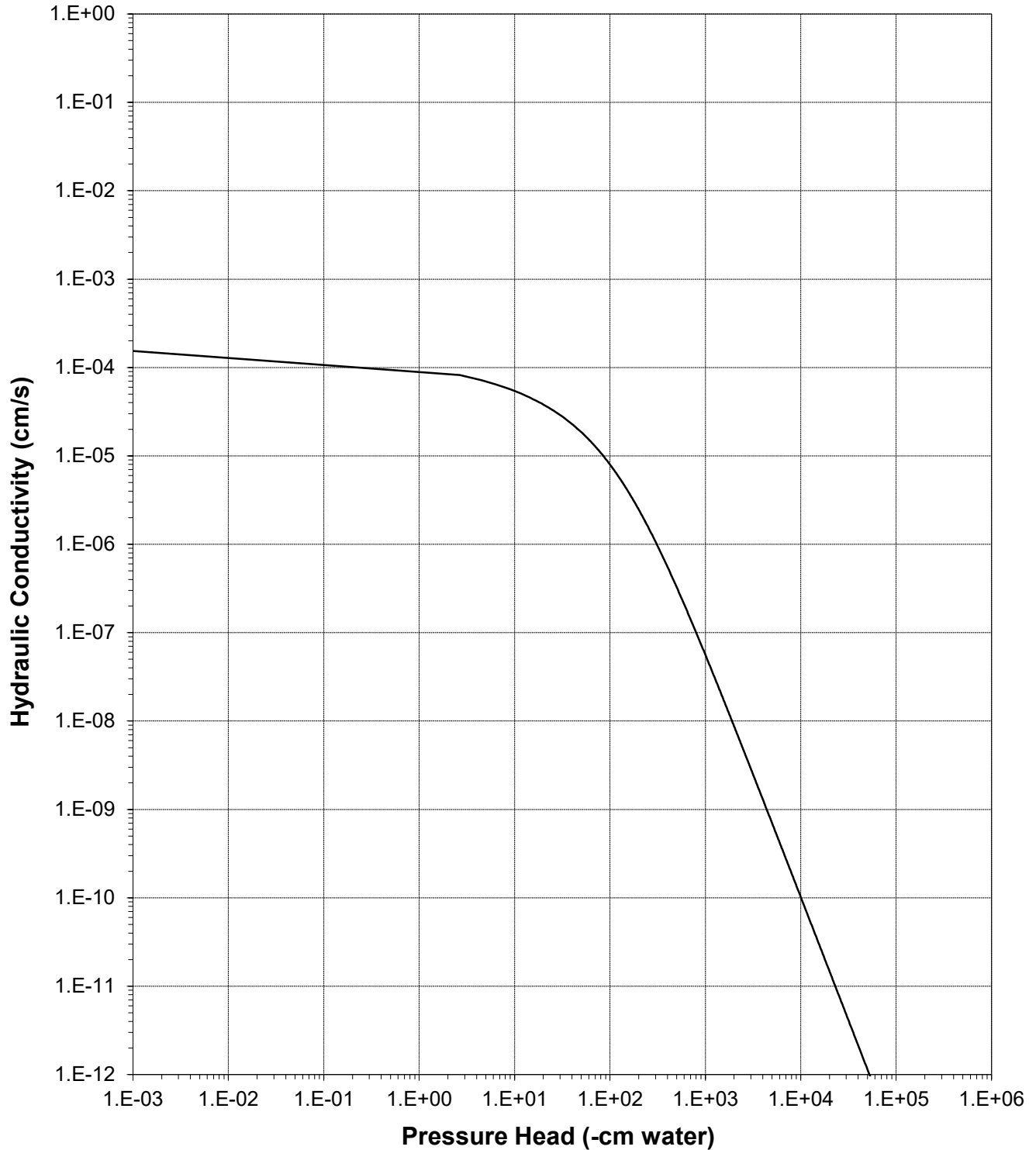
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: 4. Open Test Pit, Alluvium 1'-10' (89.0%)





Plot of Hydraulic Conductivity vs Pressure Head
Sample Number: 4. Open Test Pit, Alluvium 1'-10' (89.0%)





Oversize Correction Data Sheet

Job Name: Dwyer Engineering LLC
 Job Number: DB20.1167.00
 Sample Number: 4. Open Test Pit, Alluvium 1'-10' (89.0%)
 Project Name: Crescent Junction
 Date Sampled: NA

Split (3/4", 3/8", #4): #4

	Coarse Fraction*	Fines Fraction**	Composite
Subsample Mass (g):	0.14	99.86	100.00
Mass Fraction (%):	0.14	99.86	100.00
<i>Initial Sample θ_i</i>			
Bulk Density (g/cm ³):	2.76	1.67	1.67
Calculated Porosity (% vol):	0.00	39.47	39.43
Volume of Solids (cm ³):	0.05	36.18	36.23
Volume of Voids (cm ³):	0.00	23.59	23.59
Total Volume (cm ³):	0.05	59.77	59.82
Volumetric Fraction (%):	0.08	99.92	100.00
Initial Moisture Content (% vol):	0.00	24.41	---
<i>Saturated Sample θ_s</i>			
Bulk Density (g/cm ³):	2.76	1.67	1.67
Calculated Porosity (% vol):	0.00	39.47	39.43
Volume of Solids (cm ³):	0.05	36.18	36.23
Volume of Voids (cm ³):	0.00	23.59	23.59
Total Volume (cm ³):	0.05	59.77	59.82
Volumetric Fraction (%):	0.08	99.92	100.00
Saturated Moisture Content (% vol):	0.00	40.94	---
<i>Residual Sample θ_r</i>			
Bulk Density (g/cm ³):	2.76	1.67	1.67
Calculated Porosity (% vol):	0.00	39.47	39.43
Volume of Solids (cm ³):	0.05	36.18	36.23
Volume of Voids (cm ³):	0.00	23.59	23.59
Total Volume (cm ³):	0.05	59.77	59.82
Volumetric Fraction (%):	0.08	99.92	100.00
Residual Moisture Content (% vol):	0.00	1.06	---
Ksat (cm/sec):	NM	1.5E-04	---

* = Porosity and moisture content of coarse fraction assumed to be zero.

** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.

NM = Not measured

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: A. Bland

Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

Moisture Retention Data Hanging Column / Pressure Plate (Soil-Water Characteristic Curve)

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 5. Radon Barrier #1 (90.0%)
Project Name: Crescent Junction
Date Sampled: NA

Dry wt. of sample (g): 364.16
Tare wt., ring (g): 126.14
Tare wt., screen & clamp (g): 27.99
Initial sample volume (cm³): 224.20
Initial dry bulk density (g/cm³): 1.62
Assumed particle density (g/cm³): 2.76
Initial calculated total porosity (%): 41.15

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content [†] (% vol)	
Hanging column:	21-Jul-20	12:00	616.54	0	42.39	##
	28-Jul-20	15:00	615.01	18.0	41.73	##
	4-Aug-20	10:30	608.65	53.0	39.49	##
	11-Aug-20	10:45	601.98	121.0	36.81	##
Pressure plate:	20-Aug-20	14:30	597.21	337	34.71	##

Volume Adjusted Data¹

	Matric Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	231.77	+3.38%	1.57	43.07
	18.0	231.77	+3.38%	1.57	43.07
	53.0	228.80	+2.05%	1.59	42.33
	121.0	227.38	+1.42%	1.60	41.97
Pressure plate:	337	227.38	+1.42%	1.60	41.97

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

* Weight including tares

[†] Assumed density of water is 1.0 g/cm³

Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd
Data entered by: A. Bland
Checked by: J. Hines



Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: 5. Radon Barrier #1 (90.0%)

Initial sample bulk density (g/cm³): 1.62

Fraction of test sample used (<2.00mm fraction) (%): 98.79

Dry weight* of dew point potentiometer sample (g): 182.78

Tare weight, jar (g): 116.57

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)	
Dew point potentiometer:	28-Jul-20	14:32	186.92	109425	9.89	##
	24-Jul-20	10:21	185.23	366516	5.85	##

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	109425	227.38	+1.42%	1.60	41.97
	366516	227.38	+1.42%	1.60	41.97

Dry weight* of relative humidity box sample (g): 83.90

Tare weight (g): 44.19

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)	
Relative humidity box:	24-Jul-20	12:00	85.33	848426	5.70	##

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Relative humidity box:	848426	227.38	+1.42%	1.60	41.97

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "----" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

[†] Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm³.

Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

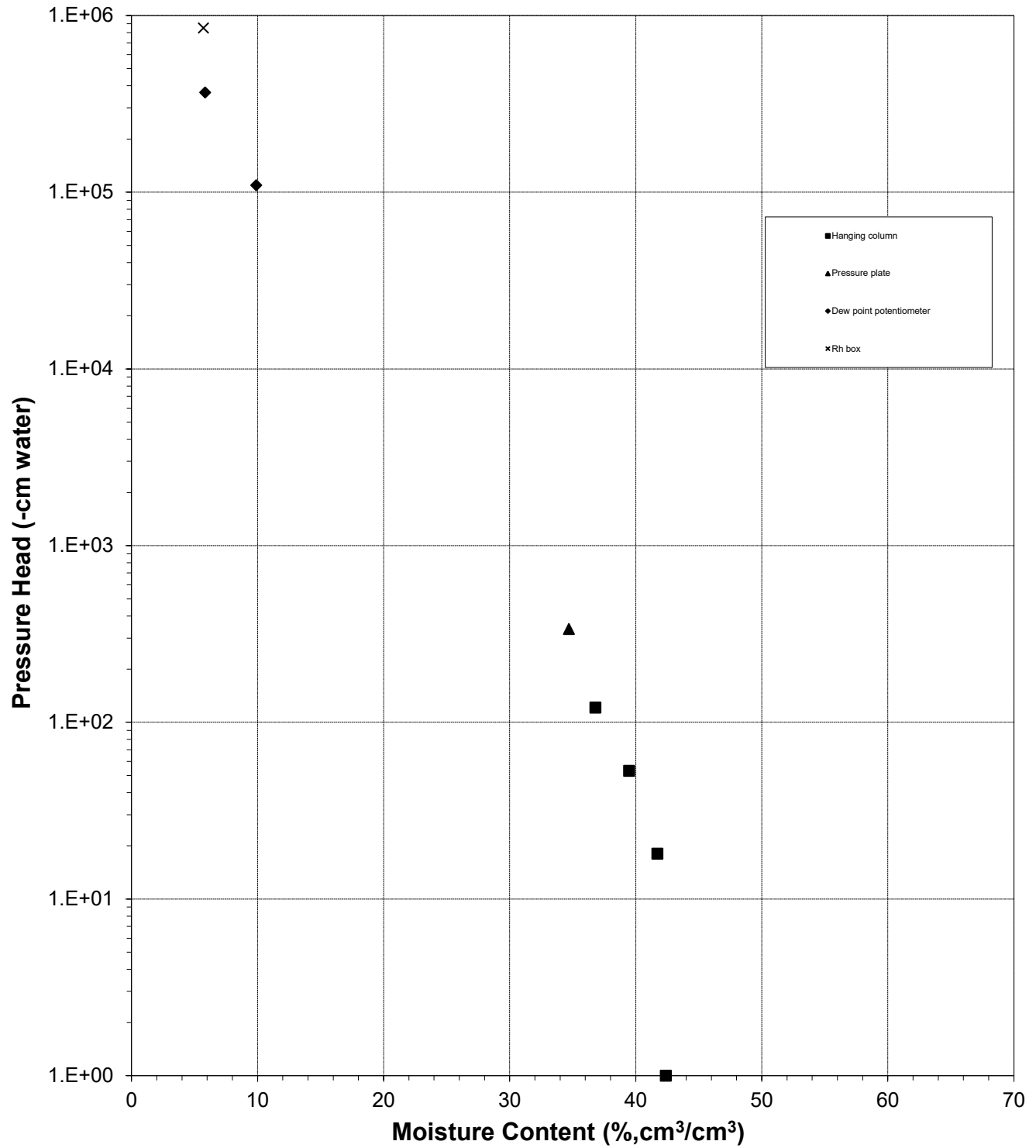
Laboratory analysis by: D.O'Dowd/D. O'Dowd

Data entered by: A. Bland

Checked by: J. Hines



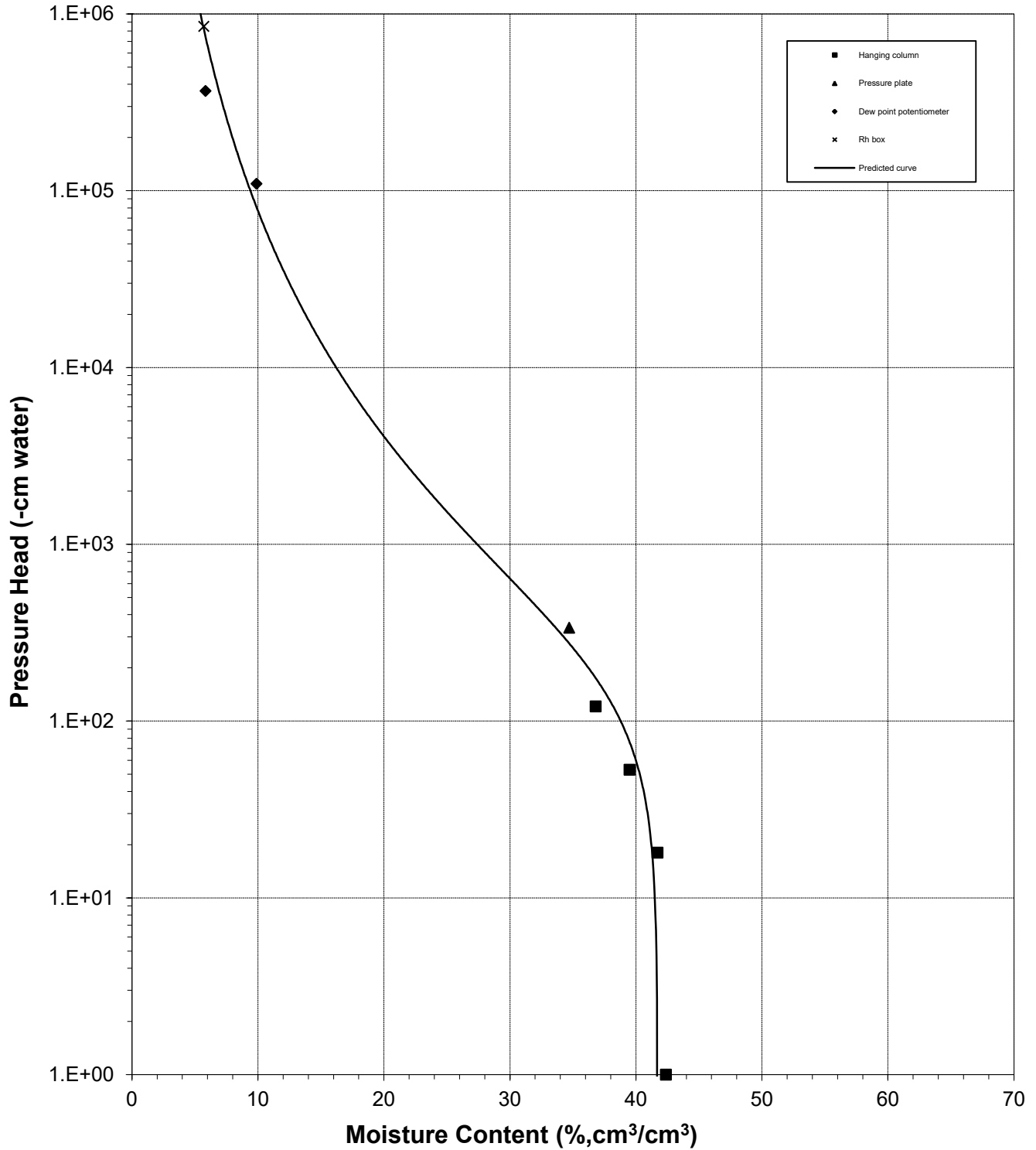
Water Retention Data Points
Sample Number: 5. Radon Barrier #1 (90.0%)





Predicted Water Retention Curve and Data Points

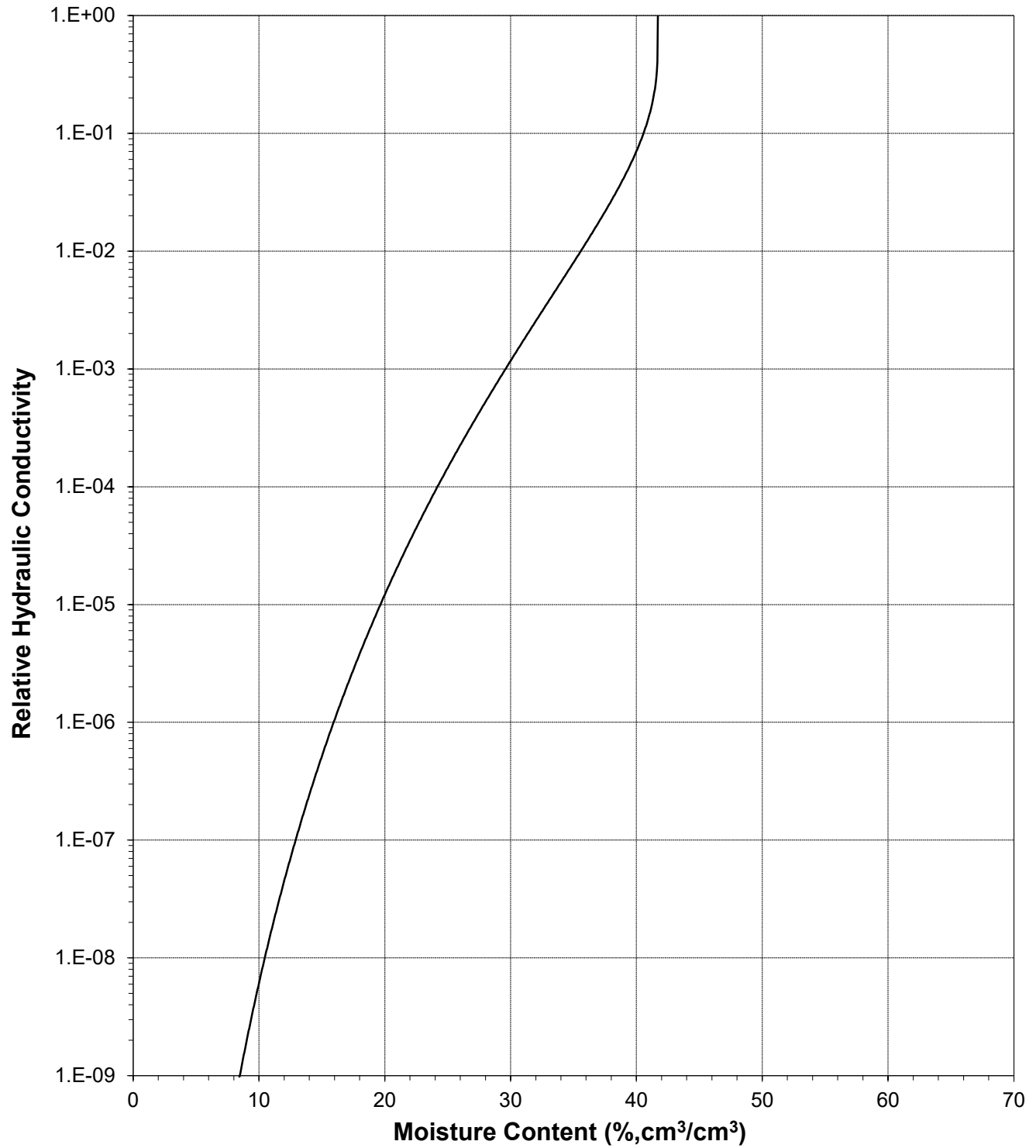
Sample Number: 5. Radon Barrier #1 (90.0%)





Plot of Relative Hydraulic Conductivity vs Moisture Content

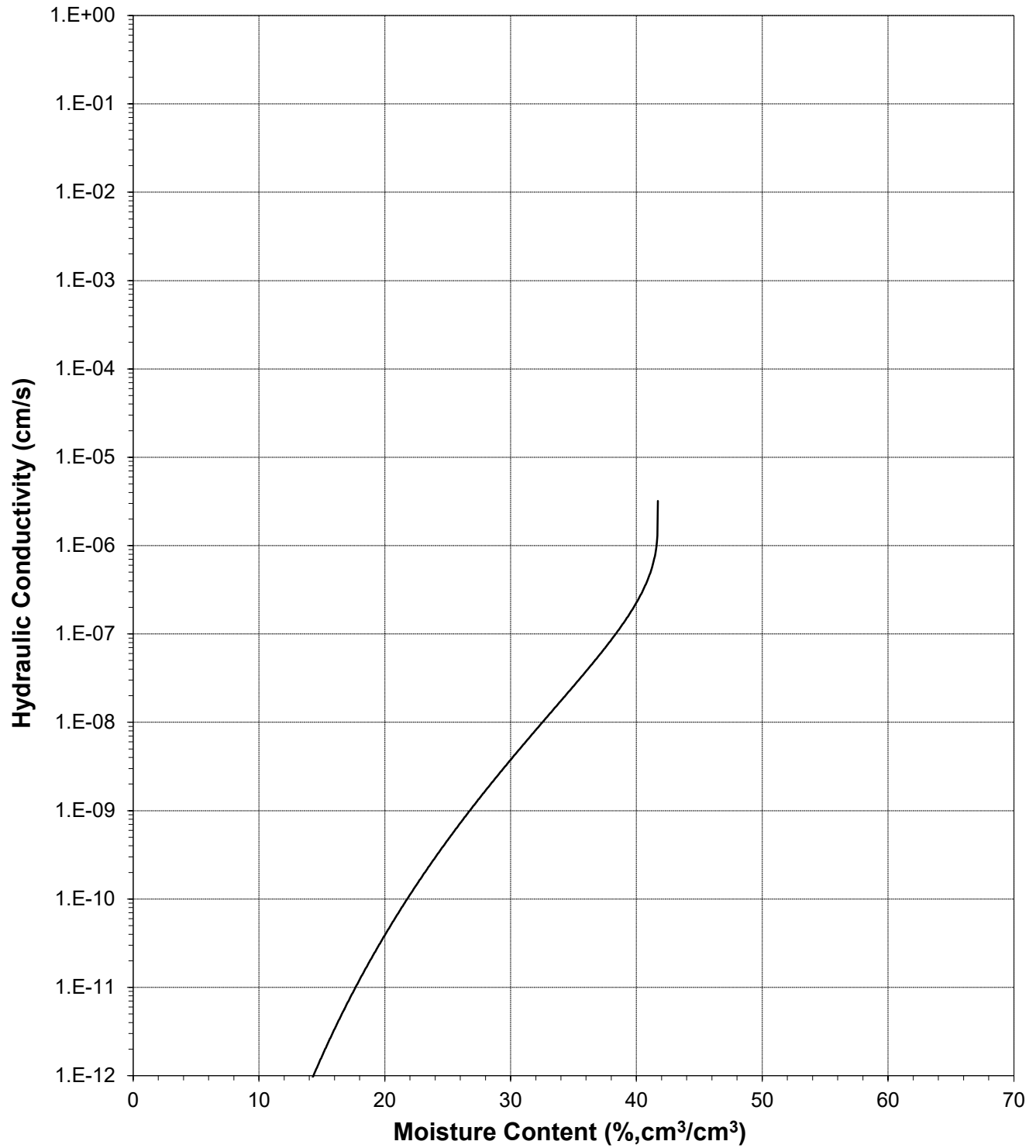
Sample Number: 5. Radon Barrier #1 (90.0%)





Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 5. Radon Barrier #1 (90.0%)

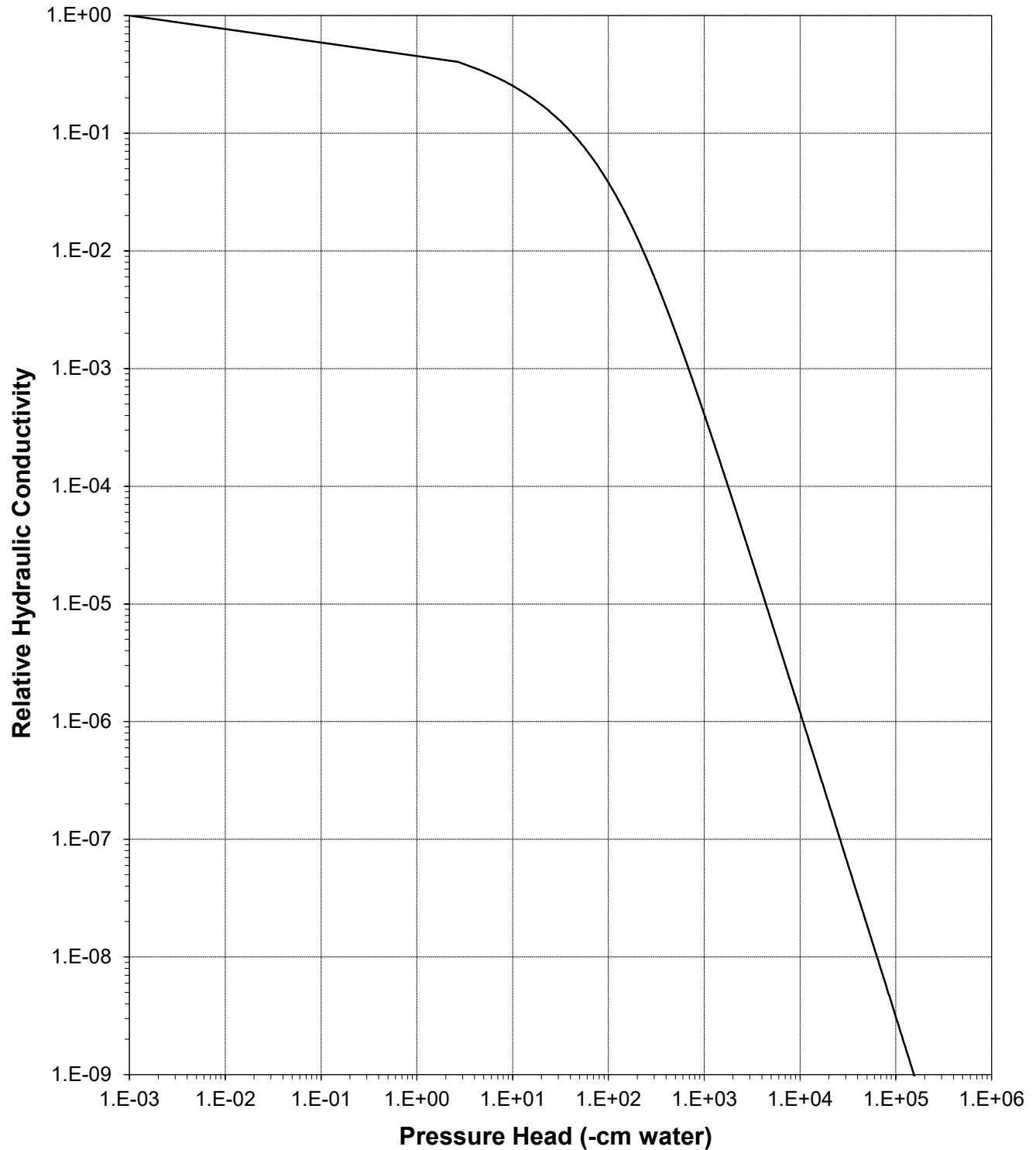




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Plot of Relative Hydraulic Conductivity vs Pressure Head

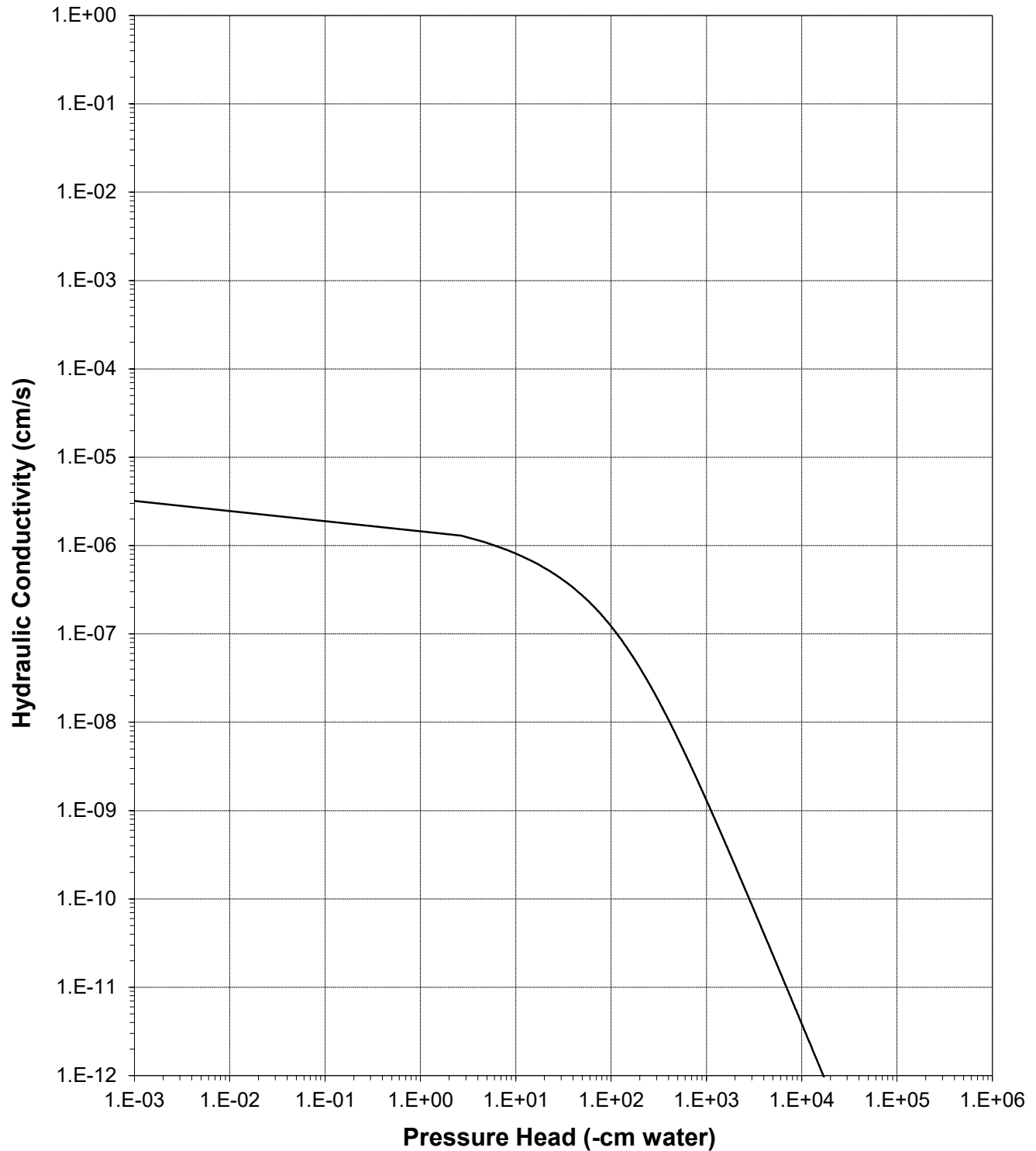
Sample Number: 5. Radon Barrier #1 (90.0%)





Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 5. Radon Barrier #1 (90.0%)





Oversize Correction Data Sheet

Job Name: Dwyer Engineering LLC
 Job Number: DB20.1167.00
 Sample Number: 5. Radon Barrier #1 (90.0%)
 Project Name: Crescent Junction
 Date Sampled: NA

Split (3/4", 3/8", #4): #4

	<u>Coarse Fraction*</u>	<u>Fines Fraction**</u>	<u>Composite</u>
Subsample Mass (g):	0.77	99.23	100.00
Mass Fraction (%):	0.77	99.23	100.00
<i>Initial Sample θ_i</i>			
Bulk Density (g/cm ³):	2.76	1.62	1.63
Calculated Porosity (% vol):	0.00	41.15	40.96
Volume of Solids (cm ³):	0.28	35.95	36.23
Volume of Voids (cm ³):	0.00	25.14	25.14
Total Volume (cm ³):	0.28	61.09	61.37
Volumetric Fraction (%):	0.45	99.55	100.00
Initial Moisture Content (% vol):	0.00	26.62	---
<i>Saturated Sample θ_s</i>			
Bulk Density (g/cm ³):	2.76	1.57	1.58
Calculated Porosity (% vol):	0.00	43.07	42.88
Volume of Solids (cm ³):	0.28	35.95	36.23
Volume of Voids (cm ³):	0.00	27.20	27.20
Total Volume (cm ³):	0.28	63.16	63.43
Volumetric Fraction (%):	0.44	99.56	100.00
Saturated Moisture Content (% vol):	0.00	41.71	---
<i>Residual Sample θ_r</i>			
Bulk Density (g/cm ³):	2.76	1.60	1.61
Calculated Porosity (% vol):	0.00	41.97	41.78
Volume of Solids (cm ³):	0.28	35.95	36.23
Volume of Voids (cm ³):	0.00	26.01	26.01
Total Volume (cm ³):	0.28	61.96	62.24
Volumetric Fraction (%):	0.45	99.55	100.00
Residual Moisture Content (% vol):	0.00	0.00	---
Ksat (cm/sec):	NM	3.2E-06	---

* = Porosity and moisture content of coarse fraction assumed to be zero.

** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.

NM = Not measured

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: A. Bland

Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

Moisture Retention Data Hanging Column / Pressure Plate (Soil-Water Characteristic Curve)

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 6. Radon Barrier #2 (90.1%)
Project Name: Crescent Junction
Date Sampled: NA

Dry wt. of sample (g): 357.80
Tare wt., ring (g): 133.07
Tare wt., screen & clamp (g): 28.54
Initial sample volume (cm³): 221.62
Initial dry bulk density (g/cm³): 1.61
Assumed particle density (g/cm³): 2.76
Initial calculated total porosity (%): 41.51

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content [†] (% vol)	
Hanging column:	21-Jul-20	12:00	614.39	0	42.40	##
	28-Jul-20	15:00	613.87	18.0	42.17	##
	4-Aug-20	10:30	608.99	53.0	40.01	##
	11-Aug-20	10:45	601.16	121.0	36.65	##
Pressure plate:	20-Aug-20	14:30	596.55	337	34.58	##

Volume Adjusted Data¹

	Matric Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	224.02	+1.08%	1.60	42.13
	18.0	224.02	+1.08%	1.60	42.13
	53.0	223.88	+1.02%	1.60	42.09
	121.0	223.06	+0.65%	1.60	41.88
Pressure plate:	337	223.06	+0.65%	1.60	41.88

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "----" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '----' denotes no volume change occurred.

* Weight including tares

[†] Assumed density of water is 1.0 g/cm³

Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd
Data entered by: A. Bland
Checked by: J. Hines



Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: 6. Radon Barrier #2 (90.1%)

Initial sample bulk density (g/cm³): 1.61

Fraction of test sample used (<2.00mm fraction) (%): 98.89

Dry weight* of dew point potentiometer sample (g): 178.37

Tare weight, jar (g): 114.79

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)	
Dew point potentiometer:	28-Jul-20	14:38	181.86	145831	8.71	##
	24-Jul-20	11:40	180.65	379774	5.69	##

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	145831	223.06	+0.65%	1.60	41.88
	379774	223.06	+0.65%	1.60	41.88

Dry weight* of relative humidity box sample (g): 87.95

Tare weight (g): 44.22

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)	
Relative humidity box:	24-Jul-20	12:00	89.40	848426	5.26	##

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Relative humidity box:	848426	223.06	+0.65%	1.60	41.88

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

* Weight including tares

[†] Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm³.

Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

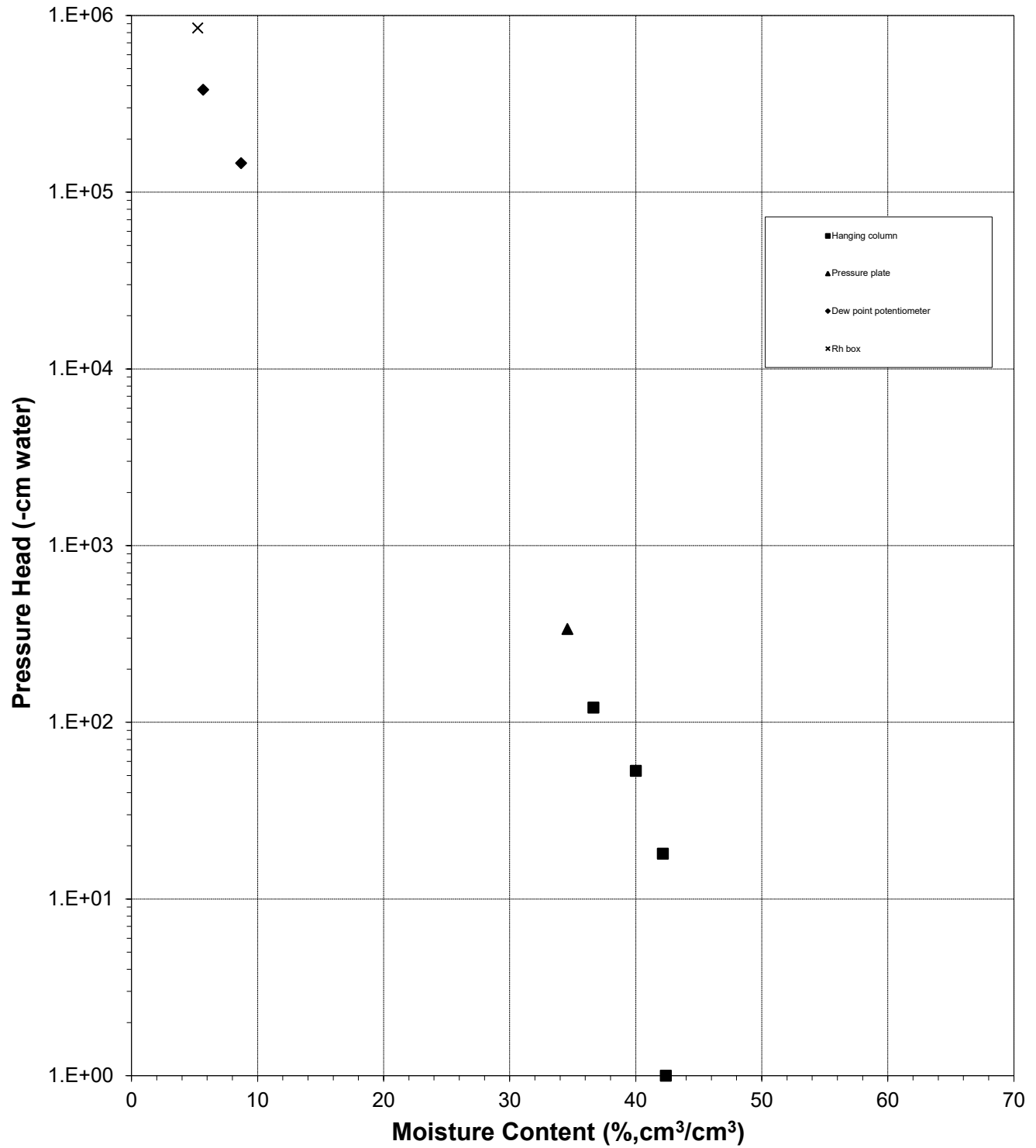
Laboratory analysis by: D.O'Dowd/D. O'Dowd

Data entered by: A. Bland

Checked by: J. Hines



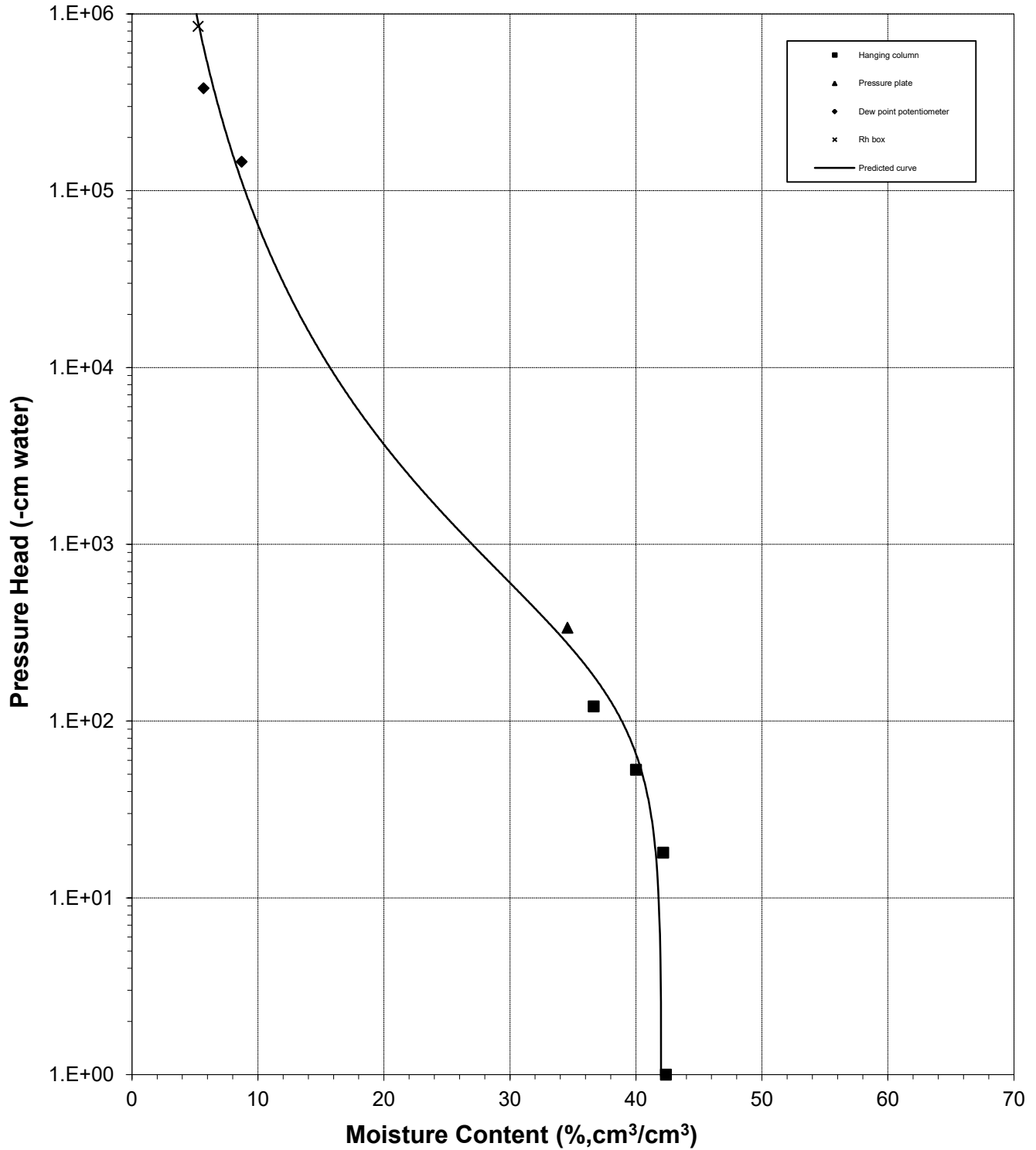
Water Retention Data Points
Sample Number: 6. Radon Barrier #2 (90.1%)





Predicted Water Retention Curve and Data Points

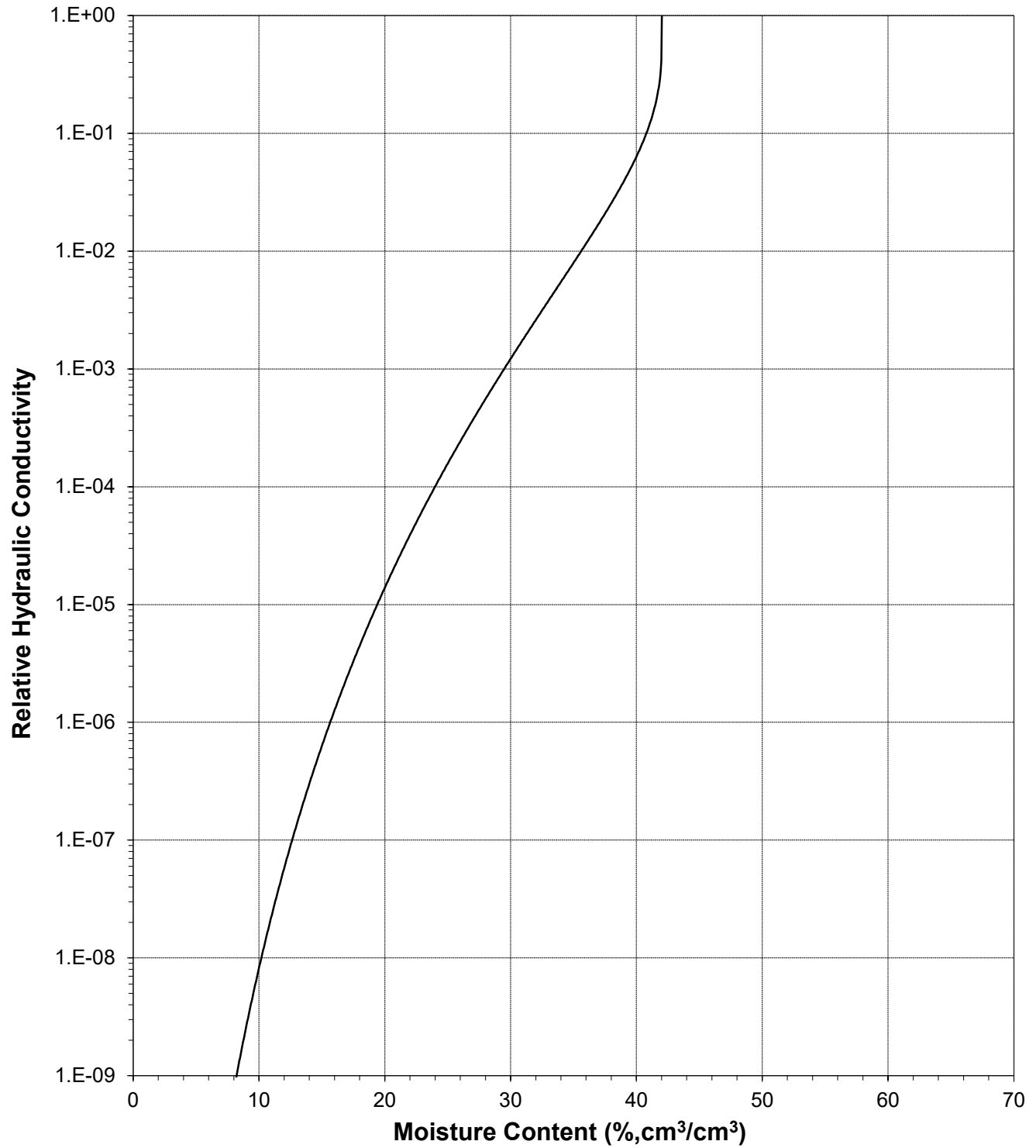
Sample Number: 6. Radon Barrier #2 (90.1%)





Plot of Relative Hydraulic Conductivity vs Moisture Content

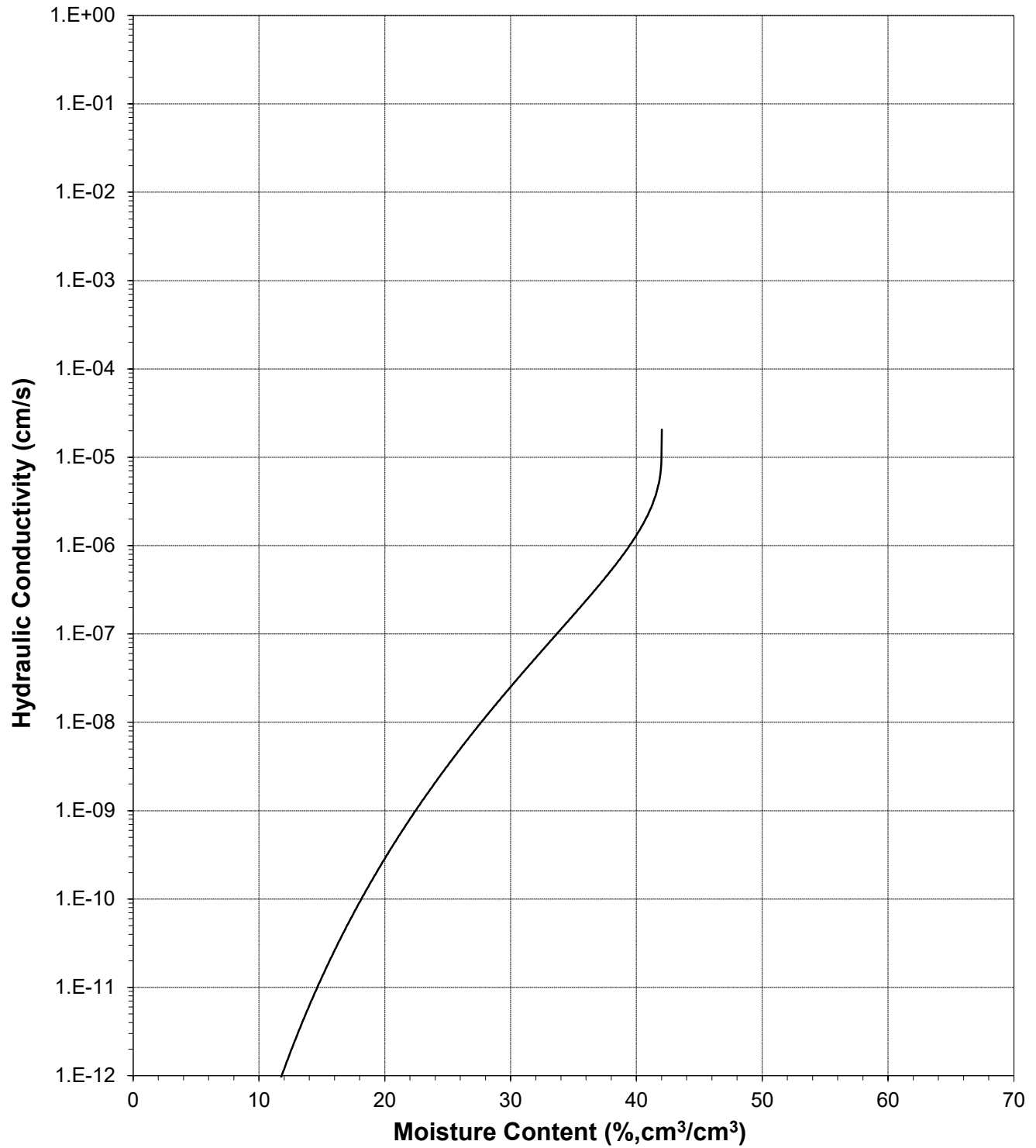
Sample Number: 6. Radon Barrier #2 (90.1%)





Plot of Hydraulic Conductivity vs Moisture Content

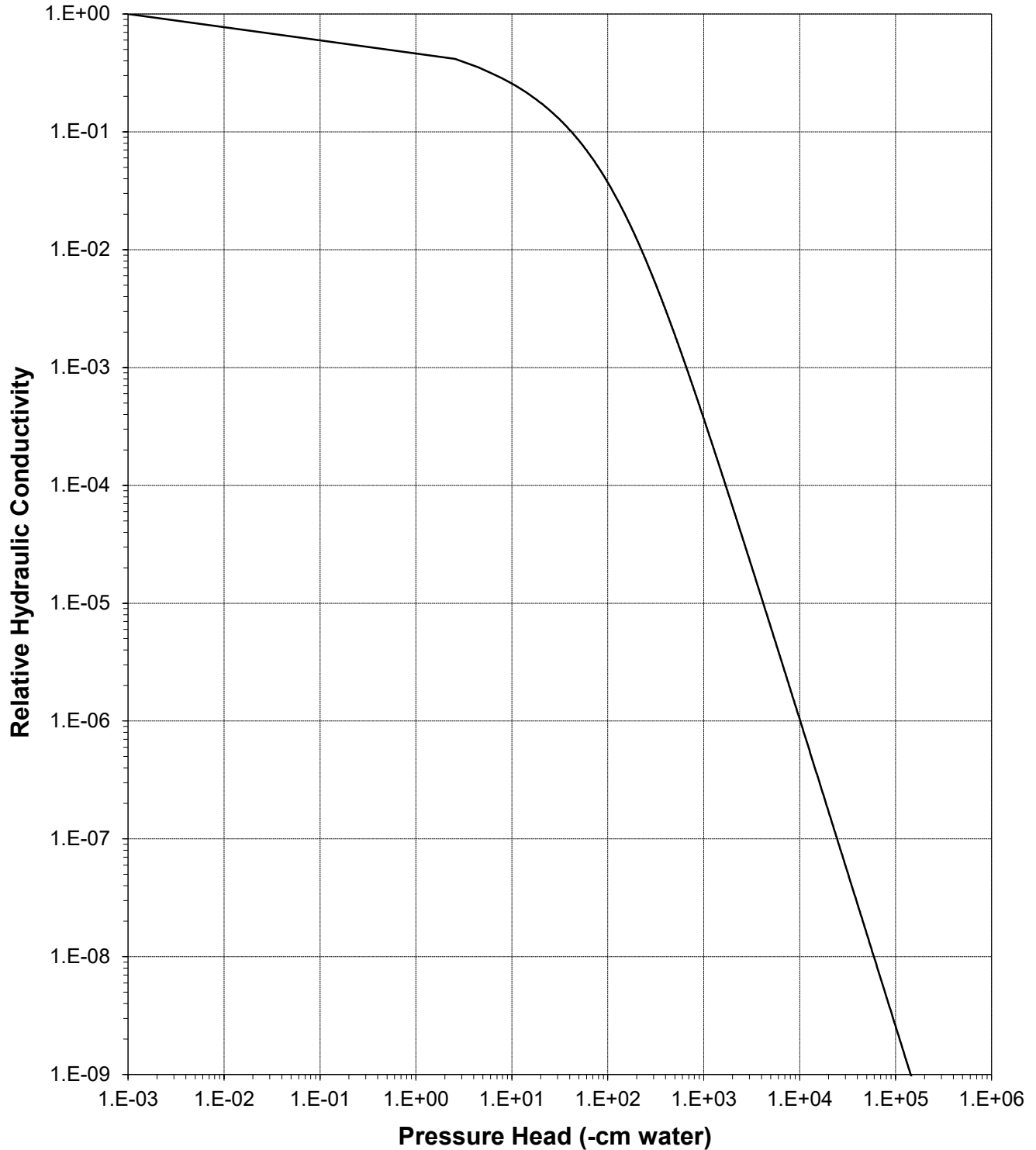
Sample Number: 6. Radon Barrier #2 (90.1%)





Plot of Relative Hydraulic Conductivity vs Pressure Head

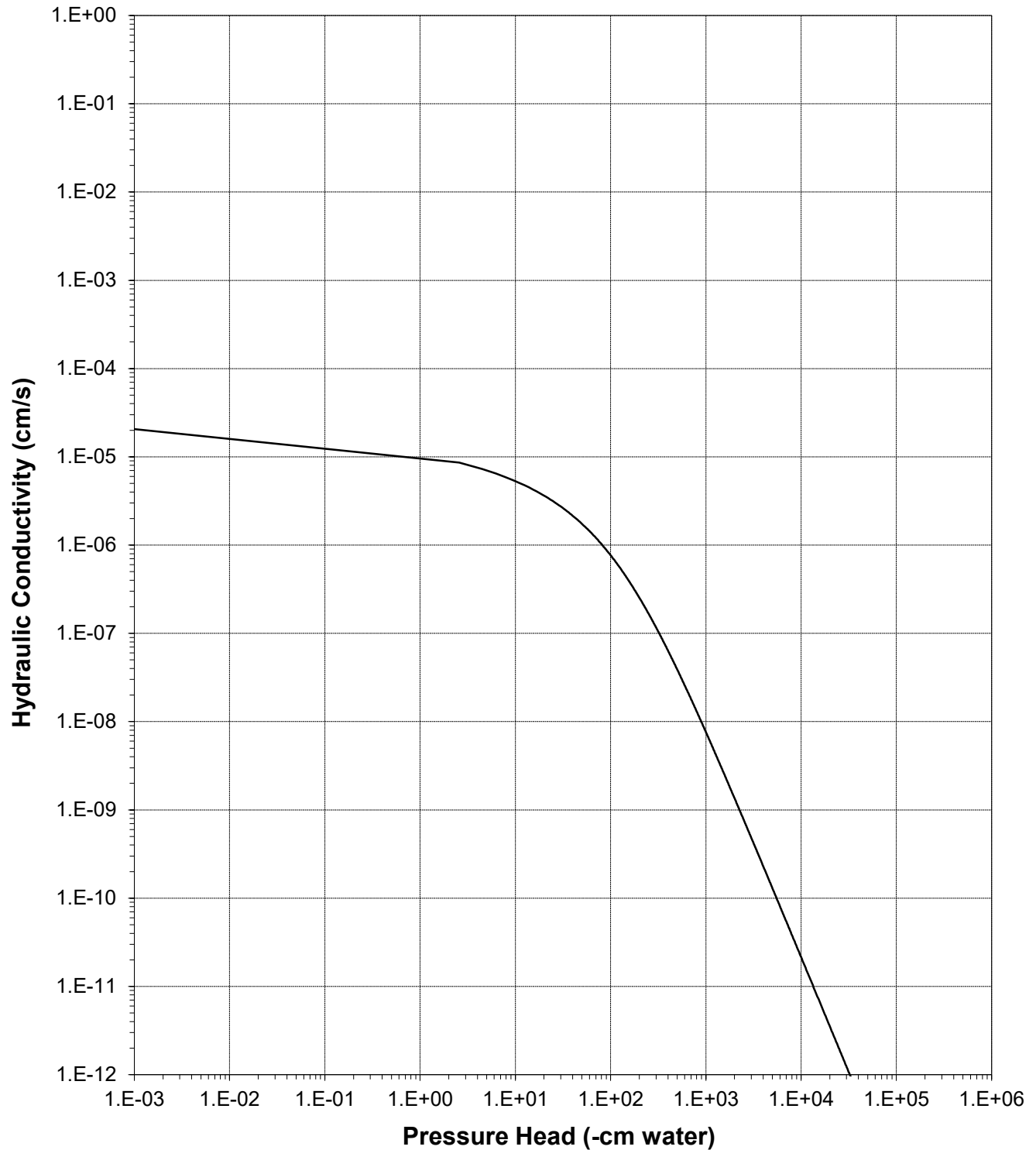
Sample Number: 6. Radon Barrier #2 (90.1%)





Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 6. Radon Barrier #2 (90.1%)





Oversize Correction Data Sheet

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 6. Radon Barrier #2 (90.1%)
Project Name: Crescent Junction
Date Sampled: NA

Split (3/4", 3/8", #4): #4

	Coarse Fraction*	Fines Fraction**	Composite
Subsample Mass (g):	0.70	99.30	100.00
Mass Fraction (%):	0.70	99.30	100.00
<i>Initial Sample θ_i</i>			
Bulk Density (g/cm ³):	2.76	1.61	1.62
Calculated Porosity (% vol):	0.00	41.51	41.33
Volume of Solids (cm ³):	0.25	35.98	36.23
Volume of Voids (cm ³):	0.00	25.53	25.53
Total Volume (cm ³):	0.25	61.51	61.76
Volumetric Fraction (%):	0.41	99.59	100.00
Initial Moisture Content (% vol):	0.00	26.37	---
<i>Saturated Sample θ_s</i>			
Bulk Density (g/cm ³):	2.76	1.60	1.60
Calculated Porosity (% vol):	0.00	42.13	41.96
Volume of Solids (cm ³):	0.25	35.98	36.23
Volume of Voids (cm ³):	0.00	26.19	26.19
Total Volume (cm ³):	0.25	62.17	62.43
Volumetric Fraction (%):	0.41	99.59	100.00
Saturated Moisture Content (% vol):	0.00	42.03	---
<i>Residual Sample θ_r</i>			
Bulk Density (g/cm ³):	2.76	1.60	1.61
Calculated Porosity (% vol):	0.00	41.88	41.71
Volume of Solids (cm ³):	0.25	35.98	36.23
Volume of Voids (cm ³):	0.00	25.93	25.93
Total Volume (cm ³):	0.25	61.90	62.16
Volumetric Fraction (%):	0.41	99.59	100.00
Residual Moisture Content (% vol):	0.00	0.00	---
<i>Ksat (cm/sec):</i>			
	NM	2.1E-05	---

* = Porosity and moisture content of coarse fraction assumed to be zero.

** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.

NM = Not measured

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: A. Bland

Checked by: J. Hines

Particle Size Analysis



Summary of Particle Size Characteristics

Sample Number	d ₁₀ (mm)	d ₅₀ (mm)	d ₆₀ (mm)	C _u	C _c	Method	ASTM Classification	USDA Classification
1. Excavated Test Pit Alluvium 1'-5'	0.0032	0.037	0.052	16	0.33	WS/H	Silty clay with sand (CL-ML)s	Silt Loam
2. Mix, Borrow Face Phase 3C	0.0048	0.043	0.056	12	0.27	WS/H	Silt with sand (ML)s	Silt Loam
3. Interim Cover Mix	0.0046	0.036	0.054	12	0.14	WS/H	Sandy silty clay s(CL-ML)	Silt Loam
4. Open Test Pit, Alluvium 1'-10'	0.0044	0.045	0.056	13	0.58	WS/H	Silt with sand (ML)s	Sandy Loam
5. Radon Barrier #1	0.0016	0.0044	0.0080	5.0	0.45	WS/H	Lean clay (CL)	Silt Loam
6. Radon Barrier #2	0.0015	0.0046	0.0082	5.5	0.29	WS/H	Lean clay (CL)	Silty Clay Loam

d₅₀ = Median particle diameter

Est = Reported values for d₁₀, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d₁₀ diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

[†] Greater than 10% of sample is coarse material



Percent Gravel, Sand, Silt and Clay*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
1. Excavated Test Pit Alluvium 1'-5'	3.7	25.6	67.2	3.6
2. Mix, Borrow Face Phase 3C	1.9	26.8	66.8	4.5
3. Interim Cover Mix	5.4	26.1	64.3	4.2
4. Open Test Pit, Alluvium 1'-10'	0.1	26.8	68.2	4.8
5. Radon Barrier #1	0.8	5.3	76.4	17.5
6. Radon Barrier #2	0.7	3.9	62.5	32.9

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.



Daniel B. Stephens & Associates, Inc.

Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Dwyer Engineering LLC
 Job Number: DB20.1167.00
 Sample Number: 1. Excavated Test Pit Alluvium 1'-5'
 Project Name: Crescent Junction
 Date Sampled: NA

Initial Dry Weight of Sample (g): 25725.17
 Weight Passing #10 (g): 24533.78
 Weight Retained #10 (g): 1191.39
 Weight of Hydrometer Sample (g): 74.84
 Calculated Weight of Sieve Sample (g): 78.47

Test Date: 17-Jul-20

Shape: Rounded
 Hardness: Weathered and Friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	25725.17	100.00
	2"	50	255.63	255.63	25469.54	99.01
	1.5"	38.1	0.00	255.63	25469.54	99.01
	1"	25	88.26	343.89	25381.28	98.66
	3/4"	19.0	120.00	463.89	25261.28	98.20
	3/8"	9.5	259.64	723.53	25001.64	97.19
	4	4.75	222.07	945.60	24779.57	96.32
	10	2.00	245.79	1191.39	24533.78	95.37
-10	(Based on calculated sieve wt.)					
	20	0.85	0.30	3.93	74.54	94.99
	40	0.425	0.42	4.35	74.12	94.45
	60	0.250	0.58	4.93	73.54	93.71
	100	0.150	2.57	7.50	70.97	90.44
	140	0.106	5.82	13.32	65.15	83.02
	200	0.075	9.63	22.95	55.52	70.75
	dry pan		1.47	24.42	54.05	
	wet pan			54.05	0.00	

d₁₀ (mm): 0.0032 d₅₀ (mm): 0.037
 d₁₆ (mm): 0.0036 d₆₀ (mm): 0.052
 d₃₀ (mm): 0.0074 d₈₄ (mm): 0.11

Median Particle Diameter--d₅₀ (mm): 0.037
 Uniformity Coefficient, Cu--[d₆₀/d₁₀] (mm): 16
 Coefficient of Curvature, Cc--[(d₃₀)²/(d₁₀*d₆₀)] (mm): 0.33
 Mean Particle Diameter--[(d₁₆+d₅₀+d₈₄)/3] (mm): 0.050

Classification of fines: CL-ML

ASTM Soil Classification: Silty clay with sand (CL-ML)s
 USDA Soil Classification: Silt Loam

Laboratory analysis by: A. Bland/D. O'Dowd
 Data entered by: A. Bland
 Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

Particle Size Analysis Hydrometer Data

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 1. Excavated Test Pit Alluvium 1'-5'
Project Name: Crescent Junction
Date Sampled: NA

Test Date: 16-Jul-20
Start Time: 9:00

Type of Water Used: DISTILLED
Reaction with H_2O_2 : NA
Dispersant*: $(NaPO_3)_6$
Assumed particle density: 2.76

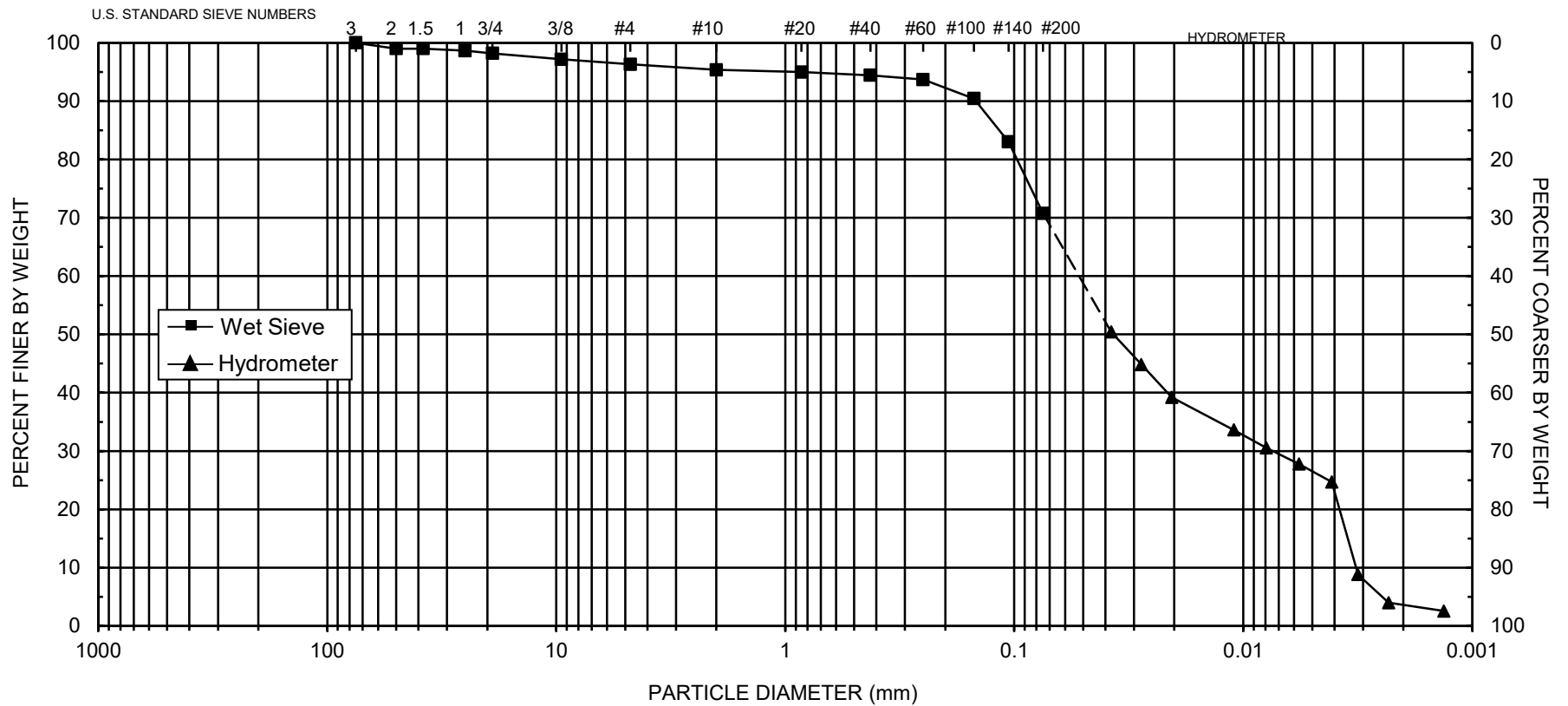
Initial Wt. (g): 74.84
Total Sample Wt. (g): 25725.17
Wt. Passing #10 (g): 24533.78

Date	Time (min)	Temp (°C)	R (g/L)	R _L (g/L)	R _{corr} (g/L)	H _m (cm)	D (mm)	P (%)	% Finer
16-Jul-20	1	21.7	46.50	5.99	40.5	8	0.0377	53	50.4
	2	21.7	42.00	5.99	36.0	9	0.0279	47	44.8
	4	21.7	37.50	5.99	31.5	10	0.0205	41	39.2
	15	21.7	33.00	5.99	27.0	10	0.0110	35	33.6
	30	21.8	30.50	5.95	24.6	11	0.0079	32	30.5
	60	21.8	28.25	5.95	22.3	11	0.0057	29	27.7
	120	21.9	25.75	5.91	19.8	12	0.0041	26	24.7
	240	21.9	13.00	5.91	7.1	14	0.0032	9	8.8
	467	22.2	9.00	5.80	3.2	14	0.0023	4	4.0
17-Jul-20	1436	21.8	8.00	5.95	2.1	15	0.0013	3	2.6

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland
Data entered by: A. Bland
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY			
		Coarse	Fine	Coarse	Medium	Fine				
USDA	COBBLES	GRAVEL		SAND					SILT	CLAY
				Very coarse	Coarse	Medium	Fine	Very fine		

$d_{10} = 0.0032$ $d_{30} = 0.0074$ $d_{50} = 0.037$ $d_{60} = 0.052$ $C_u = 16$ $C_c = 0.33$

SAMPLE NUMBER

DATE SAMPLED

ASTM CLASSIFICATION

USDA CLASSIFICATION

1. Excavated Test Pit Alluvium 1'-5'

NA

Silty clay with sand (CL-ML)s

Silt Loam



Daniel B. Stephens & Associates, Inc.



Daniel B. Stephens & Associates, Inc.

Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 2. Mix, Borrow Face Phase 3C
Project Name: Crescent Junction
Date Sampled: 7/7/20

Initial Dry Weight of Sample (g): 26678.56
Weight Passing #10 (g): 25632.47
Weight Retained #10 (g): 1046.09
Weight of Hydrometer Sample (g): 64.64
Calculated Weight of Sieve Sample (g): 67.28

Test Date: 17-Jul-20

Shape: Rounded
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	26678.56	100.00
	2"	50	0.00	0.00	26678.56	100.00
	1.5"	38.1	0.00	0.00	26678.56	100.00
	1"	25	81.13	81.13	26597.43	99.70
	3/4"	19.0	30.83	111.96	26566.60	99.58
	3/8"	9.5	168.17	280.13	26398.43	98.95
	4	4.75	234.56	514.69	26163.87	98.07
	10	2.00	531.40	1046.09	25632.47	96.08
-10	(Based on calculated sieve wt.)					
	20	0.85	0.51	3.15	64.13	95.32
	40	0.425	0.67	3.82	63.46	94.32
	60	0.250	0.58	4.40	62.88	93.46
	100	0.150	1.59	5.99	61.29	91.10
	140	0.106	4.21	10.20	57.08	84.84
	200	0.075	9.11	19.31	47.97	71.30
	dry pan		2.52	21.83	45.45	
	wet pan			45.45	0.00	

d₁₀ (mm): 0.0048 d₅₀ (mm): 0.043
d₁₆ (mm): 0.0051 d₆₀ (mm): 0.056
d₃₀ (mm): 0.0085 d₈₄ (mm): 0.10

Median Particle Diameter--d₅₀ (mm): 0.043
Uniformity Coefficient, Cu--[d₆₀/d₁₀] (mm): 12
Coefficient of Curvature, Cc--[(d₃₀)²/(d₁₀*d₆₀)] (mm): 0.27
Mean Particle Diameter--[(d₁₆+d₅₀+d₈₄)/3] (mm): 0.049

Classification of fines (visual method): ML

ASTM Soil Classification: Silt with sand (ML)s
USDA Soil Classification: Silt Loam

Laboratory analysis by: A. Bland/D. O'Dowd
Data entered by: A. Bland
Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

Particle Size Analysis Hydrometer Data

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 2. Mix, Borrow Face Phase 3C
Project Name: Crescent Junction
Date Sampled: 7/7/20

Test Date: 16-Jul-20
Start Time: 9:06

Type of Water Used: DISTILLED
Reaction with H_2O_2 : NA
Dispersant*: $(NaPO_3)_6$
Assumed particle density: 2.76

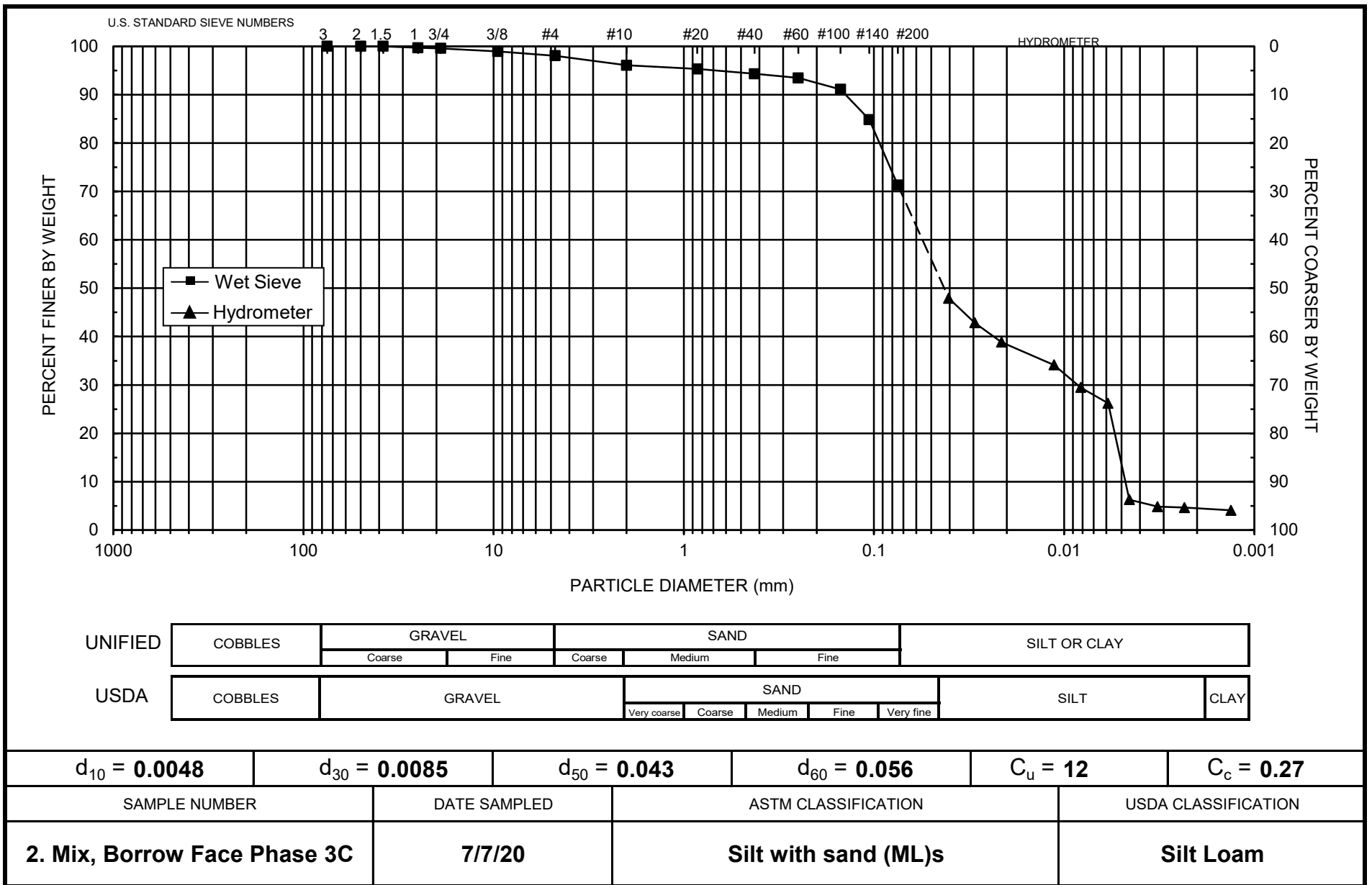
Initial Wt. (g): 64.64
Total Sample Wt. (g): 26678.56
Wt. Passing #10 (g): 25632.47

Date	Time (min)	Temp (°C)	R (g/L)	R _L (g/L)	R _{corr} (g/L)	H _m (cm)	D (mm)	P (%)	% Finer
16-Jul-20	1	21.7	39.00	5.99	33.0	9	0.0405	50	47.9
	2	21.7	35.50	5.99	29.5	10	0.0295	45	42.8
	4	21.7	32.75	5.99	26.8	10	0.0213	40	38.8
	15	21.7	29.50	5.99	23.5	11	0.0113	36	34.1
	30	21.8	26.25	5.95	20.3	12	0.0082	31	29.5
	60	21.8	24.00	5.95	18.1	12	0.0059	27	26.2
	120	21.9	10.25	5.91	4.3	14	0.0045	7	6.3
	240	21.9	9.25	5.91	3.3	14	0.0032	5	4.8
	462	22.2	9.00	5.80	3.2	14	0.0023	5	4.6
17-Jul-20	1431	21.8	8.75	5.95	2.8	14	0.0013	4	4.1

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland
Data entered by: A. Bland
Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.



Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Dwyer Engineering LLC
 Job Number: DB20.1167.00
 Sample Number: 3. Interim Cover Mix
 Project Name: Crescent Junction
 Date Sampled: NA

Initial Dry Weight of Sample (g): 30809.53
 Weight Passing #10 (g): 28392.06
 Weight Retained #10 (g): 2417.47
 Weight of Hydrometer Sample (g): 70.84
 Calculated Weight of Sieve Sample (g): 76.87

Test Date: 17-Jul-20

Shape: Angular
 Hardness: Hard and Durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	30809.53	100.00
	2"	50	193.55	193.55	30615.98	99.37
	1.5"	38.1	50.39	243.94	30565.59	99.21
	1"	25	267.89	511.83	30297.70	98.34
	3/4"	19.0	166.47	678.30	30131.23	97.80
	3/8"	9.5	470.15	1148.45	29661.08	96.27
	4	4.75	521.18	1669.63	29139.90	94.58
	10	2.00	747.84	2417.47	28392.06	92.15
-10	(Based on calculated sieve wt.)					
	20	0.85	0.83	6.86	70.01	91.07
	40	0.425	0.71	7.57	69.30	90.15
	60	0.250	0.69	8.26	68.61	89.25
	100	0.150	2.16	10.42	66.45	86.44
	140	0.106	4.91	15.33	61.54	80.06
	200	0.075	8.89	24.22	52.65	68.49
	dry pan		2.18	26.40	50.47	
	wet pan			50.47	0.00	

d₁₀ (mm): 0.0046 d₅₀ (mm): 0.036
 d₁₆ (mm): 0.0049 d₆₀ (mm): 0.054
 d₃₀ (mm): 0.0058 d₈₄ (mm): 0.13

Median Particle Diameter--d₅₀ (mm): 0.036
 Uniformity Coefficient, Cu--[d₆₀/d₁₀] (mm): 12
 Coefficient of Curvature, Cc--[(d₃₀)²/(d₁₀*d₆₀)] (mm): 0.14
 Mean Particle Diameter--[(d₁₆+d₅₀+d₈₄)/3] (mm): 0.057

Classification of fines: CL-ML

ASTM Soil Classification: Sandy silty clay s(CL-ML)
 USDA Soil Classification: Silt Loam

Laboratory analysis by: A. Bland/D. O'Dowd
 Data entered by: A. Bland
 Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

Particle Size Analysis Hydrometer Data

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 3. Interim Cover Mix
Project Name: Crescent Junction
Date Sampled: NA

Test Date: 16-Jul-20
Start Time: 9:12

Type of Water Used: DISTILLED
Reaction with H_2O_2 : NA
Dispersant*: $(NaPO_3)_6$
Assumed particle density: 2.76

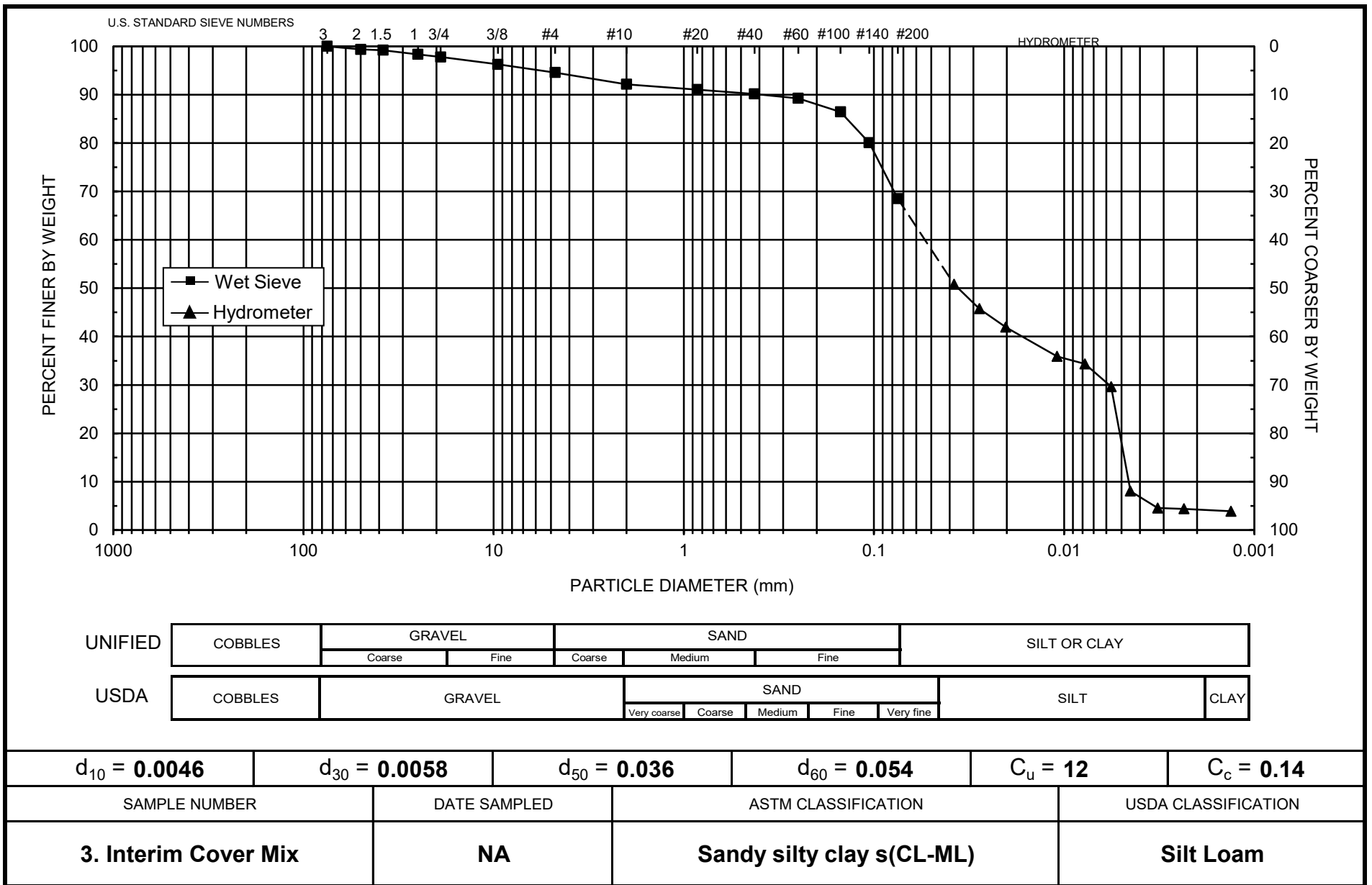
Initial Wt. (g): 70.84
Total Sample Wt. (g): 30809.53
Wt. Passing #10 (g): 28392.06

Date	Time (min)	Temp (°C)	R (g/L)	R _L (g/L)	R _{corr} (g/L)	H _m (cm)	D (mm)	P (%)	% Finer
16-Jul-20	1	21.7	46.00	5.99	40.0	8	0.0379	55	50.8
	2	21.7	42.00	5.99	36.0	9	0.0279	50	45.7
	4	21.7	39.00	5.99	33.0	9	0.0203	46	41.9
	15	21.7	34.25	5.99	28.3	10	0.0109	39	35.9
	30	21.8	33.00	5.95	27.1	10	0.0078	37	34.4
	60	21.9	29.25	5.91	23.3	11	0.0057	32	29.6
	120	21.9	12.25	5.91	6.3	14	0.0045	9	8.0
	240	21.9	9.50	5.91	3.6	14	0.0032	5	4.6
	457	22.2	9.25	5.80	3.4	14	0.0023	5	4.4
17-Jul-20	1426	21.8	9.00	5.95	3.1	14	0.0013	4	3.9

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: J. Hines
Data entered by: J. Hines
Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.



Daniel B. Stephens & Associates, Inc.

Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 4. Open Test Pit, Alluvium 1'-10'
Project Name: Crescent Junction
Date Sampled: NA

Test Date: 17-Jul-20

Initial Dry Weight of Sample (g): 21848.19
Weight Passing #10 (g): 21808.55
Weight Retained #10 (g): 39.64
Weight of Hydrometer Sample (g): 67.09
Calculated Weight of Sieve Sample (g): 67.21

Shape: Angular
Hardness: Hard and Durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	21848.19	100.00
	2"	50	0.00	0.00	21848.19	100.00
	1.5"	38.1	0.00	0.00	21848.19	100.00
	1"	25	0.00	0.00	21848.19	100.00
	3/4"	19.0	9.68	9.68	21838.51	99.96
	3/8"	9.5	2.07	11.75	21836.44	99.95
	4	4.75	17.84	29.59	21818.60	99.86
	10	2.00	10.05	39.64	21808.55	99.82
-10	(Based on calculated sieve wt.)					
	20	0.85	0.04	0.16	67.05	99.76
	40	0.425	0.12	0.28	66.93	99.58
	60	0.250	0.30	0.58	66.63	99.13
	100	0.150	1.76	2.34	64.87	96.52
	140	0.106	5.13	7.47	59.74	88.88
	200	0.075	10.62	18.09	49.12	73.08
	dry pan		2.85	20.94	46.27	
	wet pan			46.27	0.00	

d₁₀ (mm): 0.0044 d₅₀ (mm): 0.045
d₁₆ (mm): 0.0051 d₆₀ (mm): 0.056
d₃₀ (mm): 0.012 d₈₄ (mm): 0.095

Median Particle Diameter--d₅₀ (mm): 0.045
Uniformity Coefficient, Cu--[d₆₀/d₁₀] (mm): 13
Coefficient of Curvature, Cc--[(d₃₀)²/(d₁₀*d₆₀)] (mm): 0.58
Mean Particle Diameter--[(d₁₆+d₅₀+d₈₄)/3] (mm): 0.048

Classification of fines (visual method): ML

ASTM Soil Classification: Silt with sand (ML)s
USDA Soil Classification: Sandy Loam

Laboratory analysis by: A. Bland/D. O'Dowd
Data entered by: A. Bland
Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

Particle Size Analysis Hydrometer Data

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 4. Open Test Pit, Alluvium 1'-10'
Project Name: Crescent Junction
Date Sampled: NA

Test Date: 16-Jul-20
Start Time: 9:18

Type of Water Used: DISTILLED
Reaction with H₂O₂: NA
Dispersant:* (NaPO₃)₆
Assumed particle density: 2.76

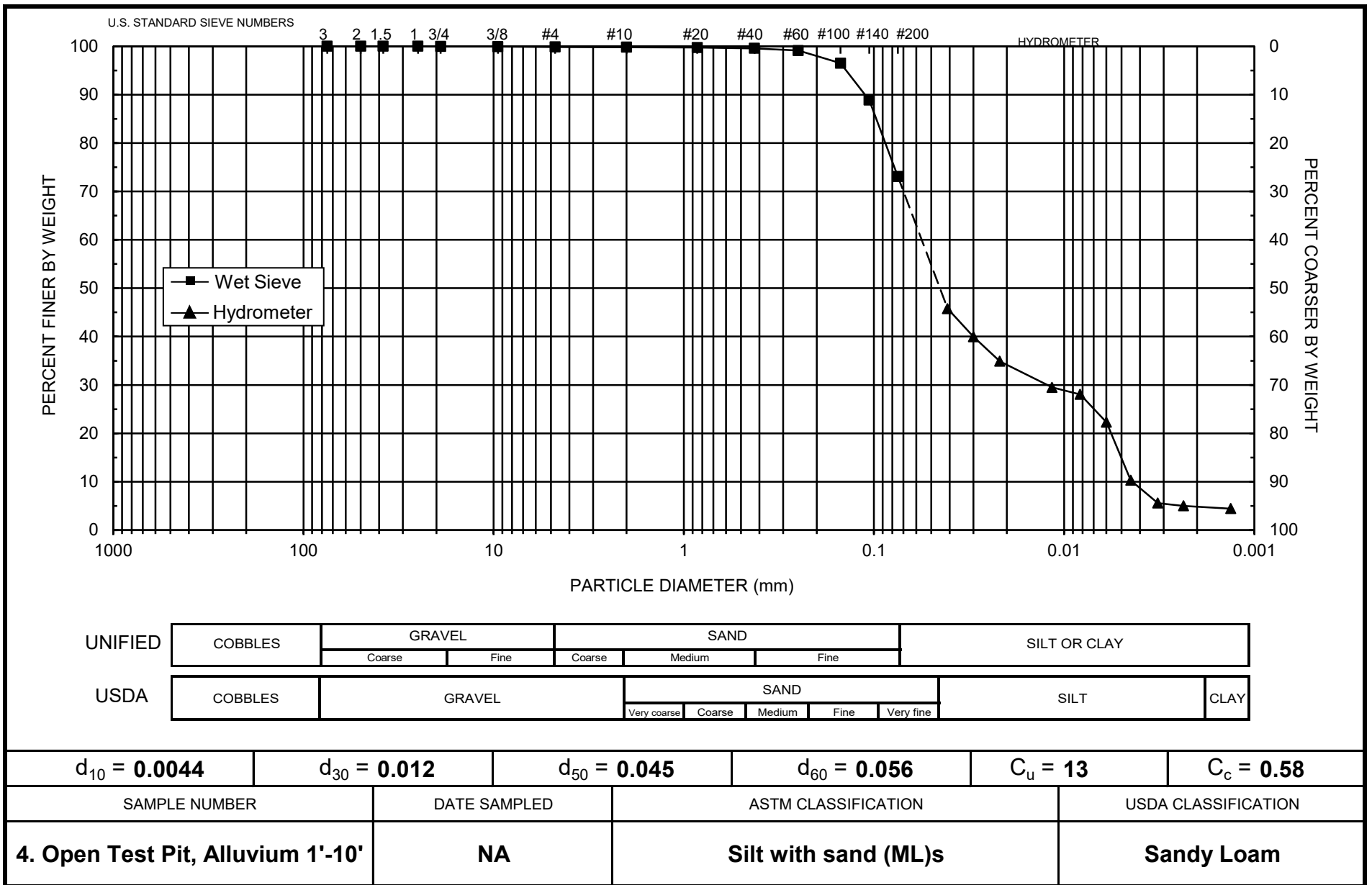
Initial Wt. (g): 67.09
Total Sample Wt. (g): 21848.19
Wt. Passing #10 (g): 21808.55

Date	Time (min)	Temp (°C)	R (g/L)	R _L (g/L)	R _{corr} (g/L)	H _m (cm)	D (mm)	P (%)	% Finer
16-Jul-20	1	21.7	37.50	5.99	31.5	10	0.0410	46	45.8
	2	21.7	33.50	5.99	27.5	10	0.0300	40	40.0
	4	21.7	30.00	5.99	24.0	11	0.0218	35	34.9
	15	21.8	26.25	5.95	20.3	12	0.0116	30	29.5
	30	21.8	25.25	5.95	19.3	12	0.0082	28	28.0
	60	21.9	21.25	5.91	15.3	12	0.0060	22	22.3
	120	21.9	13.00	5.91	7.1	14	0.0045	10	10.3
	240	21.9	9.75	5.91	3.8	14	0.0032	6	5.6
	451	22.2	9.25	5.80	3.4	14	0.0024	5	5.0
17-Jul-20	1421	21.8	9.00	5.95	3.1	14	0.0013	4	4.4

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland
Data entered by: A. Bland
Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.



Daniel B. Stephens & Associates, Inc.

Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 5. Radon Barrier #1
Project Name: Crescent Junction
Date Sampled: NA

Test Date: 17-Jul-20

Initial Dry Weight of Sample (g): 21065.53
Weight Passing #10 (g): 20810.83
Weight Retained #10 (g): 254.70
Weight of Hydrometer Sample (g): 62.25
Calculated Weight of Sieve Sample (g): 63.01

Shape: Angular
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	21065.53	100.00
	2"	50	0.00	0.00	21065.53	100.00
	1.5"	38.1	0.00	0.00	21065.53	100.00
	1"	25	34.56	34.56	21030.97	99.84
	3/4"	19.0	0.00	34.56	21030.97	99.84
	3/8"	9.5	50.27	84.83	20980.70	99.60
	4	4.75	77.43	162.26	20903.27	99.23
	10	2.00	92.44	254.70	20810.83	98.79
-10						
			(Based on calculated sieve wt.)			
	20	0.85	0.28	1.04	61.97	98.35
	40	0.425	0.44	1.48	61.53	97.65
	60	0.250	0.25	1.73	61.28	97.25
	100	0.150	0.31	2.04	60.97	96.76
	140	0.106	0.52	2.56	60.45	95.93
	200	0.075	1.26	3.82	59.19	93.93
	dry pan		0.75	4.57	58.44	
	wet pan			58.44	0.00	

d₁₀ (mm): 0.0016 d₅₀ (mm): 0.0044
d₁₆ (mm): 0.0019 d₆₀ (mm): 0.0080
d₃₀ (mm): 0.0024 d₈₄ (mm): 0.041

Median Particle Diameter--d₅₀ (mm): 0.0044
Uniformity Coefficient, Cu--[d₆₀/d₁₀] (mm): 5.0
Coefficient of Curvature, Cc--[(d₃₀)²/(d₁₀*d₆₀)] (mm): 0.45
Mean Particle Diameter--[(d₁₆+d₅₀+d₈₄)/3] (mm): 0.016

Classification of fines: CL

ASTM Soil Classification: Lean clay (CL)
USDA Soil Classification: Silt Loam

Laboratory analysis by: A. Bland
Data entered by: A. Bland
Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

Particle Size Analysis Hydrometer Data

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 5. Radon Barrier #1
Project Name: Crescent Junction
Date Sampled: NA

Test Date: 27-Jul-20
Start Time: 9:00

Type of Water Used: DISTILLED
Reaction with H_2O_2 : NA
Dispersant*: $(NaPO_3)_6$
Assumed particle density: 2.76

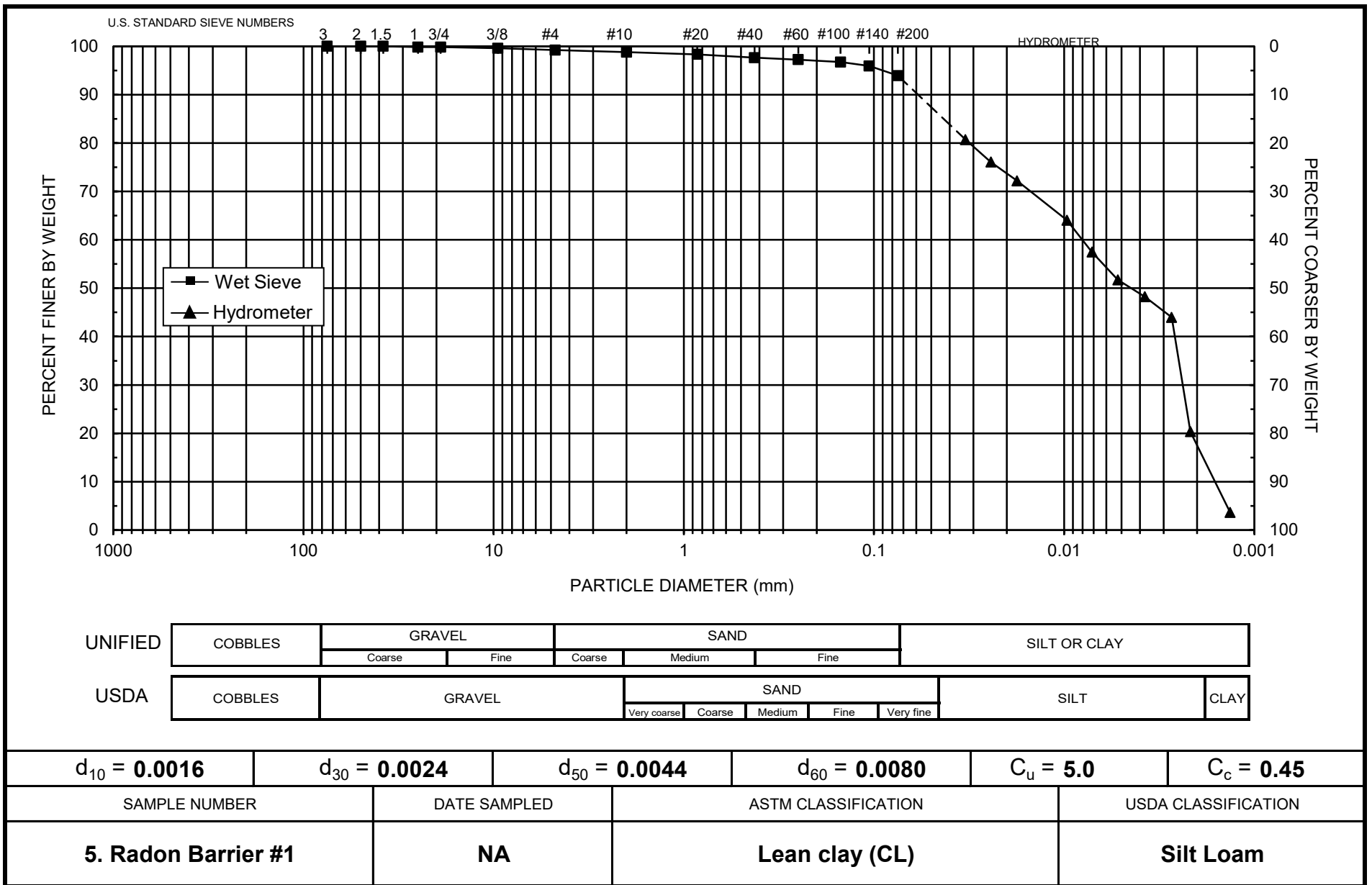
Initial Wt. (g): 62.25
Total Sample Wt. (g): 21065.53
Wt. Passing #10 (g): 20810.83

Date	Time (min)	Temp (°C)	R (g/L)	R _L (g/L)	R _{corr} (g/L)	H _m (cm)	D (mm)	P (%)	% Finer
27-Jul-20	1	21.9	58.00	5.91	52.1	6	0.0330	82	80.7
	2	21.9	55.00	5.91	49.1	7	0.0243	77	76.1
	4	21.9	52.50	5.91	46.6	7	0.0177	73	72.2
	15	21.9	47.25	5.91	41.3	8	0.0097	65	64.0
	30	21.9	43.00	5.91	37.1	9	0.0071	58	57.5
	60	22.0	39.25	5.88	33.4	9	0.0052	52	51.7
	120	22.0	37.00	5.88	31.1	10	0.0038	49	48.2
	240	22.0	34.25	5.88	28.4	10	0.0027	45	44.0
	472	22.0	19.00	5.88	13.1	13	0.0022	21	20.3
28-Jul-20	1410	21.9	8.25	5.91	2.3	15	0.0013	4	3.6

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland
Data entered by: A. Bland
Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.



Daniel B. Stephens & Associates, Inc.

Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 6. Radon Barrier #2
Project Name: Crescent Junction
Date Sampled: NA

Test Date: 17-Jul-20

Initial Dry Weight of Sample (g): 21846.00
Weight Passing #10 (g): 21602.80
Weight Retained #10 (g): 243.19
Weight of Hydrometer Sample (g): 58.97
Calculated Weight of Sieve Sample (g): 59.63

Shape: Angular
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	21846.00	100.00
	2"	50	0.00	0.00	21846.00	100.00
	1.5"	38.1	0.00	0.00	21846.00	100.00
	1"	25	16.98	16.98	21829.02	99.92
	3/4"	19.0	33.89	50.87	21795.13	99.77
	3/8"	9.5	38.02	88.89	21757.11	99.59
	4	4.75	64.20	153.09	21692.91	99.30
	10	2.00	90.10	243.19	21602.80	98.89
-10	(Based on calculated sieve wt.)					
	20	0.85	0.11	0.77	58.86	98.70
	40	0.425	0.26	1.03	58.60	98.27
	60	0.250	0.23	1.26	58.37	97.88
	100	0.150	0.26	1.52	58.11	97.44
	140	0.106	0.33	1.85	57.78	96.89
	200	0.075	0.90	2.75	56.88	95.38
	dry pan		0.60	3.35	56.28	
	wet pan			56.28	0.00	

d₁₀ (mm): 0.0015 d₅₀ (mm): 0.0046

d₁₆ (mm): 0.0016 d₆₀ (mm): 0.0082

d₃₀ (mm): 0.0019 d₈₄ (mm): 0.040

Median Particle Diameter--d₅₀ (mm): 0.0046

Uniformity Coefficient, Cu--[d₆₀/d₁₀] (mm): 5.5

Coefficient of Curvature, Cc--[(d₃₀)²/(d₁₀*d₆₀)] (mm): 0.29

Mean Particle Diameter--[(d₁₆+d₅₀+d₈₄)/3] (mm): 0.015

Classification of fines: CL

ASTM Soil Classification: Lean clay (CL)

USDA Soil Classification: Silty Clay Loam

Laboratory analysis by: A. Bland

Data entered by: A. Bland

Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

Particle Size Analysis Hydrometer Data

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 6. Radon Barrier #2
Project Name: Crescent Junction
Date Sampled: NA

Test Date: 27-Jul-20
Start Time: 9:06

Type of Water Used: DISTILLED
Reaction with H_2O_2 : NA
Dispersant*: $(NaPO_3)_6$
Assumed particle density: 2.76

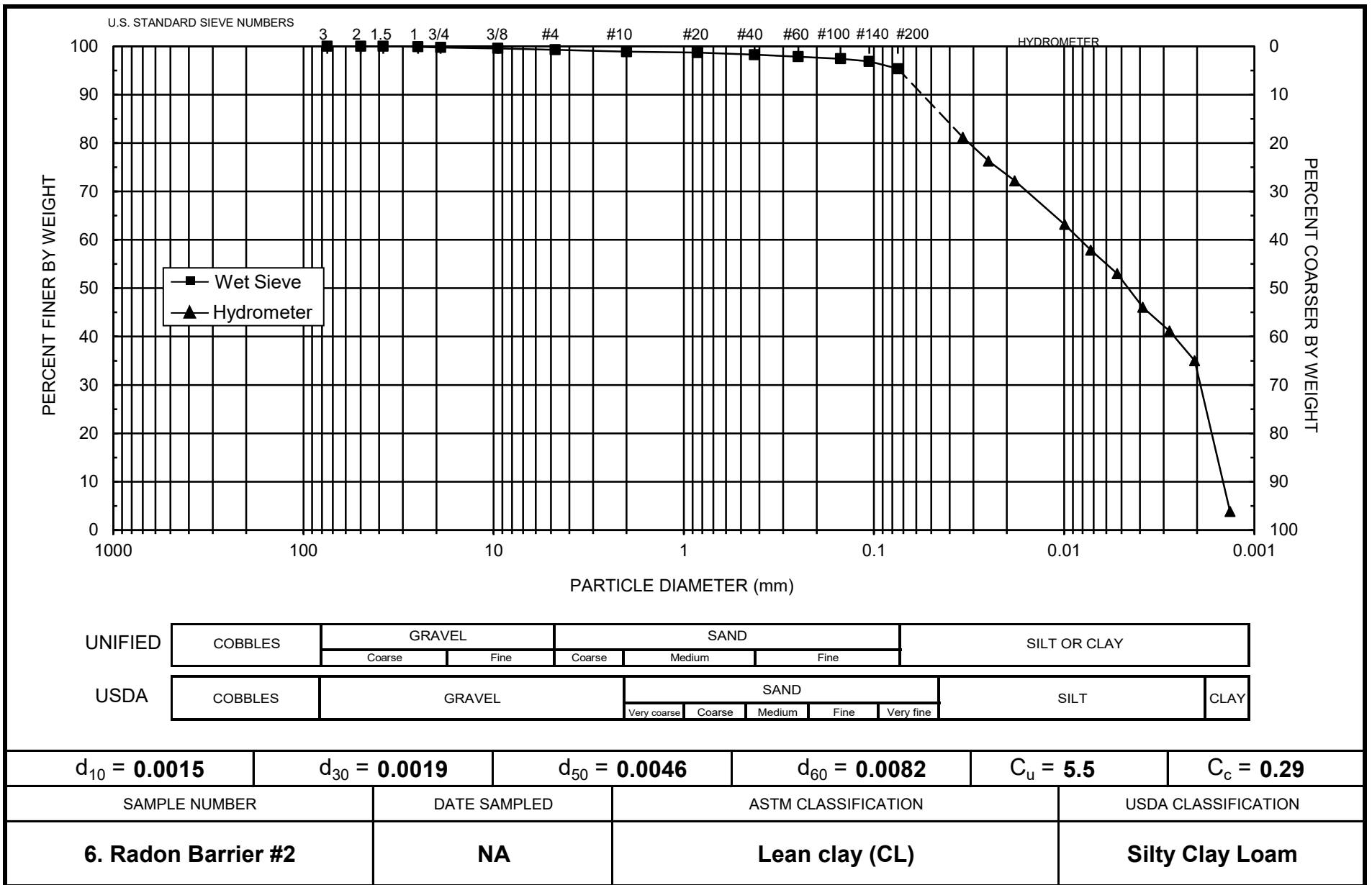
Initial Wt. (g): 58.97
Total Sample Wt. (g): 21846.00
Wt. Passing #10 (g): 21602.80

Date	Time (min)	Temp (°C)	R (g/L)	R _L (g/L)	R _{corr} (g/L)	H _m (cm)	D (mm)	P (%)	% Finer
27-Jul-20	1	21.9	55.50	5.91	49.6	7	0.0341	82	81.2
	2	21.9	52.50	5.91	46.6	7	0.0250	77	76.3
	4	21.9	50.00	5.91	44.1	8	0.0182	73	72.2
	15	21.9	44.50	5.91	38.6	9	0.0099	64	63.2
	30	21.9	41.25	5.91	35.3	9	0.0072	59	57.9
	60	22.0	38.25	5.88	32.4	10	0.0053	54	53.0
	120	22.0	34.00	5.88	28.1	10	0.0039	47	46.0
	240	22.0	31.00	5.88	25.1	11	0.0028	42	41.1
	467	22.0	27.25	5.88	21.4	11	0.0021	35	35.0
28-Jul-20	1405	21.9	8.25	5.91	2.3	15	0.0013	4	3.8

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland
Data entered by: A. Bland
Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

Atterberg Limits/ Identification of Fines



Summary of Atterberg Tests

Sample Number	Liquid Limit	Plastic Limit	Plasticity Index	Classification
1. Excavated Test Pit Alluvium 1'	22	18	4	CL-ML
2. Mix, Borrow Face Phase 3C	---	---	---	ML
3. Interim Cover Mix	24	18	6	CL-ML
4. Open Test Pit, Alluvium 1'-10	---	---	---	ML
5. Radon Barrier #1	37	19	18	CL
6. Radon Barrier #2	36	17	19	CL

--- = Soil requires visual-manual classification due to non-plasticity



Atterberg Limits

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 1. Excavated Test Pit Alluvium 1'-5'
Project Name: Crescent Junction
Date Sampled: NA
Test Date: 16-Jul-20

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	32	25	16
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	126.72	134.64	138.15
Weight of pan plus dry soil (g):	124.14	130.45	133.96
Weight of pan (g):	111.98	111.76	116.24
Gravimetric moisture content (% g/g):	21.22	22.42	23.65
Liquid Limit:	22		

Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	122.38	120.11
Weight of pan plus dry soil (g):	121.20	118.96
Weight of pan (g):	114.79	112.73
Gravimetric moisture content (% g/g):	18.41	18.46
Plastic Limit:	18	

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 22
Plastic Limit: 18
Plasticity Index: 4
Classification: CL-ML

Comments:

- = Soil requires visual-manual classification due to non-plasticity
- * = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Bland
Checked by: J. Hines



Atterberg Limits

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 2. Mix, Borrow Face Phase 3C
Project Name: Crescent Junction
Date Sampled: 7/7/20
Test Date: 16-Jul-20

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---
Classification (Visual Method): ML

Comments:

- = Soil requires visual-manual classification due to non-plasticity
- * = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Bland
Checked by: J. Hines



**Data for Description and Identification of Fines
(Visual-Manual Procedure)**

Job Name: Northwind Portage
Job Number: DB20.1167.00
Sample Number: 2. Mix, Borrow Face Phase 3C
Project Name: Crescent Junction
Date Sampled: 7/7/20
Test Date: 16-Jul-20

Visual-manual classification of material passing the #40 sieve in lieu of
Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample: Dark Brown (10YR 3/3)
Odor: None
Moisture Condition: Moist
HCl Reaction: Strong

Preliminary Identification:

Dry Strength: Low
Dilatency: Rapid
Toughness: Low
Plasticity: Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by: D. O'Dowd
Data entered by: A. Bland
Checked by: J. Hines



Atterberg Limits

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 3. Interim Cover Mix
Project Name: Crescent Junction
Date Sampled: NA
Test Date: 16-Jul-20

Liquid Limit

	Trial 1	Trial 2	Trial 3
<i>Number of drops:</i>	35	22	15
<i>Pan number:</i>	LL1	LL2	LL3
<i>Weight of pan plus moist soil (g):</i>	137.00	135.02	132.24
<i>Weight of pan plus dry soil (g)</i>	133.04	131.60	129.00
<i>Weight of pan (g):</i>	115.31	117.66	116.50
<i>Gravimetric moisture content (% g/g):</i>	22.34	24.53	25.92
<i>Liquid Limit:</i>	24		

Plastic Limit

	Trial 1	Trial 2
<i>Pan number:</i>	PL1	PL2
<i>Weight of pan plus moist soil (g):</i>	118.95	125.01
<i>Weight of pan plus dry soil (g)</i>	117.92	123.86
<i>Weight of pan (g):</i>	112.00	117.40
<i>Gravimetric moisture content (% g/g):</i>	17.40	17.80
<i>Plastic Limit:</i>	18	

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 24
Plastic Limit: 18
Plasticity Index: 6
Classification: CL-ML

Comments:

- = Soil requires visual-manual classification due to non-plasticity
- * = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Bland
Checked by: J. Hines



Atterberg Limits

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 4. Open Test Pit, Alluvium 1'-10'
Project Name: Crescent Junction
Date Sampled: NA
Test Date: 16-Jul-20

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---
Classification (Visual Method): ML

Comments:

- = Soil requires visual-manual classification due to non-plasticity
- * = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Bland
Checked by: J. Hines



**Data for Description and Identification of Fines
(Visual-Manual Procedure)**

Job Name: Northwind Portage
Job Number: DB20.1167.00
Sample Number: 4. Open Test Pit, Alluvium 1'-10'
Project Name: Crescent Junction
Date Sampled: NA
Test Date: 16-Jul-20

Visual-manual classification of material passing the #40 sieve in lieu of
Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample: Brown (10YR 4/3)
Odor: None
Moisture Condition: Moist
HCl Reaction: Strong

Preliminary Identification:

Dry Strength: Low
Dilatency: Rapid
Toughness: Low
Plasticity: Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by: D. O'Dowd
Data entered by: A. Bland
Checked by: J. Hines



Atterberg Limits

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 5. Radon Barrier #1
Project Name: Crescent Junction
Date Sampled: NA
Test Date: 16-Jul-20

Liquid Limit

	Trial 1	Trial 2	Trial 3
<i>Number of drops:</i>	31	24	17
<i>Pan number:</i>	LL1	LL2	LL3
<i>Weight of pan plus moist soil (g):</i>	133.68	126.26	129.70
<i>Weight of pan plus dry soil (g)</i>	128.79	122.00	124.96
<i>Weight of pan (g):</i>	115.16	110.59	112.70
<i>Gravimetric moisture content (% g/g):</i>	35.88	37.34	38.66
<i>Liquid Limit:</i>	37		

Plastic Limit

	Trial 1	Trial 2
<i>Pan number:</i>	PL1	PL2
<i>Weight of pan plus moist soil (g):</i>	122.04	122.10
<i>Weight of pan plus dry soil (g)</i>	120.65	120.68
<i>Weight of pan (g):</i>	113.18	113.02
<i>Gravimetric moisture content (% g/g):</i>	18.61	18.54
<i>Plastic Limit:</i>	19	

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 37
Plastic Limit: 19
Plasticity Index: 18
Classification: CL

Comments:

- = Soil requires visual-manual classification due to non-plasticity
- * = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Bland
Checked by: J. Hines



Atterberg Limits

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 6. Radon Barrier #2
Project Name: Crescent Junction
Date Sampled: NA

Test Date: 16-Jul-20

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	32	23	15
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	128.08	128.51	134.00
Weight of pan plus dry soil (g)	124.20	123.97	128.64
Weight of pan (g):	113.18	111.62	114.45
Gravimetric moisture content (% g/g):	35.21	36.76	37.77
Liquid Limit:	36		

Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	122.99	124.35
Weight of pan plus dry soil (g)	121.36	122.94
Weight of pan (g):	111.99	114.70
Gravimetric moisture content (% g/g):	17.40	17.11
Plastic Limit:	17	

Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 36
Plastic Limit: 17
Plasticity Index: 19
Classification: CL

Comments:

- = Soil requires visual-manual classification due to non-plasticity
- * = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: A. Bland
Checked by: J. Hines

Proctor Compaction



Summary of Proctor Compaction Tests

Sample Number	Measured		Oversize Corrected	
	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm ³)	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm ³)
1. Excavated Test Pit Alluvium 1'-5'	13.4	1.90	---	---
2. Mix, Borrow Face Phase 3C	13.4	1.90	---	---
3. Interim Cover Mix	13.3	1.90	12.6	1.93
4. Open Test Pit, Alluvium 1'-10'	13.3	1.88	---	---
5. Radon Barrier #1	16.4	1.80	---	---
6. Radon Barrier #2	16.5	1.79	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



Daniel B. Stephens & Associates, Inc.

Proctor Compaction Data

Job Name: Dwyer Engineering LLC
Job Number: DB20.1167.00
Sample Number: 1. Excavated Test Pit Alluvium 1'-5'
Project Name: Crescent Junction
Date Sampled: NA
Test Date: 14-Jul-20

Split (3/4", 3/8", #4): #4
Mass of coarse material (g): 3.68
Mass of fines material (g): 96.32
Mold weight (g): 4194
Mold volume (cm³): 943.92
Compaction Method: Standard A
Preparation Method: Dry
Type of Rammer: Mechanical

As Received Moisture Content (% g/g): NA

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm ³)	Moisture Content (% g/g)
1	6017	969.00	903.98	213.61	1.77	9.42
2	6159	901.21	828.89	208.68	1.86	11.66
3	6222	912.53	830.09	213.42	1.90	13.37
4	6171	885.81	793.77	207.40	1.81	15.70
5	6086	945.80	835.31	211.70	1.70	17.72

Soil Fractions

Coarse Fraction (% g/g): 3.7
Fines Fraction (% g/g): 96.3

Properties of Coarse Material

Assumed particle density (g/cm³): 2.76
Assumed Initial Moisture Content (% g/g): 0.0

Override Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm ³)	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Override correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd
Data entered by: A. Bland
Checked by: J. Hines

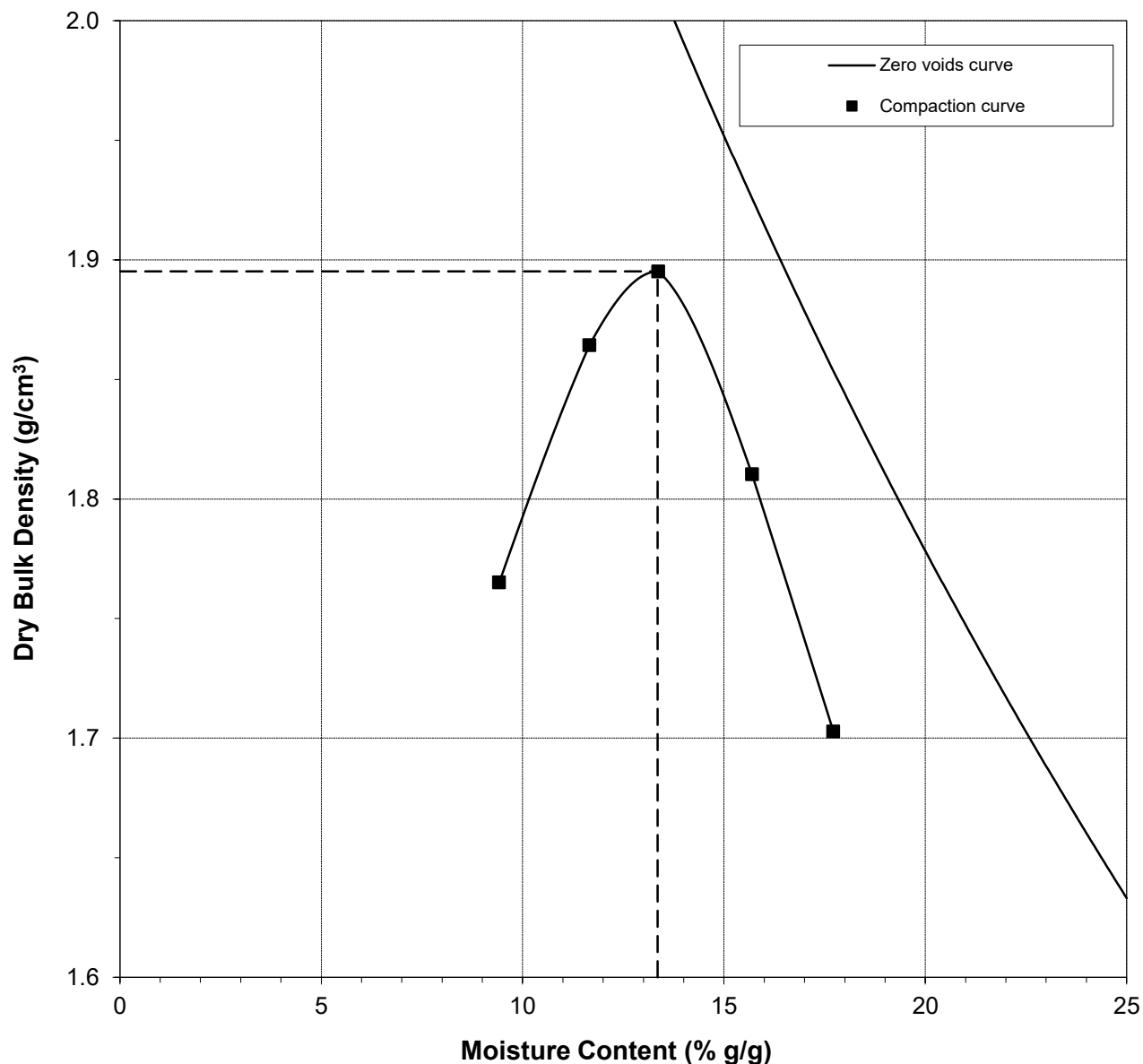


Proctor Compaction Data Points with Fitted Curve

Sample Number: 1. Excavated Test Pit Alluvium 1'-5'

	Measured	Corrected
Optimum Moisture Content (% g/g):	13.4	---
Maximum Dry Bulk Density (g/cm ³):	1.90	---

Test Date: 14-Jul-20



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: A. Bland

Checked by: J. Hines



Proctor Compaction Data

Job Name: Dwyer Engineering LLC	Split (3/4", 3/8", #4): #4
Job Number: DB20.1167.00	Mass of coarse material (g): 1.93
Sample Number: 2. Mix, Borrow Face Phase 3C	Mass of fines material (g): 98.07
Project Name: Crescent Junction	Mold weight (g): 4194
Date Sampled: 7/7/20	Mold volume (cm ³): 943.92
Test Date: 14-Jul-20	Compaction Method: Standard A
	Preparation Method: Dry
As Received Moisture Content (% g/g): NA	Type of Rammer: Mechanical

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm ³)	Moisture Content (% g/g)
1	6027	959.82	900.51	269.18	1.78	9.39
2	6136	979.82	902.35	212.68	1.85	11.23
3	6229	988.50	902.58	264.28	1.90	13.46
4	6195	1036.82	935.55	265.84	1.84	15.12
5	6102	1135.59	1006.34	269.31	1.72	17.54

Soil Fractions
 Coarse Fraction (% g/g): 1.9
 Fines Fraction (% g/g): 98.1

Properties of Coarse Material
 Assumed particle density (g/cm³): 2.76
 Assumed Initial Moisture Content (% g/g): 0.0

Override Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm ³)	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Override correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd
 Data entered by: A. Bland
 Checked by: J. Hines

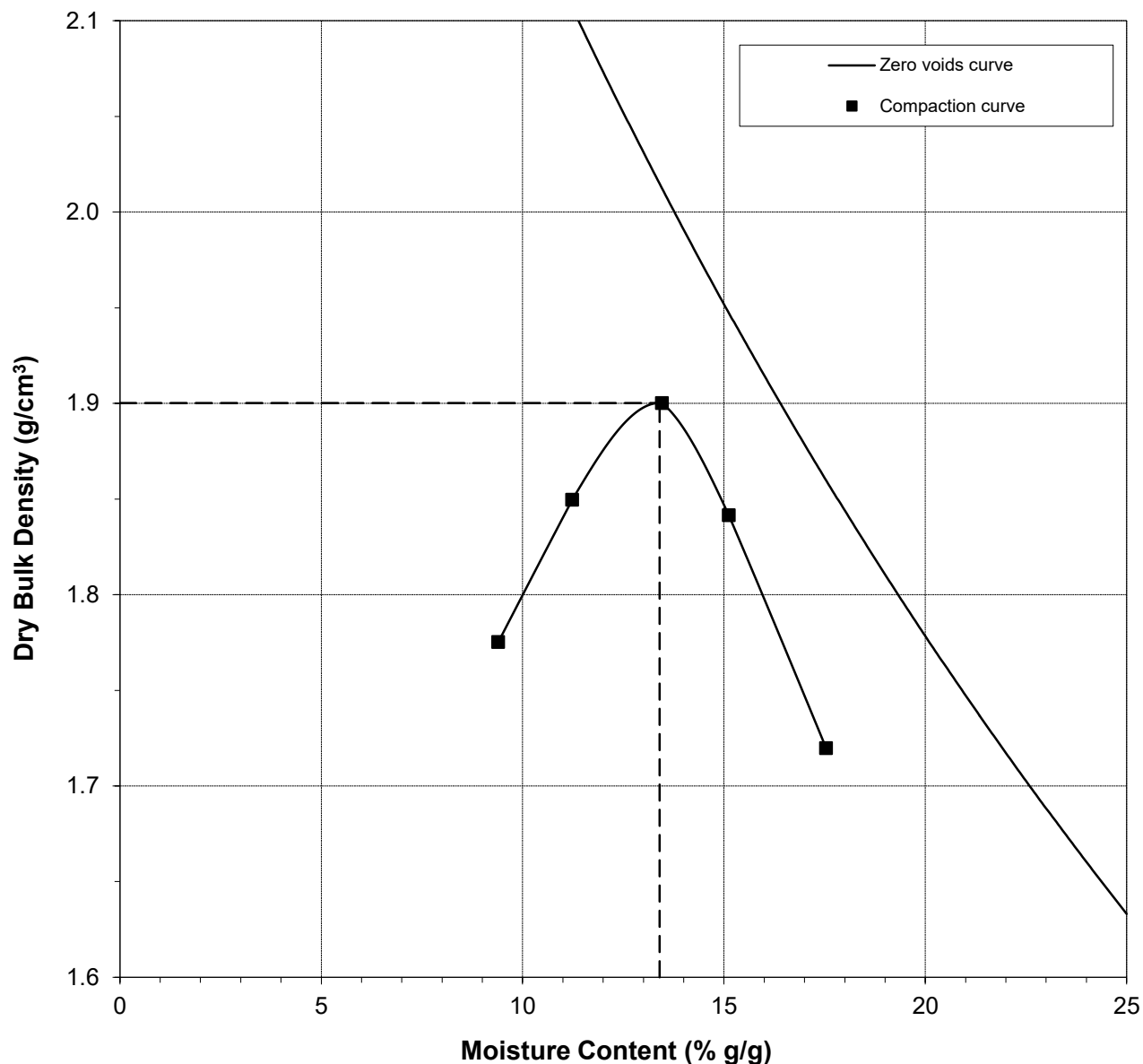


Proctor Compaction Data Points with Fitted Curve

Sample Number: 2. Mix, Borrow Face Phase 3C

	Measured	Corrected
Optimum Moisture Content (% g/g):	13.4	---
Maximum Dry Bulk Density (g/cm ³):	1.90	---

Test Date: 14-Jul-20



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: A. Bland

Checked by: J. Hines



Proctor Compaction Data

Job Name: Dwyer Engineering LLC
 Job Number: DB20.1167.00
 Sample Number: 3. Interim Cover Mix
 Project Name: Crescent Junction
 Date Sampled: NA
 Test Date: 14-Jul-20

Split (3/4", 3/8", #4): #4
 Mass of coarse material (g): 5.42
 Mass of fines material (g): 94.58
 Mold weight (g): 4194
 Mold volume (cm³): 943.92
 Compaction Method: Standard A
 Preparation Method: Dry
 Type of Rammer: Mechanical

As Received Moisture Content (% g/g): NA

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm ³)	Moisture Content (% g/g)
1	5958	904.05	849.75	210.10	1.72	8.49
2	6081	905.82	838.03	207.89	1.80	10.76
3	6206	1044.99	950.84	211.02	1.89	12.73
4	6220	1116.08	1005.58	259.42	1.87	14.81
5	6143	994.33	882.32	210.83	1.77	16.68

Soil Fractions

Coarse Fraction (% g/g): 5.4
 Fines Fraction (% g/g): 94.6

Properties of Coarse Material

Assumed particle density (g/cm³): 2.76
 Assumed Initial Moisture Content (% g/g): 0.0

Upsize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm ³)	Moisture Content of Composite (% g/g)
1	1.76	8.03
2	1.84	10.17
3	1.92	12.04
4	1.90	14.01
5	1.80	15.78

--- = Upsize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd
 Data entered by: A. Bland
 Checked by: J. Hines

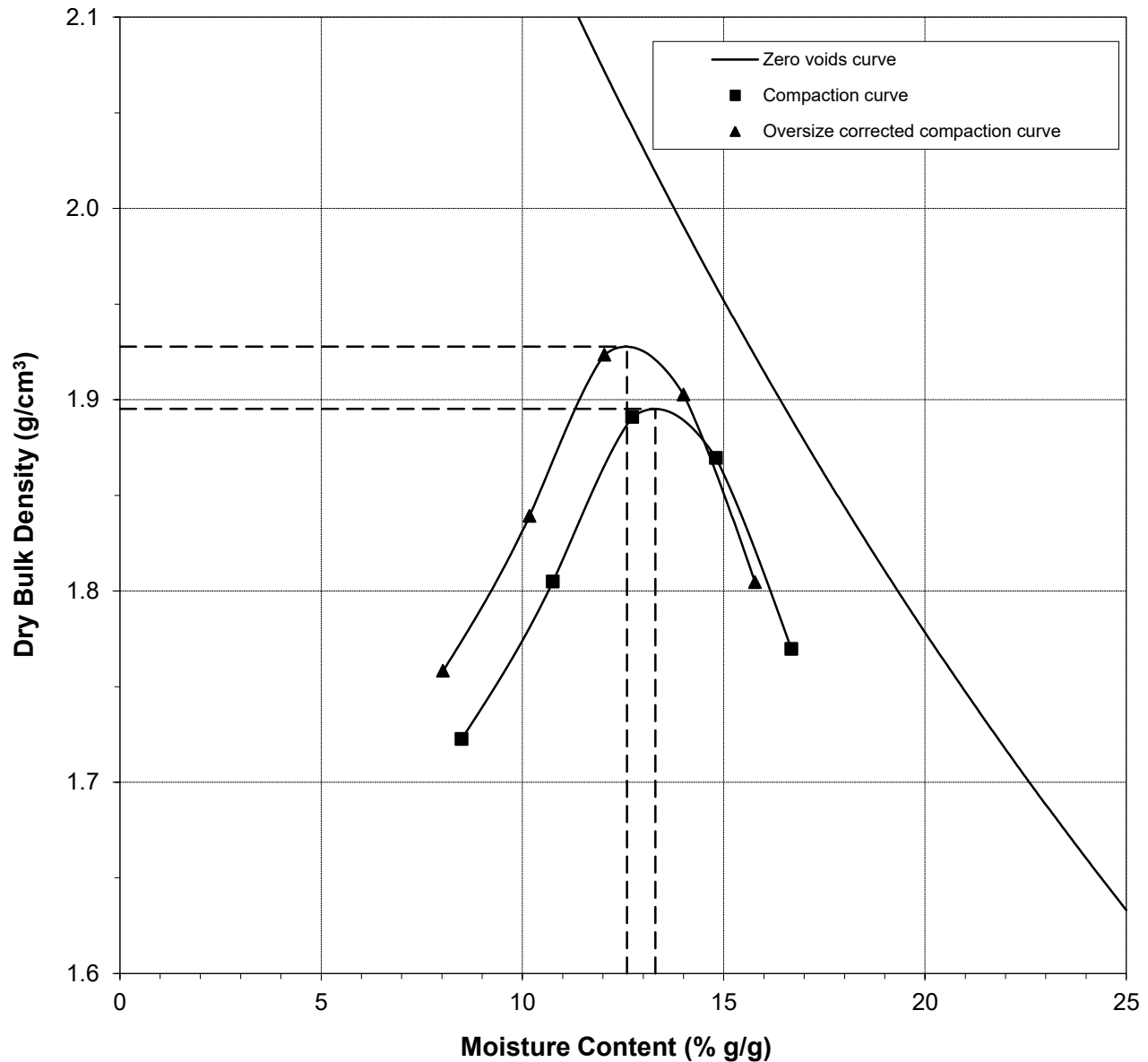


Proctor Compaction Data Points with Fitted Curve

Sample Number: 3. Interim Cover Mix

	Measured	Corrected
Optimum Moisture Content (% g/g):	13.3	12.6
Maximum Dry Bulk Density (g/cm ³):	1.90	1.93

Test Date: 14-Jul-20



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: A. Bland

Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

Proctor Compaction Data

Job Name: Dwyer Engineering LLC
 Job Number: DB20.1167.00
 Sample Number: 4. Open Test Pit, Alluvium 1'-10'
 Project Name: Crescent Junction
 Date Sampled: NA
 Test Date: 14-Jul-20

Split (3/4", 3/8", #4): #4
 Mass of coarse material (g): 0.14
 Mass of fines material (g): 99.86
 Mold weight (g): 4194
 Mold volume (cm³): 943.92
 Compaction Method: Standard A
 Preparation Method: Dry
 Type of Rammer: Mechanical

As Received Moisture Content (% g/g): NA

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm ³)	Moisture Content (% g/g)
1	5996	934.74	873.82	212.80	1.75	9.22
2	6111	913.26	841.39	212.70	1.82	11.43
3	6202	1095.47	997.62	260.83	1.88	13.28
4	6155	890.41	800.09	212.65	1.80	15.38
5	6094	1013.10	894.12	209.63	1.71	17.38

Soil Fractions

Coarse Fraction (% g/g): 0.1
 Fines Fraction (% g/g): 99.9

Properties of Coarse Material

Assumed particle density (g/cm³): 2.76
 Assumed Initial Moisture Content (% g/g): 0.0

Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm ³)	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd
 Data entered by: A. Bland
 Checked by: J. Hines

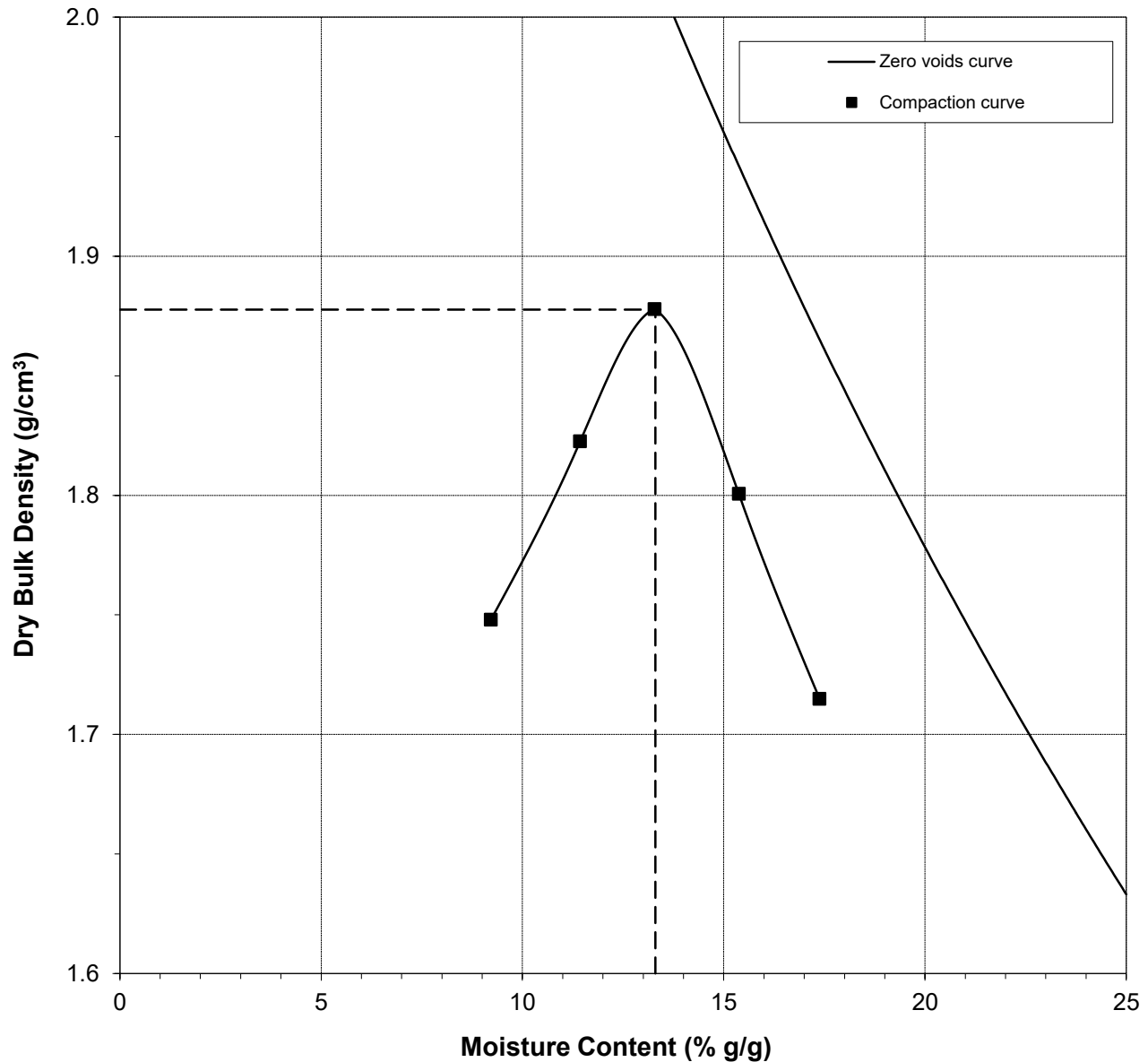


Proctor Compaction Data Points with Fitted Curve

Sample Number: 4. Open Test Pit, Alluvium 1'-10'

	Measured	Corrected
Optimum Moisture Content (% g/g):	13.3	---
Maximum Dry Bulk Density (g/cm ³):	1.88	---

Test Date: 14-Jul-20



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: A. Bland

Checked by: J. Hines



Proctor Compaction Data

Job Name: Dwyer Engineering LLC
 Job Number: DB20.1167.00
 Sample Number: 5. Radon Barrier #1
 Project Name: Crescent Junction
 Date Sampled: NA
 Test Date: 14-Jul-20

Split (3/4", 3/8", #4): #4
 Mass of coarse material (g): 0.77
 Mass of fines material (g): 99.23
 Mold weight (g): 4194
 Mold volume (cm³): 943.92
 Compaction Method: Standard A
 Preparation Method: Dry
 Type of Rammer: Mechanical

As Received Moisture Content (% g/g): NA

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm ³)	Moisture Content (% g/g)
1	5951	916.20	844.49	208.51	1.67	11.28
2	6052	922.84	839.02	208.62	1.74	13.30
3	6152	1050.01	938.18	212.07	1.80	15.40
4	6183	978.17	864.99	208.75	1.80	17.25
5	6135	968.31	855.59	269.66	1.72	19.24

Soil Fractions

Coarse Fraction (% g/g): 0.8
 Fines Fraction (% g/g): 99.2

Properties of Coarse Material

Assumed particle density (g/cm³): 2.76
 Assumed Initial Moisture Content (% g/g): 0.0

Override Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm ³)	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Override correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd
 Data entered by: A. Bland
 Checked by: J. Hines

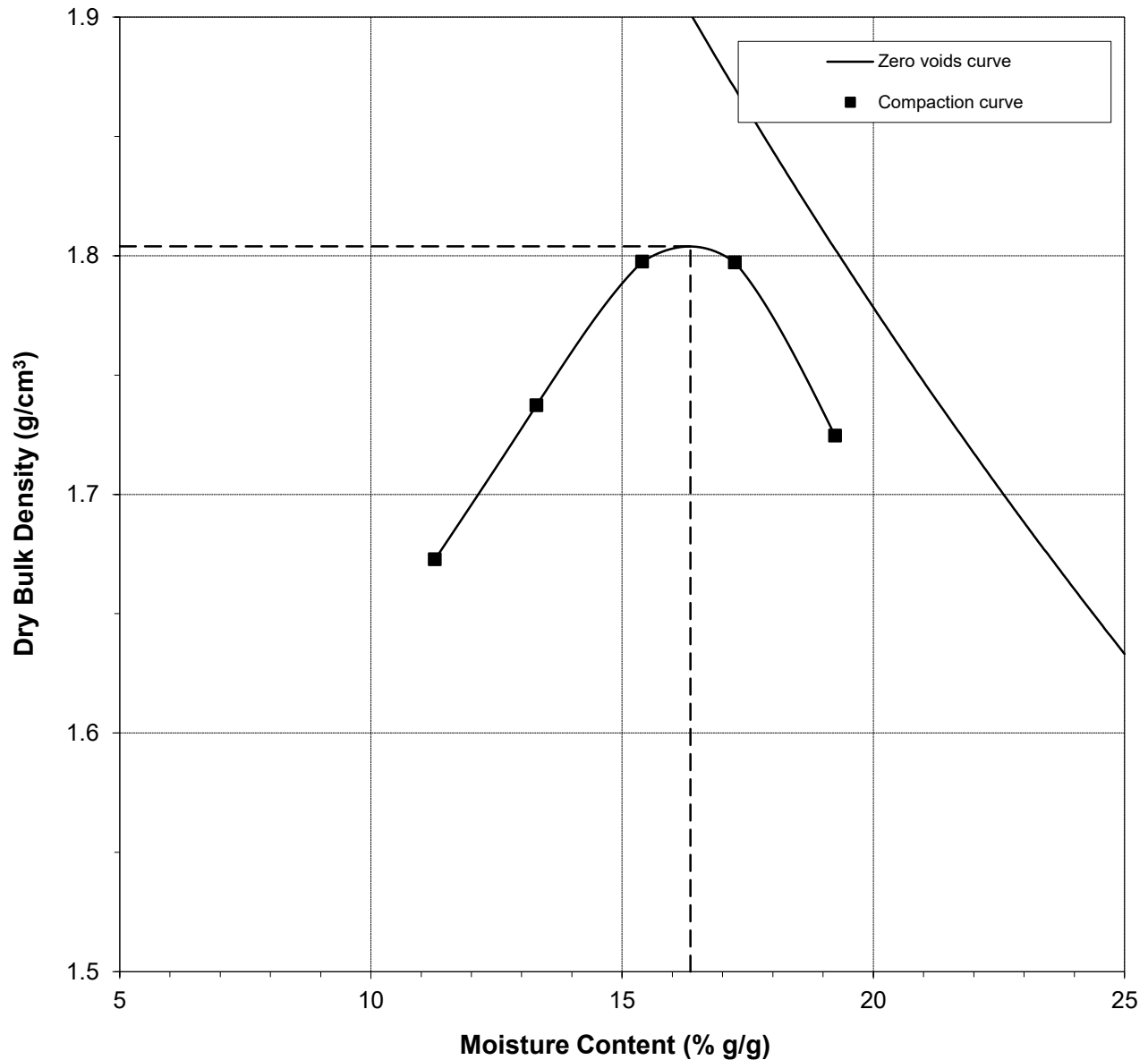


Proctor Compaction Data Points with Fitted Curve

Sample Number: 5. Radon Barrier #1

	Measured	Corrected
Optimum Moisture Content (% g/g):	16.4	---
Maximum Dry Bulk Density (g/cm ³):	1.80	---

Test Date: 14-Jul-20



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: A. Bland

Checked by: J. Hines



Proctor Compaction Data

Job Name: Dwyer Engineering LLC
 Job Number: DB20.1167.00
 Sample Number: 6. Radon Barrier #2
 Project Name: Crescent Junction
 Date Sampled: NA
 Test Date: 14-Jul-20

Split (3/4", 3/8", #4): #4
 Mass of coarse material (g): 0.70
 Mass of fines material (g): 99.30
 Mold weight (g): 4194
 Mold volume (cm³): 943.92
 Compaction Method: Standard A
 Preparation Method: Dry
 Type of Rammer: Mechanical

As Received Moisture Content (% g/g): NA

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm ³)	Moisture Content (% g/g)
1	6049	986.79	906.02	293.48	1.74	13.19
2	6133	1117.11	1005.25	269.15	1.78	15.20
3	6173	1048.78	936.07	284.36	1.79	17.29
4	6141	1043.16	917.39	270.16	1.73	19.43
5	6068	974.42	848.89	268.51	1.63	21.63

Soil Fractions

Coarse Fraction (% g/g): 0.7
 Fines Fraction (% g/g): 99.3

Properties of Coarse Material

Assumed particle density (g/cm³): 2.76
 Assumed Initial Moisture Content (% g/g): 0.0

Override Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm ³)	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Override correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: 4
 Data entered by: A. Bland
 Checked by: J. Hines



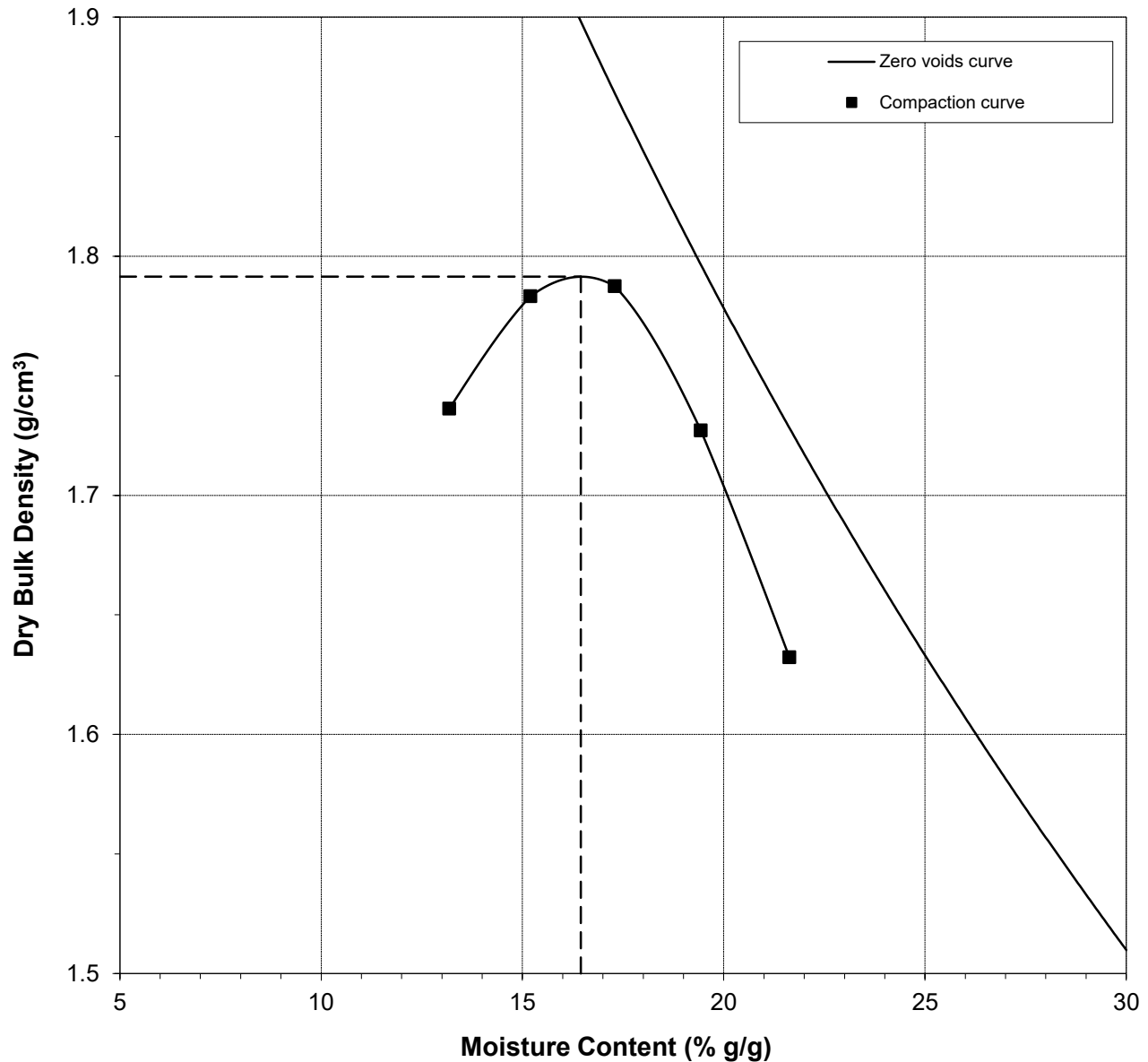
Daniel B. Stephens & Associates, Inc.

Proctor Compaction Data Points with Fitted Curve

Sample Number: 6. Radon Barrier #2

	Measured	Corrected
Optimum Moisture Content (% g/g):	16.5	---
Maximum Dry Bulk Density (g/cm ³):	1.79	---

Test Date: 14-Jul-20



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: 4
Data entered by: A. Bland
Checked by: J. Hines

Laboratory Tests and Methods



Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263, ASTM D2216
Calculated Porosity:	ASTM D7263
Saturated Hydraulic Conductivity: Falling Head Rising Tail: (Flexible Wall)	ASTM D5084
Hanging Column Method:	ASTM D6836 (modified apparatus)
Pressure Plate Method:	ASTM D6836
Water Potential (Dewpoint Potentiometer) Method:	ASTM D6836
Relative Humidity (Box) Method:	Campbell, G. and G. Gee. 1986. Water Potential: Miscellaneous Methods. Chp. 25, pp. 631-632, in A. Klute (ed.), Methods of Soil Analysis. Part 1. American Society of Agronomy, Madison, WI; Karathanasis & Hajek. 1982. Quantitative Evaluation of Water Adsorption on Soil Clays. SSA Journal 46:1321-1325
Moisture Retention Characteristics & Calculated Unsaturated Hydraulic Conductivity:	ASTM D6836; van Genuchten, M.T. 1980. A closed-form equation for predicting the hydraulic conductivity of unsaturated soils. SSSAJ 44:892-898; van Genuchten, M.T., F.J. Leij, and S.R. Yates. 1991. The RETC code for quantifying the hydraulic functions of unsaturated soils. Robert S. Kerr Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Ada, Oklahoma. EPA/600/2091/065. December 1991
Particle Size Analysis:	ASTM D7928, ASTM D6913
USCS (ASTM) Classification:	ASTM D6913, ASTM D4318, ASTM D2487
USDA Classification:	ASTM D7928, ASTM D6913, USDA Soil Textural Triangle
Atterberg Limits:	ASTM D4318
Visual-Manual Description:	ASTM D2488
Standard Proctor Compaction:	ASTM D698