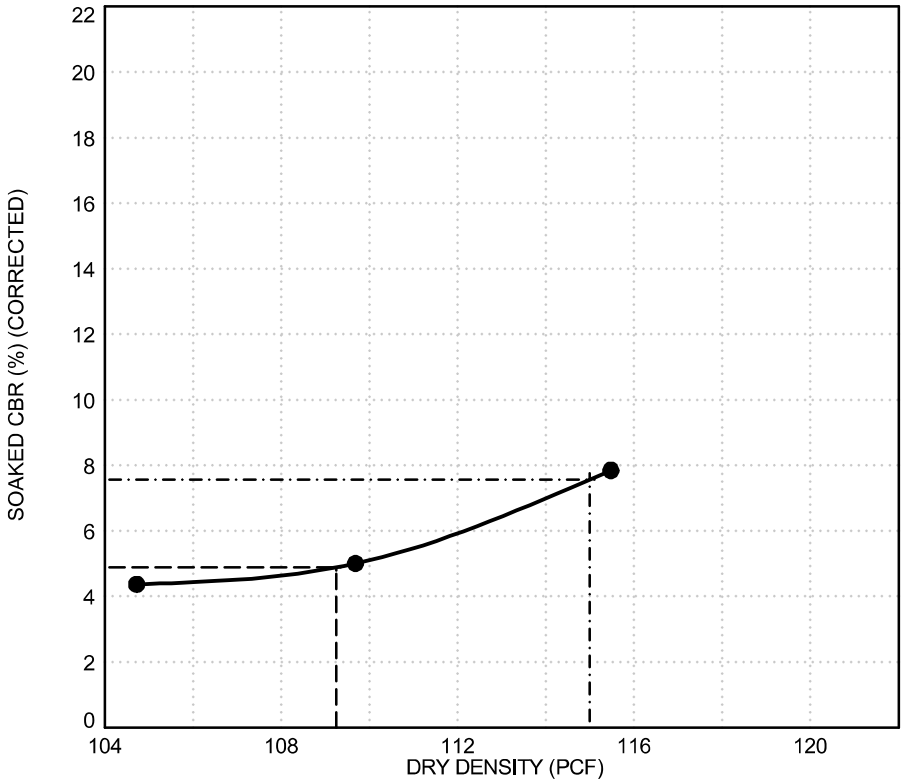
CALIFORNIA BEARING RATIO

ASTM D1883-07[2]



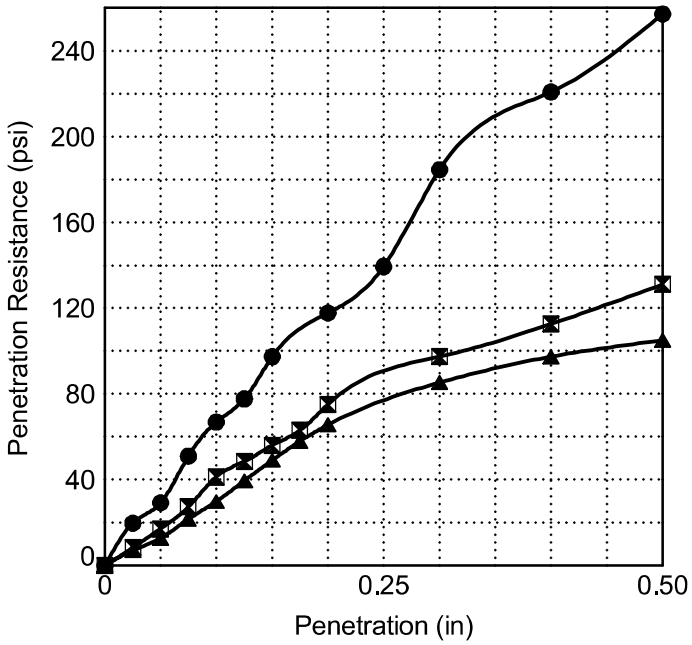
Source of Material: **B-1C 0.0**

Description of Material: **Fat Clay (CH)**

Remarks:

Percent Fines: **%**

Atterberg Limits: LL PL PI



Sample No.	1	2	3
Sample Condition	Soaked		
Compaction Method	ASTM 1557C		
Maximum Dry Density, (pcf)	115	115	115
Optimum Moisture Content, (%)	13.2	13.2	13.2
Dry Density before Soaking, (pcf)	115.48	109.69	104.72
Moisture Content, (%)			
After Compaction	13.1	13	13.3
Top 1" After Soaking	20	21.4	23.4
Surcharge,. (lbs)	10.00	10.00	10.00
Swell, (%)	2.99	3.25	2.84
Bearing Ratio, (%)	7.8	5.0	4.4

Dry Density @ 90% 103.5 pcf

Dry Density @ 95% 109.3 pcf

Dry Density @ 100% 115.0 pcf

CBR @ 90% Density

CBR @ 95% Density 4.9

CBR @ 100% Density 7.6

PROJECT: Proposed Hoffman Solar Development

SITE: Tyree Chapel Road
Franklin, KY

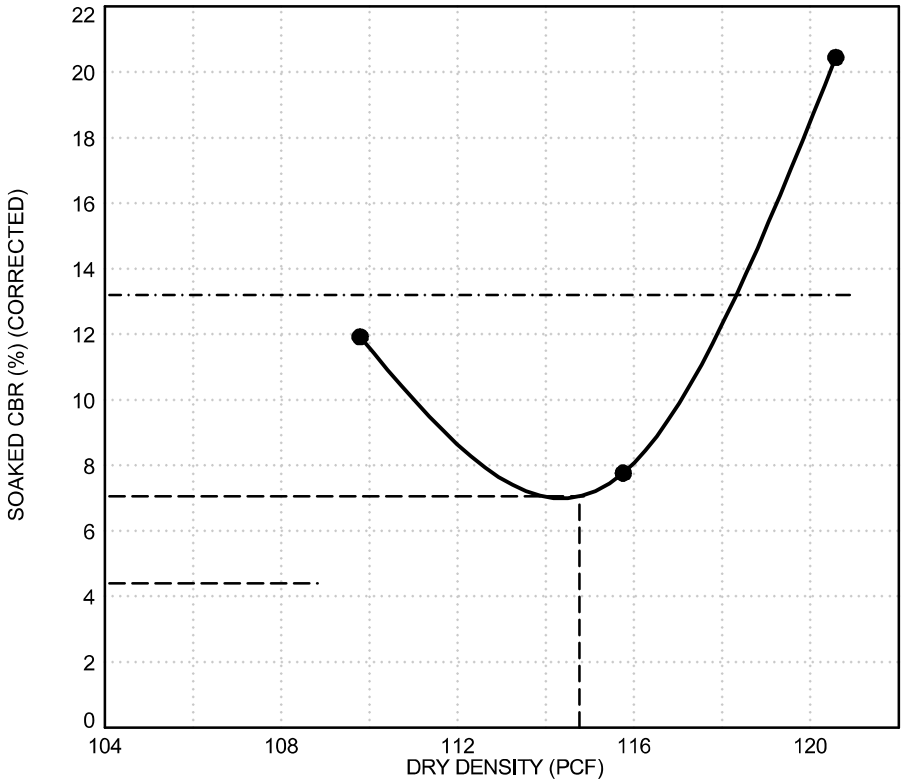
Terracon
13050 Eastgate Park Way Ste 101
Louisville, KY

PROJECT NUMBER: 57205066

CLIENT: Horus Renewables Corp
Newton, MA

CALIFORNIA BEARING RATIO

ASTM D1883-07[2]



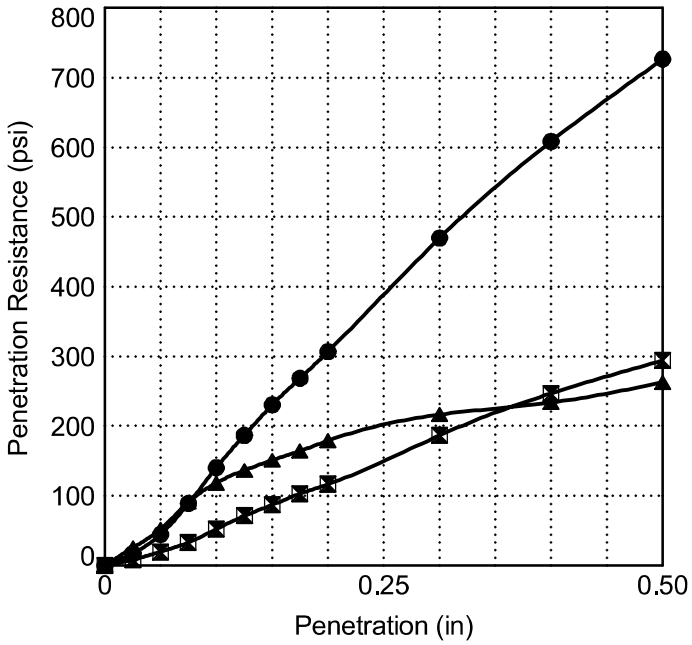
Source of Material: **B-6C 0.0**

Description of Material: **Lean Clay (CL)**

Remarks:

Percent Fines: **%**

Atterberg Limits: LL **47** PL **21** PI **26**



Sample No.	1	2	3
Sample Condition	Soaked		
Compaction Method	ASTM 1557C		
Maximum Dry Density, (pcf)	120.8	120.8	120.8
Optimum Moisture Content, (%)	11.6	11.6	11.6
Dry Density before Soaking, (pcf)	120.58	115.76	109.79
Moisture Content, (%)			
After Compaction	11.7	11.7	11.7
Top 1" After Soaking	12.6	14.5	16.3
Surcharge,. (lbs)	10.00	10.00	10.00
Swell, (%)	0.52	0.44	0.52
Bearing Ratio, (%)	20.4	7.8	11.9

Dry Density @ 90% 108.7 pcf

Dry Density @ 95% 114.8 pcf

Dry Density @ 100% 120.8 pcf

CBR @ 90% Density

CBR @ 95% Density 7.1

CBR @ 100% Density

PROJECT: Proposed Hoffman Solar Development

SITE: Tyree Chapel Road
Franklin, KY

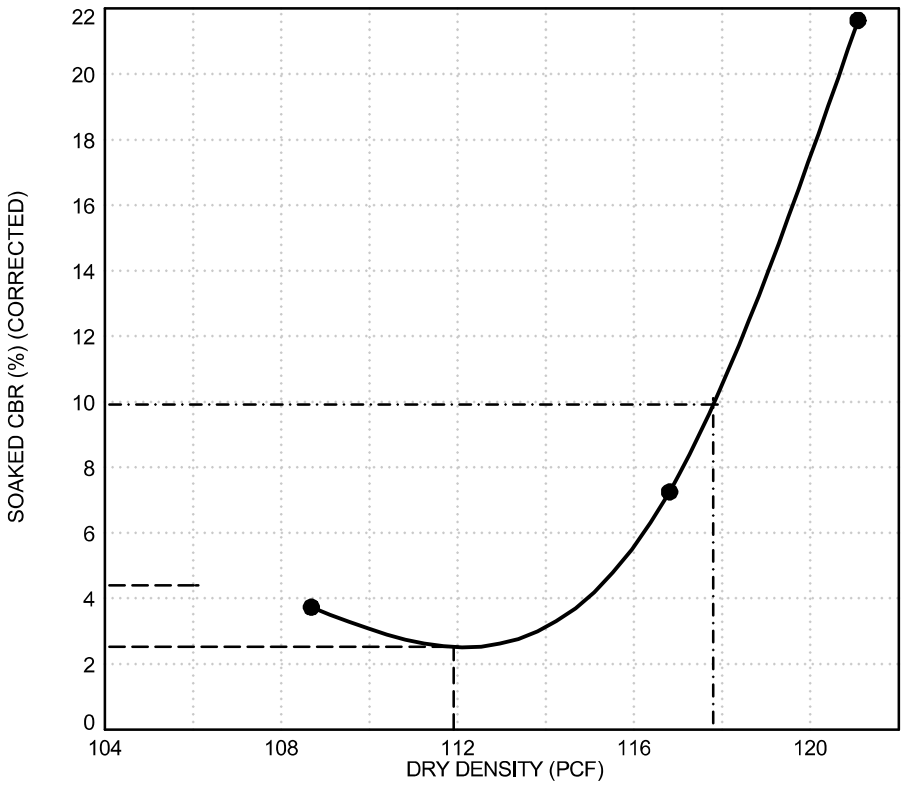
Terracon
13050 Eastgate Park Way Ste 101
Louisville, KY

PROJECT NUMBER: 57205066

CLIENT: Horus Renewables Corp
Newton, MA

CALIFORNIA BEARING RATIO

ASTM D1883-07[2]



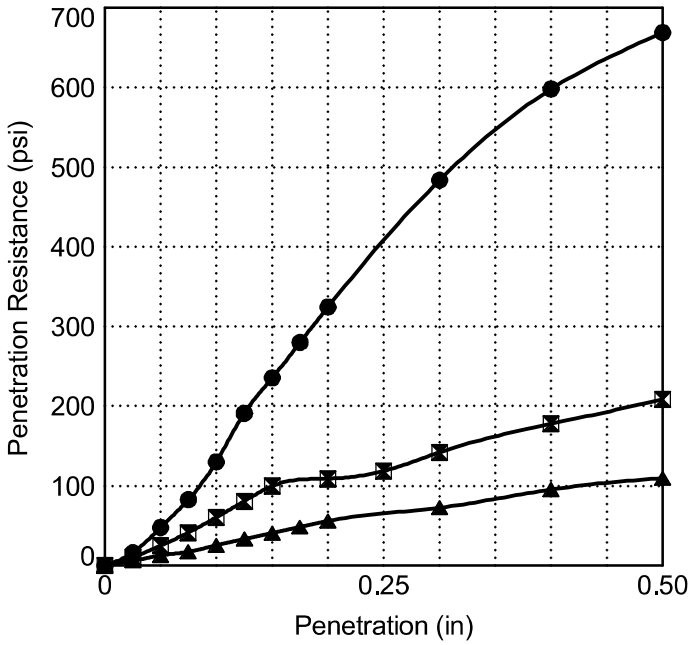
Source of Material: **B-12C 0.0**

Description of Material: **Lean Clay (CL)**

Remarks:

Percent Fines: **%**

Atterberg Limits: LL **48** PL **20** PI **28**



Sample No.	1	2	3
Sample Condition	Soaked		
Compaction Method	ASTM 1557C		
Maximum Dry Density, (pcf)	117.8	117.8	117.8
Optimum Moisture Content, (%)	13.4	13.4	13.4
Dry Density before Soaking, (pcf)	121.08	116.81	108.68
Moisture Content, (%)			
After Compaction	10.1	8.4	10.4
Top 1" After Soaking	16.3	19.6	21.5
Surcharge,. (lbs)	10.00	10.00	10.00
Swell, (%)	0.59	1.77	0.31
Bearing Ratio, (%)	21.6	7.3	3.7

Dry Density @ 90% 106.0 pcf

Dry Density @ 95% 111.9 pcf

Dry Density @ 100% 117.8 pcf

CBR @ 90% Density

CBR @ 95% Density 2.5

CBR @ 100% Density 9.9

PROJECT: Proposed Hoffman Solar Development

SITE: Tyree Chapel Road
Franklin, KY

Terracon
13050 Eastgate Park Way Ste 101
Louisville, KY

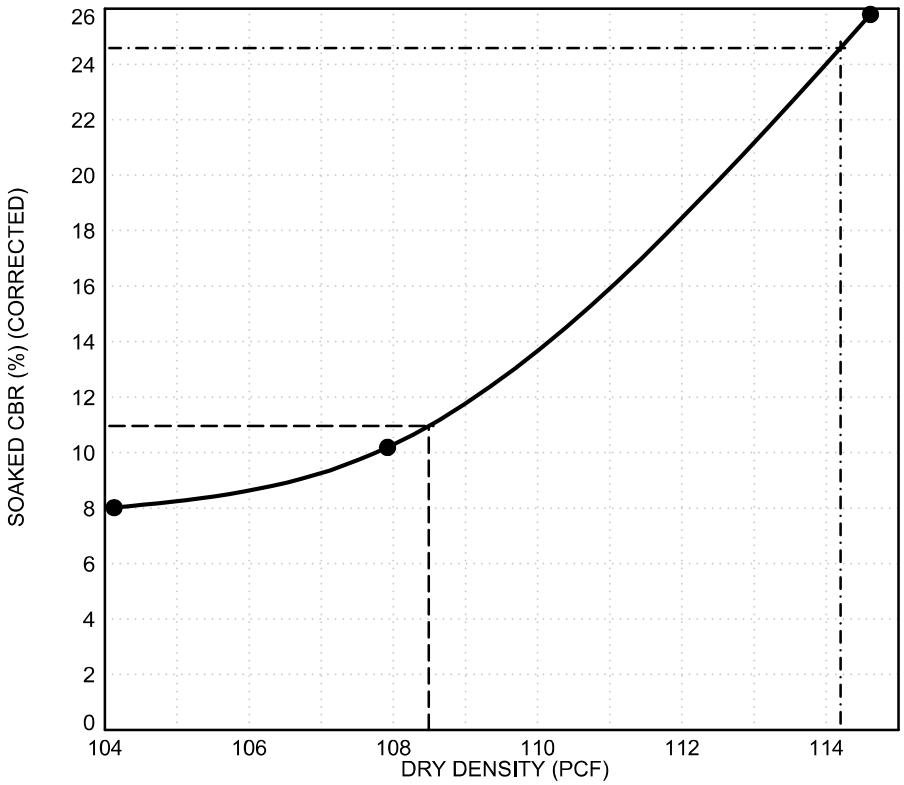
PROJECT NUMBER: 57205066

CLIENT: Horus Renewables Corp
Newton, MA

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CBR 3PT REPORT 57205066 PROPOSED HOFFMAN .GPJ TERRACON_DATATEMPLATE.GDT 3/2/21

CALIFORNIA BEARING RATIO

ASTM D1883-07[2]



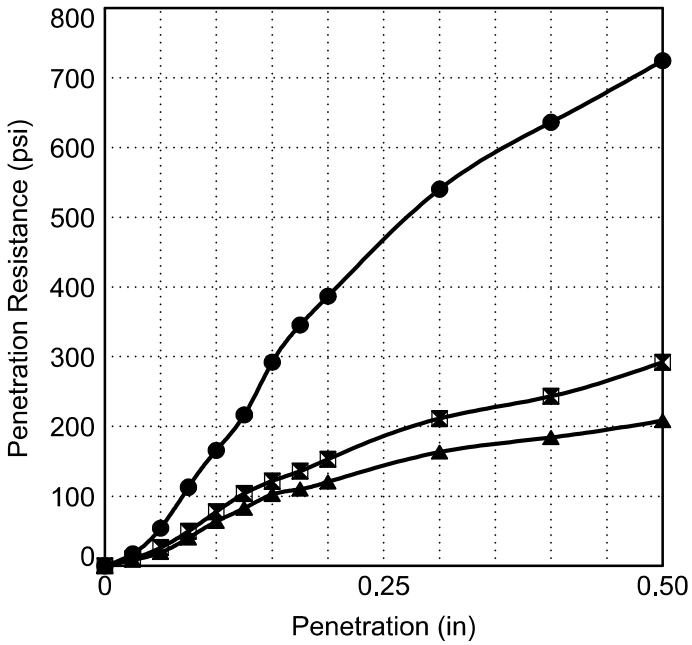
Source of Material: **B-14C 0.0**

Description of Material: **Lean Clay (CL)**

Remarks:

Percent Fines: %

Atterberg Limits: LL PL PI



Sample No.	1	2	3
Sample Condition	Soaked		
Compaction Method	ASTM 1557C		
Maximum Dry Density, (pcf)	114.2	114.2	114.2
Optimum Moisture Content, (%)	12.9	12.9	12.9
Dry Density before Soaking, (pcf)	114.61	107.92	104.13
Moisture Content, (%)			
After Compaction	13	13	12.9
Top 1" After Soaking	15.1	18.4	19.5
Surcharge,. (lbs)	10.00	10.00	10.00
Swell, (%)	0.96	1.53	1.66
Bearing Ratio, (%)	25.8	10.2	8.0

Dry Density @ 90% 102.8 pcf

Dry Density @ 95% 108.5 pcf

Dry Density @ 100% 114.2 pcf

CBR @ 90% Density

CBR @ 95% Density 11.0

CBR @ 100% Density 24.6

PROJECT: Proposed Hoffman Solar Development

SITE: Tyree Chapel Road
Franklin, KY

Terracon
13050 Eastgate Park Way Ste 101
Louisville, KY

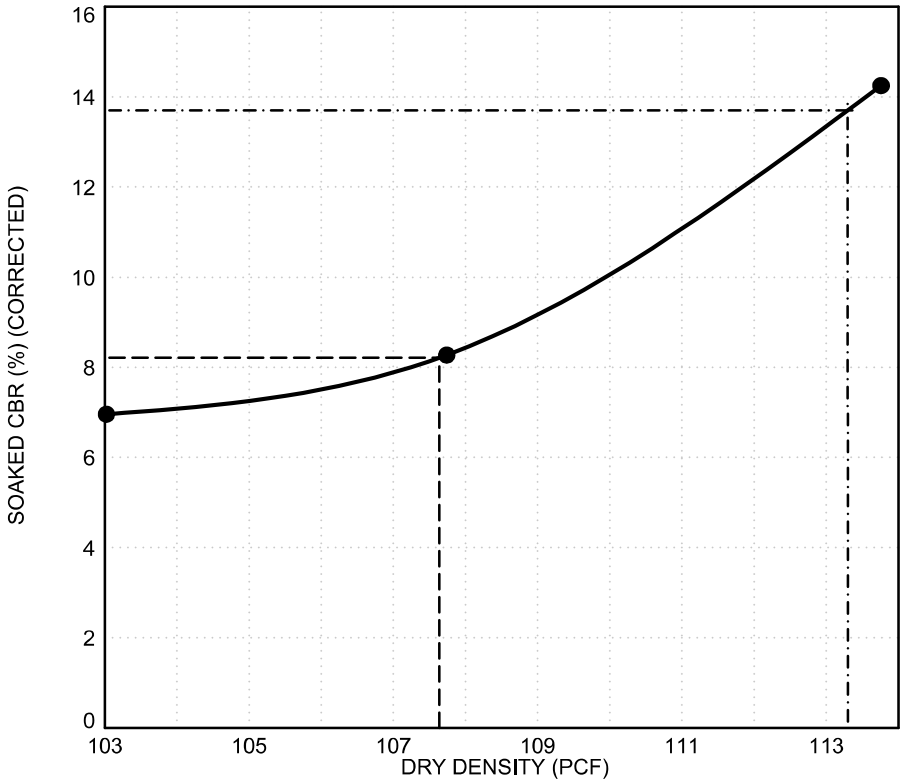
PROJECT NUMBER: 57205066

CLIENT: Horus Renewables Corp
Newton, MA

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CBR 3PT REPORT 57205066 PROPOSED HOFFMAN .GPJ 02195238 US 50 AND CHIPMAN.GPJ 2/4/21

CALIFORNIA BEARING RATIO

ASTM D1883-07[2]



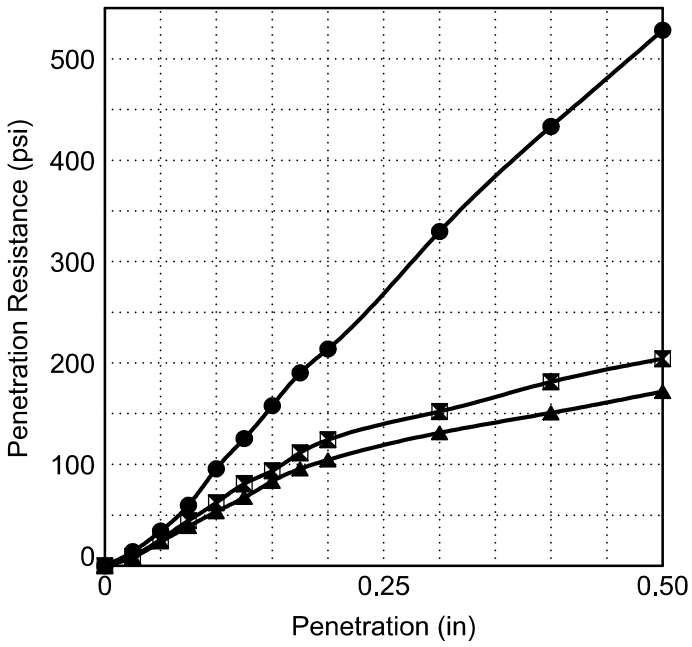
Source of Material: **B-17C 0.0**

Description of Material: **Fat Clay (CH)**

Remarks:

Percent Fines: **%**

Atterberg Limits: LL PL PI



Sample No.	1	2	3
Sample Condition	Soaked		
Compaction Method	ASTM 1557C		
Maximum Dry Density, (pcf)	113.3	113.3	113.3
Optimum Moisture Content, (%)	12.7	12.7	12.7
Dry Density before Soaking, (pcf)	113.76	107.74	103.02
Moisture Content, (%)			
After Compaction	12.7	12.7	12.6
Top 1" After Soaking	14.7	19.4	21.5
Surcharge,. (lbs)	10.00	10.00	10.00
Swell, (%)	0.31	2.88	2.33
Bearing Ratio, (%)	14.3	8.3	7.0

Dry Density @ 90% 102.0 pcf

Dry Density @ 95% 107.6 pcf

Dry Density @ 100% 113.3 pcf

CBR @ 90% Density

CBR @ 95% Density 8.2

CBR @ 100% Density 13.7

PROJECT: Proposed Hoffman Solar Development

SITE: Tyree Chapel Road
Franklin, KY

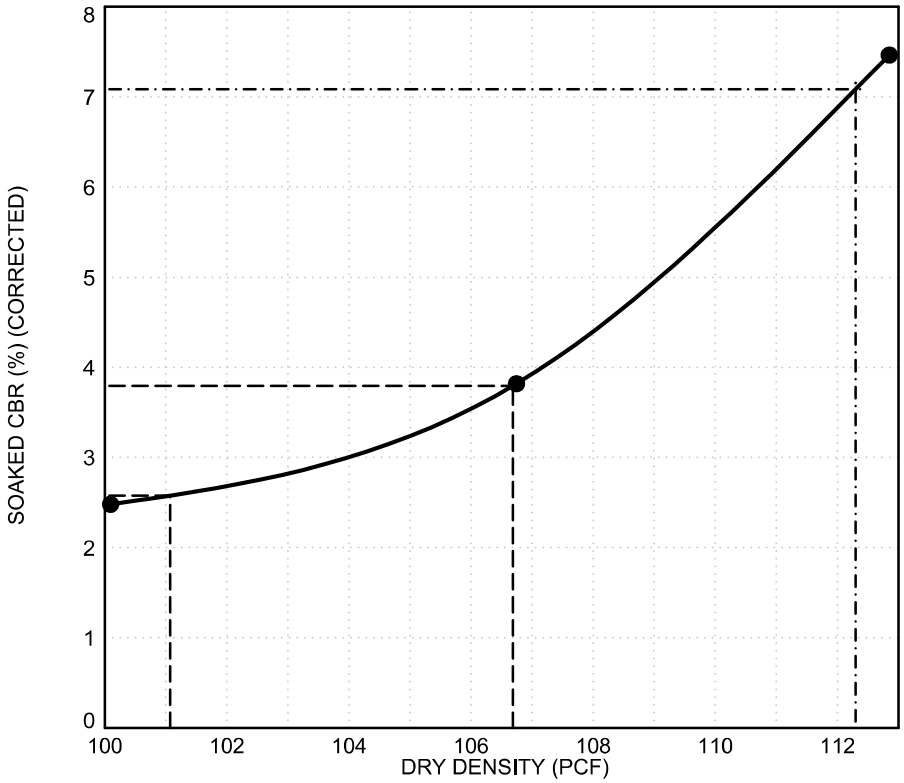
Terracon
13050 Eastgate Park Way Ste 101
Louisville, KY

PROJECT NUMBER: 57205066

CLIENT: Horus Renewables Corp
Newton, MA

CALIFORNIA BEARING RATIO

ASTM D1883-07[2]



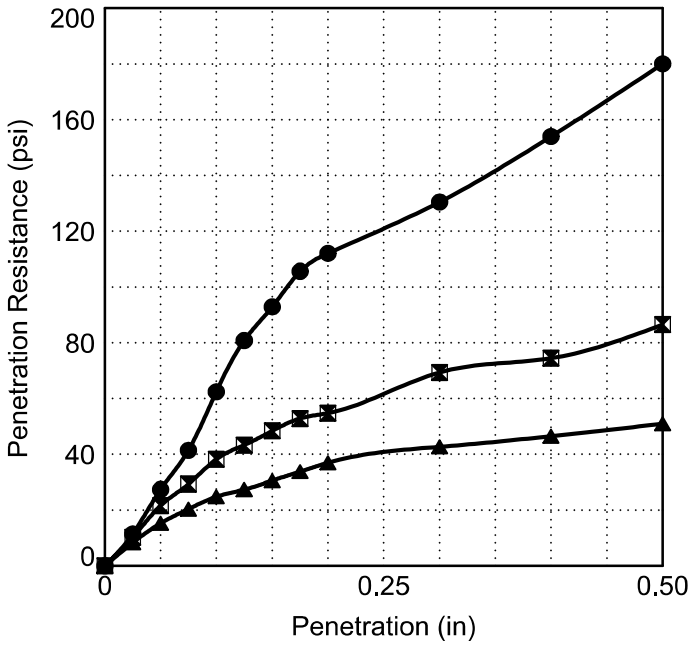
Source of Material: **B-21C 0.0**

Description of Material: **Fat Clay (CH)**

Remarks:

Percent Fines: **%**

Atterberg Limits: LL **76** PL **25** PI **51**



Sample No.	1	2	3
Sample Condition	Soaked		
Compaction Method	ASTM 1557C		
Maximum Dry Density, (pcf)	112.3	112.3	112.3
Optimum Moisture Content, (%)	14.8	14.8	14.8
Dry Density before Soaking, (pcf)	112.85	106.75	100.09
Moisture Content, (%)			
After Compaction	14.7	14.7	14.8
Top 1" After Soaking	18.6	22.7	24.4
Surcharge,. (lbs)	10.00	10.00	10.00
Swell, (%)	3.03	3.86	1.42
Bearing Ratio, (%)	6.2	3.8	2.5

Dry Density @ 90% 101.1 pcf

Dry Density @ 95% 106.7 pcf

Dry Density @ 100% 112.3 pcf

CBR @ 90% Density 2.6

CBR @ 95% Density 3.8

CBR @ 100% Density 7.1

PROJECT: Proposed Hoffman Solar Development

SITE: Tyree Chapel Road
Franklin, KY

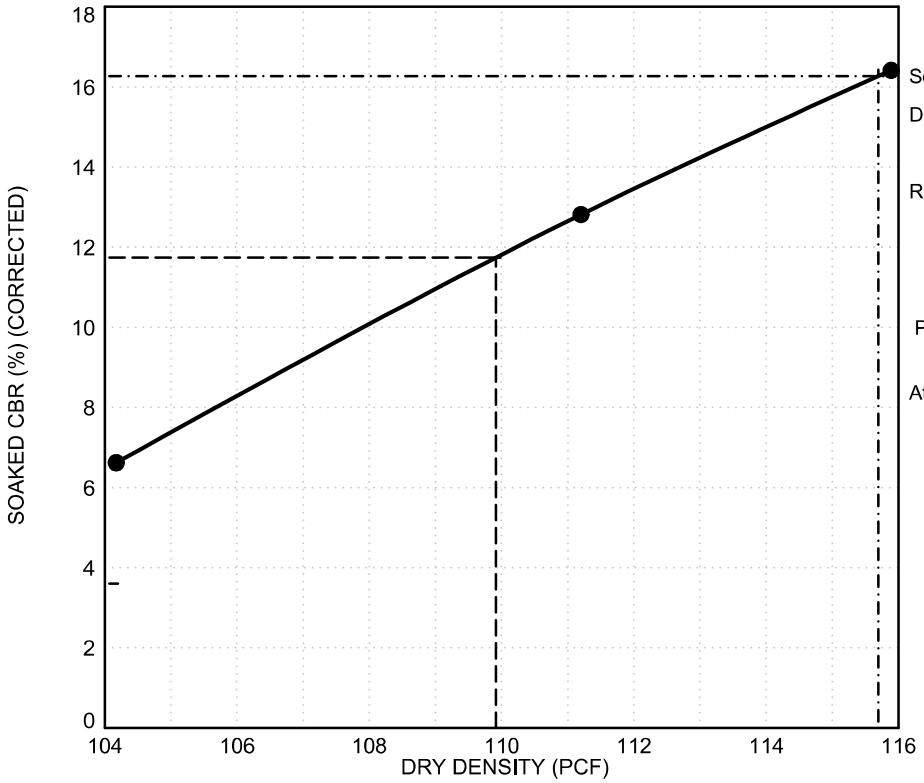
Terracon
13050 Eastgate Park Way Ste 101
Louisville, KY

PROJECT NUMBER: 57205066

CLIENT: Horus Renewables Corp
Newton, MA

CALIFORNIA BEARING RATIO

ASTM D1883-07[2]



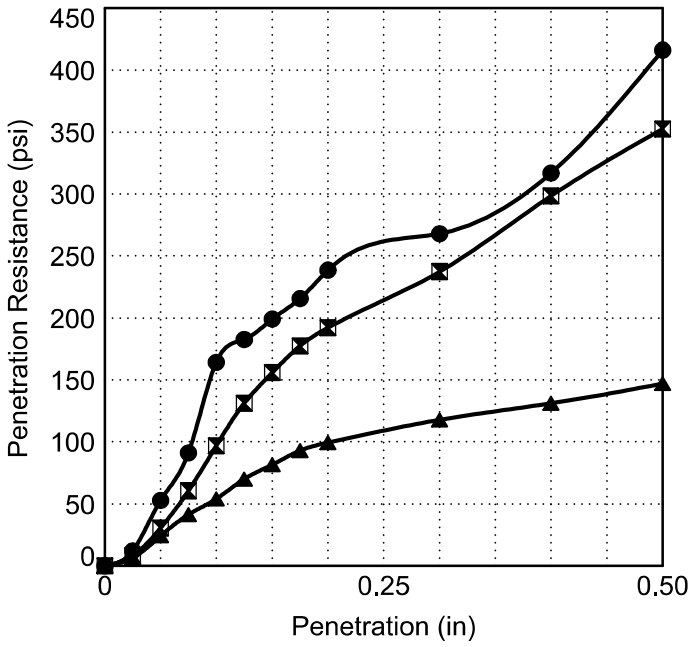
Source of Material: **B-22C 0.0**

Description of Material: **Lean Clay (CL)**

Remarks:

Percent Fines: **%**

Atterberg Limits: LL **40** PL **21** PI **19**



Sample No.	1	2	3
Sample Condition	Soaked		
Compaction Method	ASTM 1557C		
Maximum Dry Density, (pcf)	115.7	115.7	115.7
Optimum Moisture Content, (%)	13.9	13.9	13.9
Dry Density before Soaking, (pcf)	115.89	111.20	104.17
Moisture Content, (%)			
After Compaction	13.9	13.9	13.9
Top 1" After Soaking	15.6	16.5	19.4
Surcharge,. (lbs)	10.00	10.00	10.00
Swell, (%)	0.55	0.79	0.94
Bearing Ratio, (%)	15.9	12.8	6.6

Dry Density @ 90% 104.1 pcf

Dry Density @ 95% 109.9 pcf

Dry Density @ 100% 115.7 pcf

CBR @ 90% Density

CBR @ 95% Density 11.7

CBR @ 100% Density 16.3

PROJECT: Proposed Hoffman Solar Development

SITE: Tyree Chapel Road
Franklin, KY

Terracon
13050 Eastgate Park Way Ste 101
Louisville, KY

PROJECT NUMBER: 57205066

CLIENT: Horus Renewables Corp
Newton, MA

CHEMICAL LABORATORY TEST REPORT

Project Number: 57205066
Service Date: 01/14/21
Report Date: 01/18/21

Terracon
10400, State Highway 191
Midland, Texas (79707)
(432)-684-9600

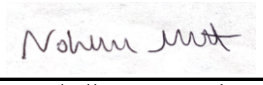
Client

Horus Renewables Corp
168 Mt. Vernon St.
Newton, MA 02465

Project

Proposed Hoffman Solar Development
Tyree Chapel Road
Franklin, KY

Sample Location	B-1	B-6	B-10	B-12	B-13	B-14
Sample Depth (ft.)	2-3	2-3	2-3	2-3	2-3	2-3
pH Analysis, ASTM - G51-18	6.10	5.80	5.70	4.30	4.10	5.10
Water Soluble Sulfate (SO4), ASTM C 1580 (mg/kg)	116	115	80	123	87	97
Sulfides, ASTM - D4658-15, (mg/kg)	nil	nil	nil	nil	nil	nil
Chlorides, ASTM D 512 , (mg/kg)	18	13	18	16	10	11
RedOx, ASTM D-1498, (mV)	+373	+387	+420	+425	+428	+428
Total Salts, ASTM D1125-14, (mg/kg)	278	211	156	157	177	261
Resistivity, ASTM G187, (ohm-cm)	6092	8776	9912	9912	9809	5524

Analyzed By: 

Nohelia Monasterios
Field Engineer

CHEMICAL LABORATORY TEST REPORT

Project Number: 57205066
Service Date: 01/14/21
Report Date: 01/18/21

Terracon
10400, State Highway 191
Midland, Texas (79707)
(432)-684-9600

Client

Horus Renewables Corp
168 Mt. Vernon St.
Newton, MA 02465

Project

Proposed Hoffman Solar Development
Tyree Chapel Road
Franklin, KY

Sample Location	B-16	B-17	B-20	B-21	B-22
Sample Depth (ft.)	2-3	2-3	2-3	2-3	2-3
pH Analysis, ASTM - G51-18	5.30	5.30	4.80	4.70	4.70
Water Soluble Sulfate (SO4), ASTM C 1580 (mg/kg)	150	75	54	47	66
Sulfides, ASTM - D4658-15, (mg/kg)	nil	nil	nil	nil	nil
Chlorides, ASTM D 512 , (mg/kg)	8	8	11	14	23
RedOx, ASTM D-1498, (mV)	+434	+415	+437	+440	+448
Total Salts, ASTM D1125-14, (mg/kg)	231	206	125	140	162
Resistivity, ASTM G187, (ohm-cm)	5730	8673	12390	10377	10325

Analyzed By: Nohelia Monasterios
Field Engineer

LOSS ON IGNITION TEST REPORT

Project Number: 57205066
Service Date: 01/15/21
Report Date: 01/18/21

Terracon
10400, State Highway 191
Midland, Texas (79707)
(432)-684-9600

Client

Horus Renewables Corp
168 Mt. Vernon St.
Newton, MA 02465

Project

Proposed Hoffman Solar Development
Tyree Chapel Road
Franklin, KY

Sample Location	*Sample Depth*	*Loss on Ignition (LOI) of Solid Combustion Residue, ASTM D7348, (% Burnt/Combustible)*
B-1	*2-3*	*4.5*
B-6	*2-3*	*3.8*
B-10	*2-3*	*2.5*
B-12	*2-3*	*4.1*
B-13	*2-3*	*3.9*
B-14	*2-3*	*2.9*
B-16	*2-3*	*3.6*
B-17	*2-3*	*3.4*
B-20	*2-3*	*3.4*
B-21	*2-3*	*5*
B-22	*2-3*	*2.8*

Analyzed By: Nohelia Monasterios
Field Engineer

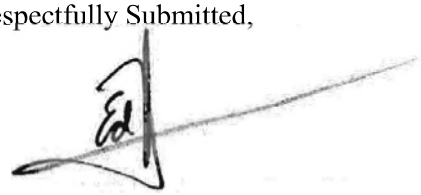
Thermal Resistivity Testing for Hoffman Solar

January 25, 2021

Prepared for:
Sadra Javadi
Terracon
13050 Eastgate Park Way, Suite 101
Louisville, KY 40223
sadra.javadi@terracon.com

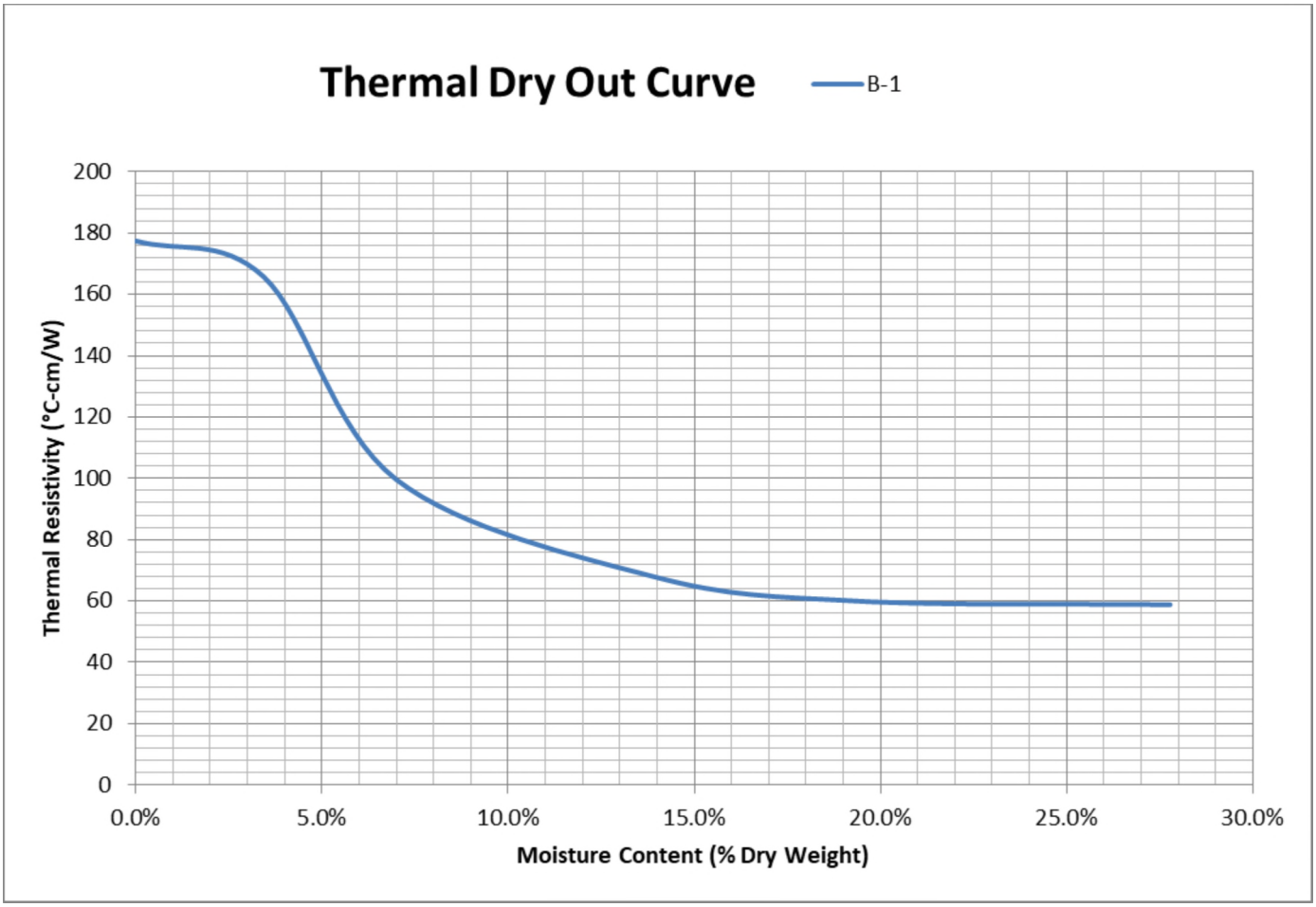
Project X Job#: S210119D
Client Job or PO#: 57205066

Respectfully Submitted,



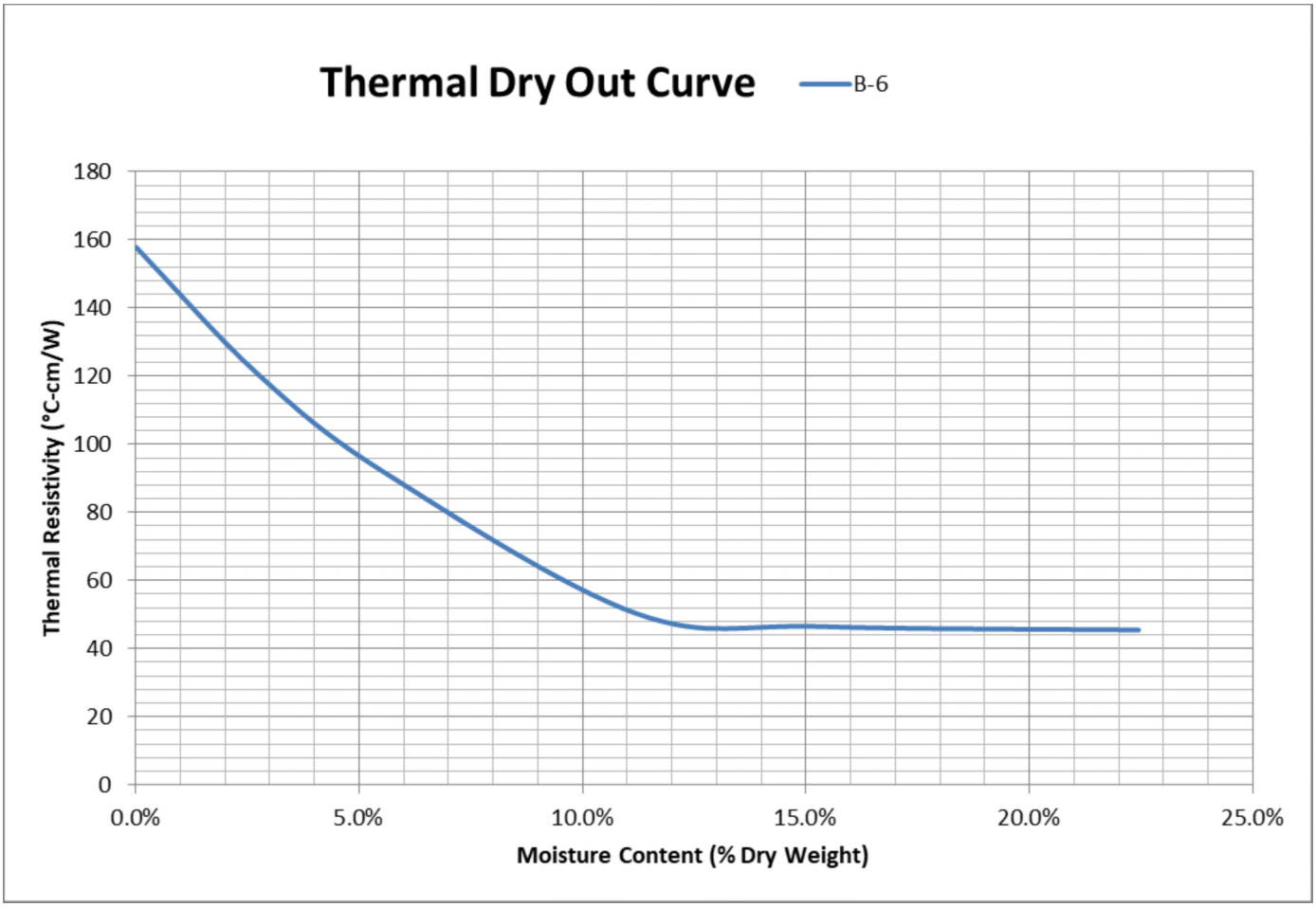
Eduardo Hernandez, M.Sc., P.E.
Sr. Corrosion Consultant
NACE Corrosion Technologist #16592
Professional Engineer
California No. M37102
ehernandez@projectxcorrosion.com

Client:	Terracon
Job Name:	Hoffman-Solar
Client Job #:	57205066
Project X Job #:	S210119D
Method:	IEEE Std 442-81
Date:	1/25/2021



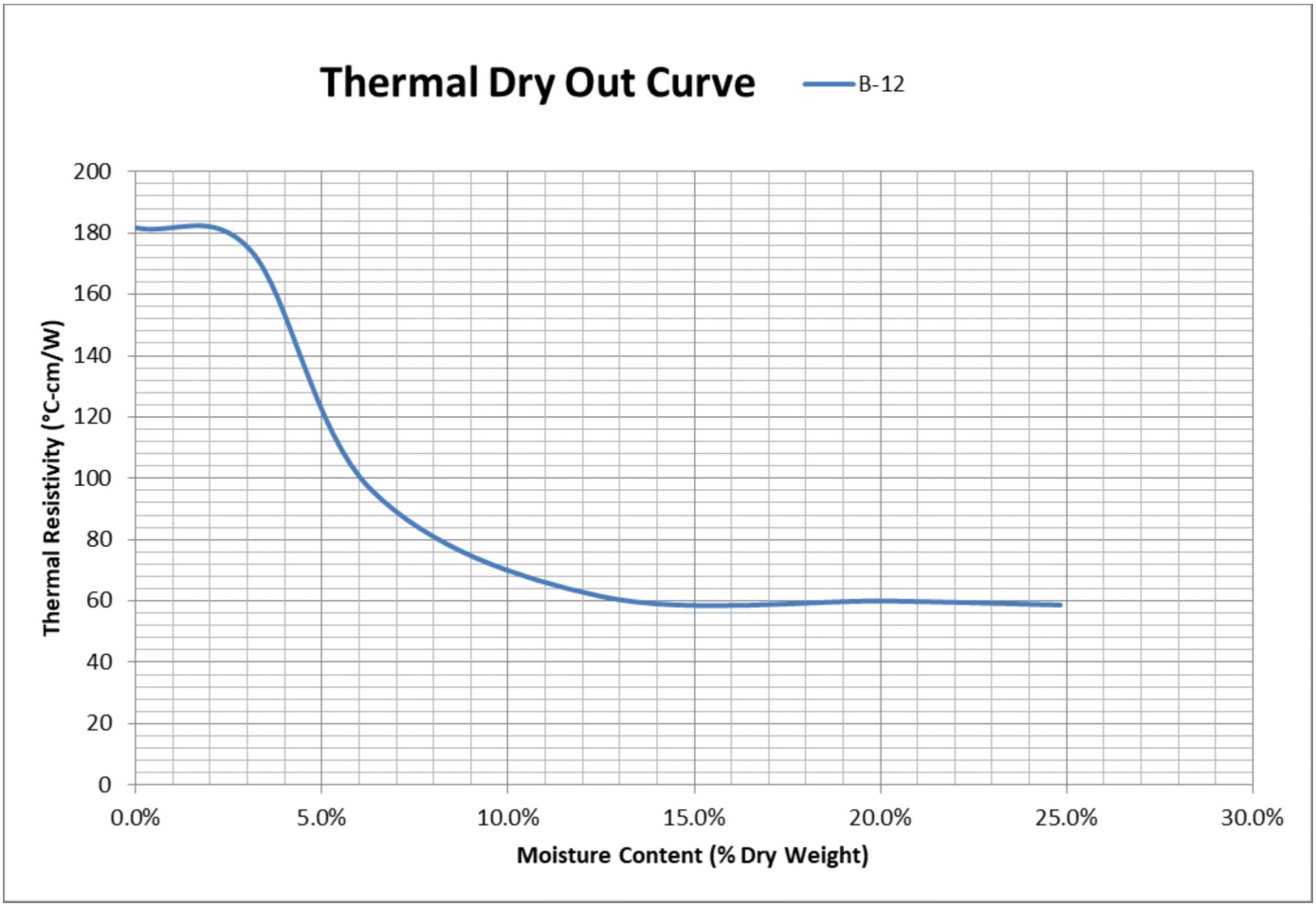
				Remolded Tube Sample		
(S210119D) Sample Location	Sample Depth (ft)	Thermal Resistivity (°C-cm/W)		Optimal Moisture Content	Proctor Dry Density	Requested Compaction
		Wet	Dry	(%)	(PCF)	(%)
B-1	1-4	59	177	17.6%	101.50	90%

Client:	Terracon
Job Name:	Hoffman-Solar
Client Job #:	57205066
Project X Job #:	S210119D
Method:	IEEE Std 442-81
Date:	1/25/2021



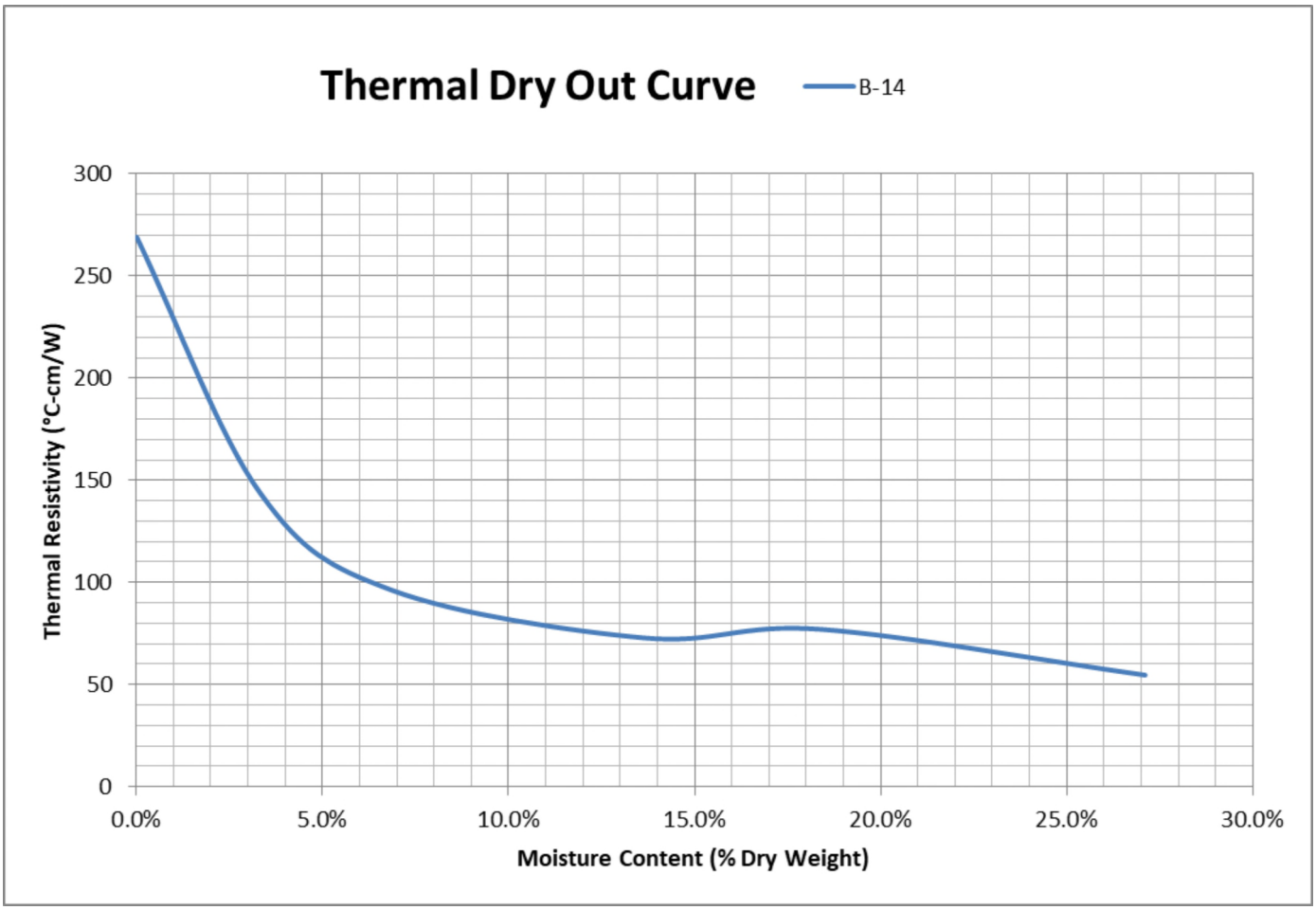
				Remolded Tube Sample		
(S210119D) Sample Location	Sample Depth (ft)	Thermal Resistivity (°C-cm/W)		Optimal Moisture Content	Proctor Dry Density	Requested Compaction
		Wet	Dry	(%)	(PCF)	(%)
B-6	1-4	46	158	14.0%	110.40	90%

Client:	Terracon
Job Name:	Hoffman-Solar
Client Job #:	57205066
Project X Job #:	S210119D
Method:	IEEE Std 442-81
Date:	1/25/2021



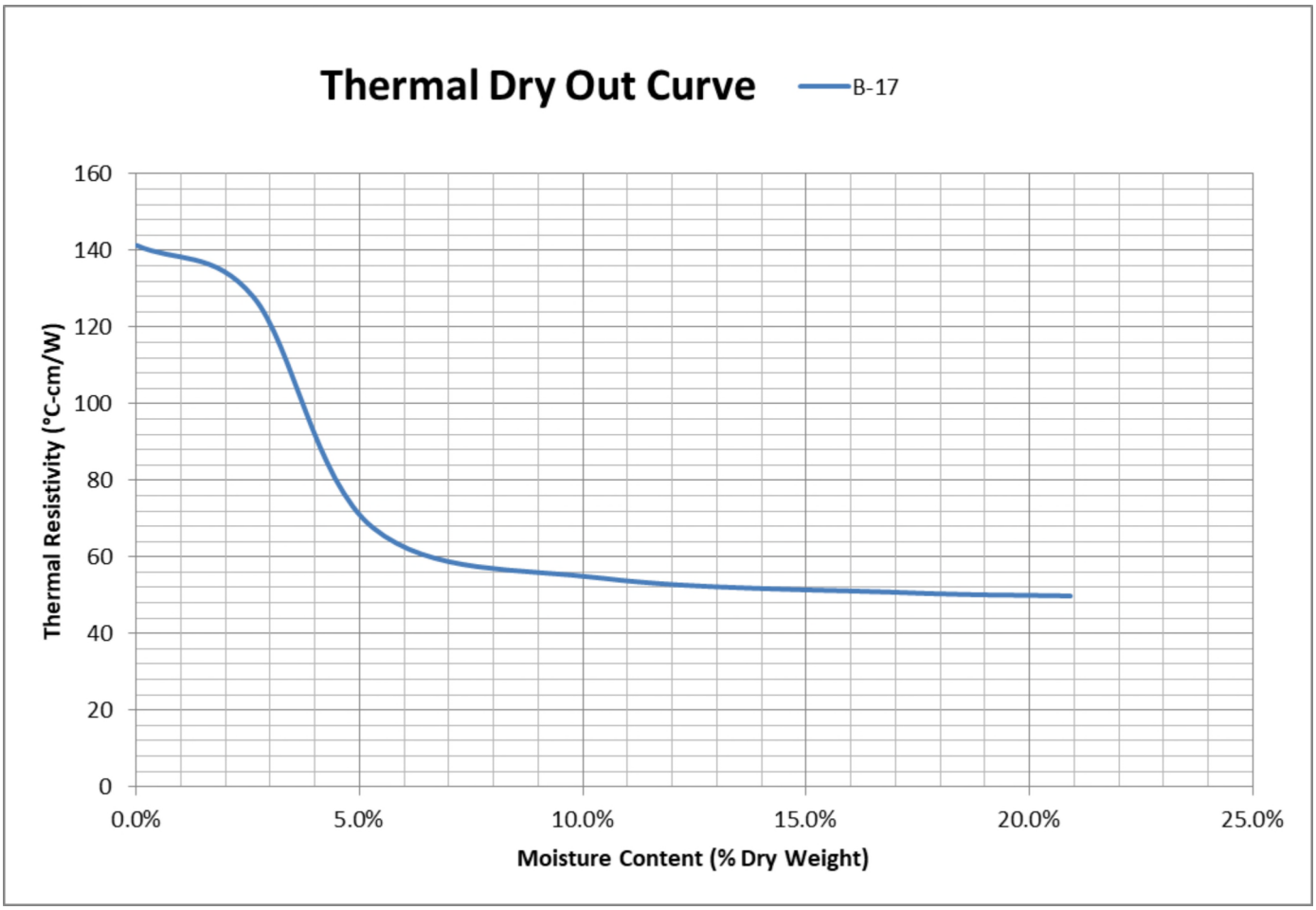
				Remolded Tube Sample		
(S210119D) Sample Location	Sample Depth (ft)	Thermal Resistivity (°C-cm/W)		Optimal Moisture Content	Proctor Dry Density	Requested Compaction
		Wet	Dry	(%)	(PCF)	(%)
B-12	1-4	59	182	18.4%	103.10	90%

Client:	Terracon
Job Name:	Hoffman-Solar
Client Job Number:	57205066
Project X Job Number:	S210119D
Method:	IEEE Std 442-81
Date:	1/25/2021



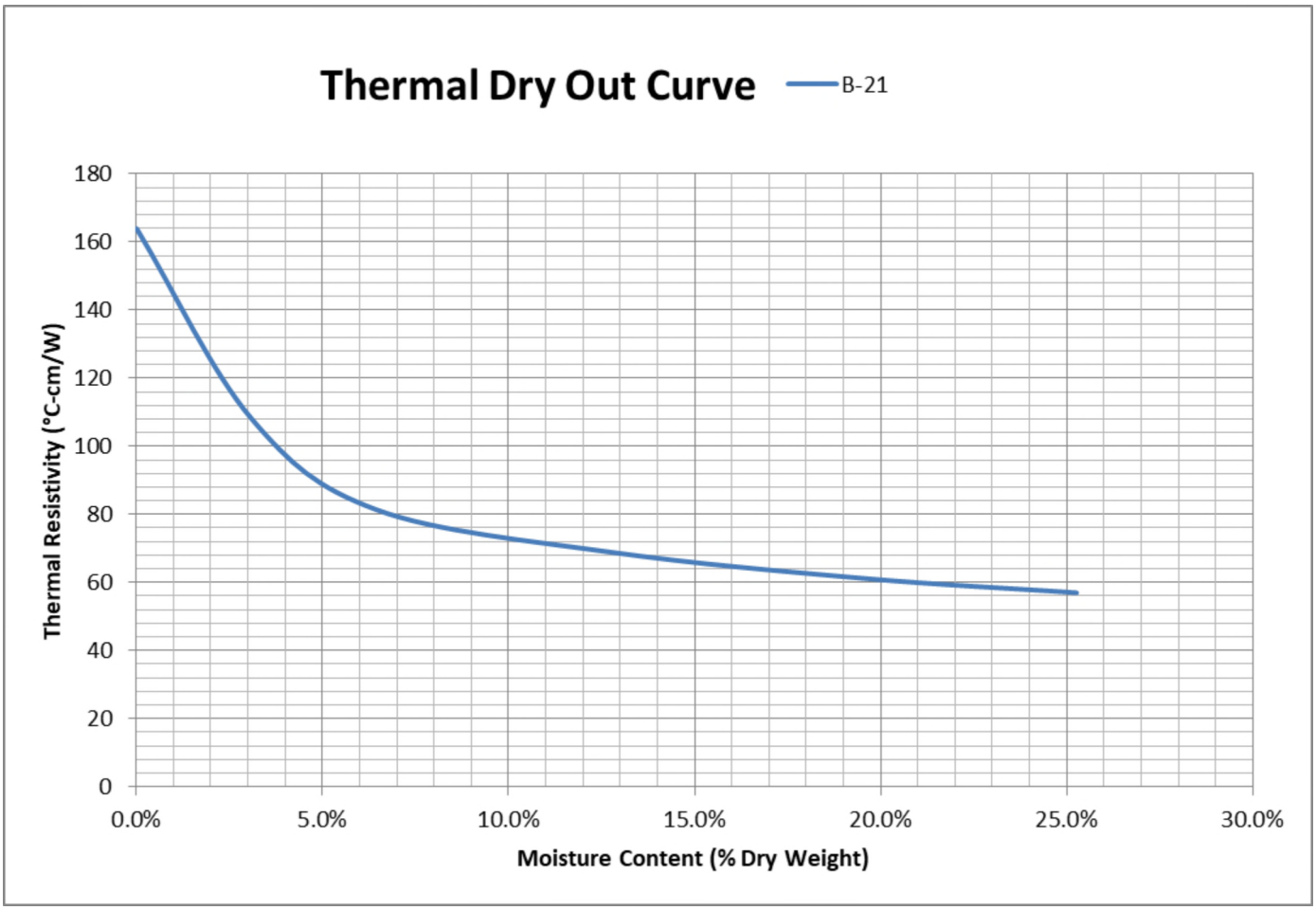
(S210119D) Sample Location	Sample Depth (ft)	Thermal Resistivity (°C-cm/W)		Remolded Tube Sample		
				Optimal Moisture Content	Proctor Dry Density	Requested Compaction
		Wet	Dry	(%)	(PCF)	(%)
B-14	1-4	55	269	16.6%	106.10	90%

Client:	Terracon
Job Name:	Hoffman-Solar
Client Job Number:	57205066
Project X Job Number:	S210119D
Method:	IEEE Std 442-81
Date:	1/25/2021



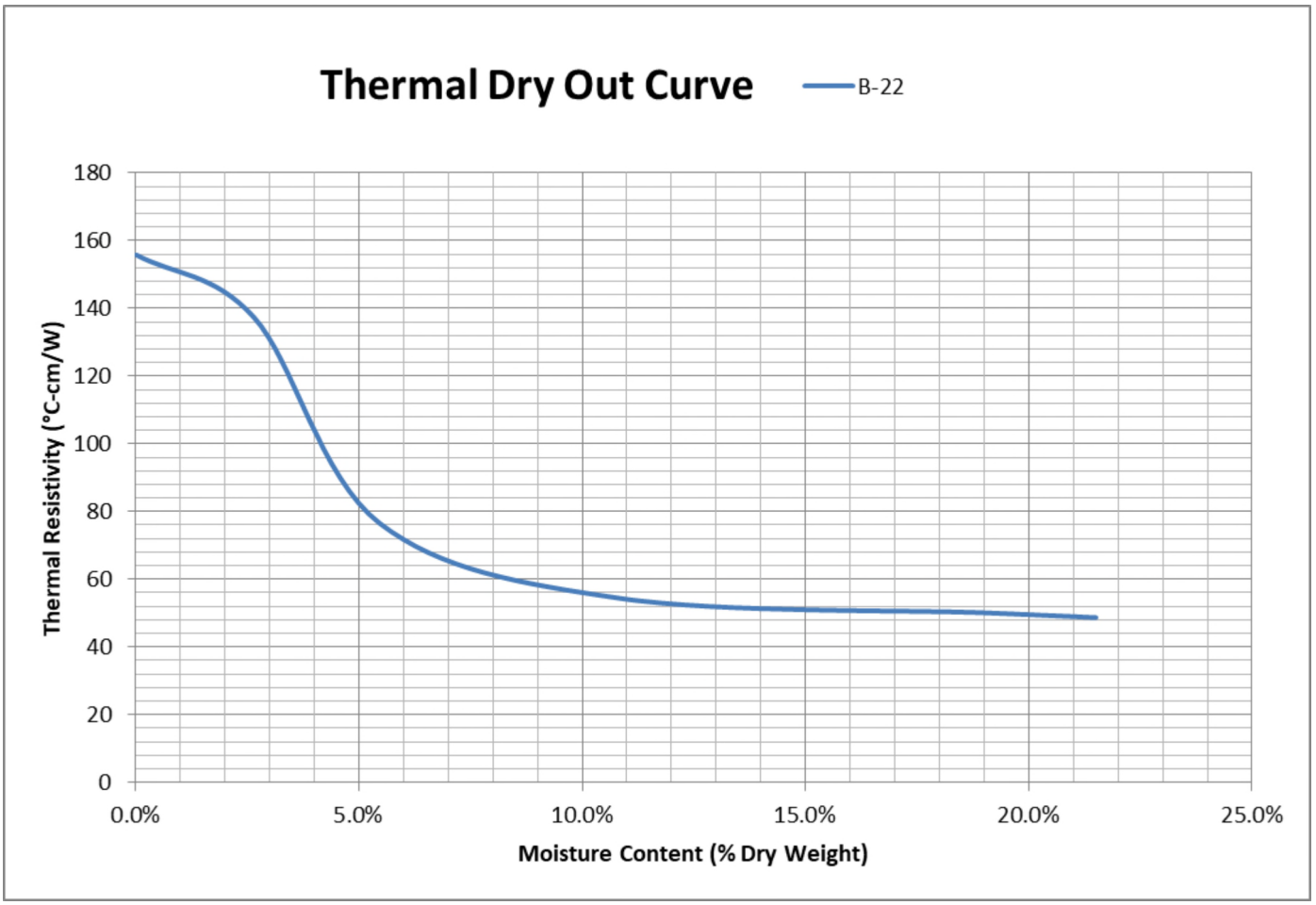
(S210119D) Sample Location	Sample Depth (ft)	Thermal Resistivity (°C-cm/W)		Remolded Tube Sample		
				Optimal Moisture Content	Proctor Dry Density	Requested Compaction
		Wet	Dry	(%)	(PCF)	(%)
B-17	1-4	50	141	15.6%	107.00	90%

Client:	Terracon
Job Name:	Hoffman-Solar
Client Job Number:	57205066
Project X Job Number:	S210119D
Method:	IEEE Std 442-81
Date:	1/25/2021



(S210119D) Sample Location	Sample Depth (ft)	Thermal Resistivity (°C-cm/W)		Remolded Tube Sample		
				Optimal Moisture Content	Proctor Dry Density	Requested Compaction
		Wet	Dry	(%)	(PCF)	(%)
B-21	1-4	57	164	17.7%	103.10	90%

Client:	Terracon
Job Name:	Hoffman-Solar
Client Job #:	57205066
Project X Job #:	S210119D
Method:	IEEE Std 442-81
Date:	1/25/2021



(S210119D) Sample Location	Sample Depth (ft)	Thermal Resistivity (°C-cm/W)		Remolded Tube Sample		
				Optimal Moisture Content	Proctor Dry Density	Requested Compaction
		Wet	Dry	(%)	(PCF)	(%)
B-22	1-4	49	156	17.1%	106.50	90%

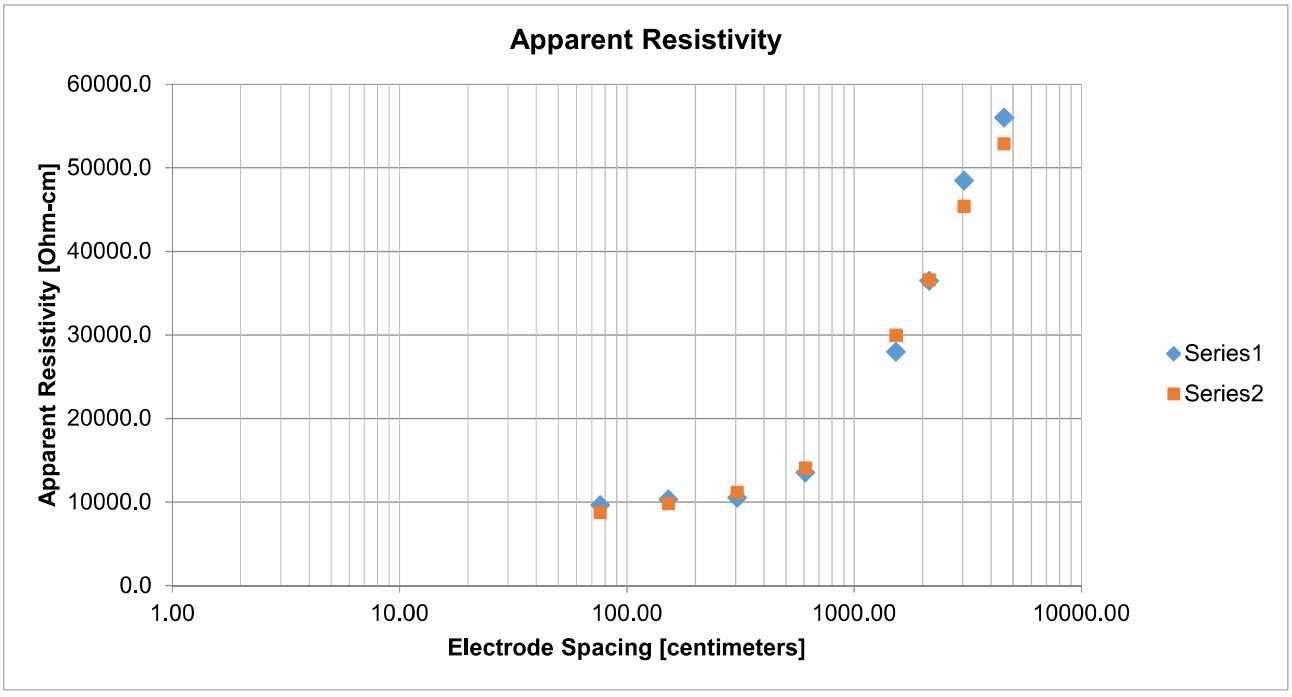
FIELD ELECTRICAL RESISTIVITY TEST DATA

Test Line at B-1 location with approximate center point: 36.673113°, -86.545413°

Project	**Project** Hoffman Solar Project	**Weather**	Partially Cloudy
Location	**Location** Franklin, KY	**Surface Soil**	Lean Clay
Project #	**Project #** 57205066	**Instrument**	AEMC Model 6471
Test Date	**Test Date** January 18, 2021	**Tested By**	Isaac Hardesty

Electrode Spacing "a"		**Electrode Depth "b"**		**"A" Test (Extended E-W)**		**"B" Test (Extended N-S)**	
[feet]	[centimeters]	[feet]	[centimeters]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]
2.5	76.20	0.5	15.24	18.90	9645.1	17.20	8777.6
5	152.40	0.5	15.24	10.60	10325.0	10.10	9838.0
10	304.80	0.5	15.24	5.48	10540.6	5.81	11175.3
20	609.60	0.5	15.24	3.54	13573.8	3.68	14110.6
50	1524.00	1	30.48	2.920	27980.2	3.130	29992.5
70	2133.60	1	30.48	2.720	36476.8	2.730	36610.9
100	3048.00	1	30.48	2.530	48460.9	2.370	45396.2
150	4572.00	1	30.48	1.950	56021.5	1.840	52861.3

Apparent resistivity p is calculated as : $$\rho = \frac{4\pi aR}{1 + \frac{2a}{\sqrt{a^2 + 4b^2}} - \frac{a}{\sqrt{a^2 + b^2}}}$$



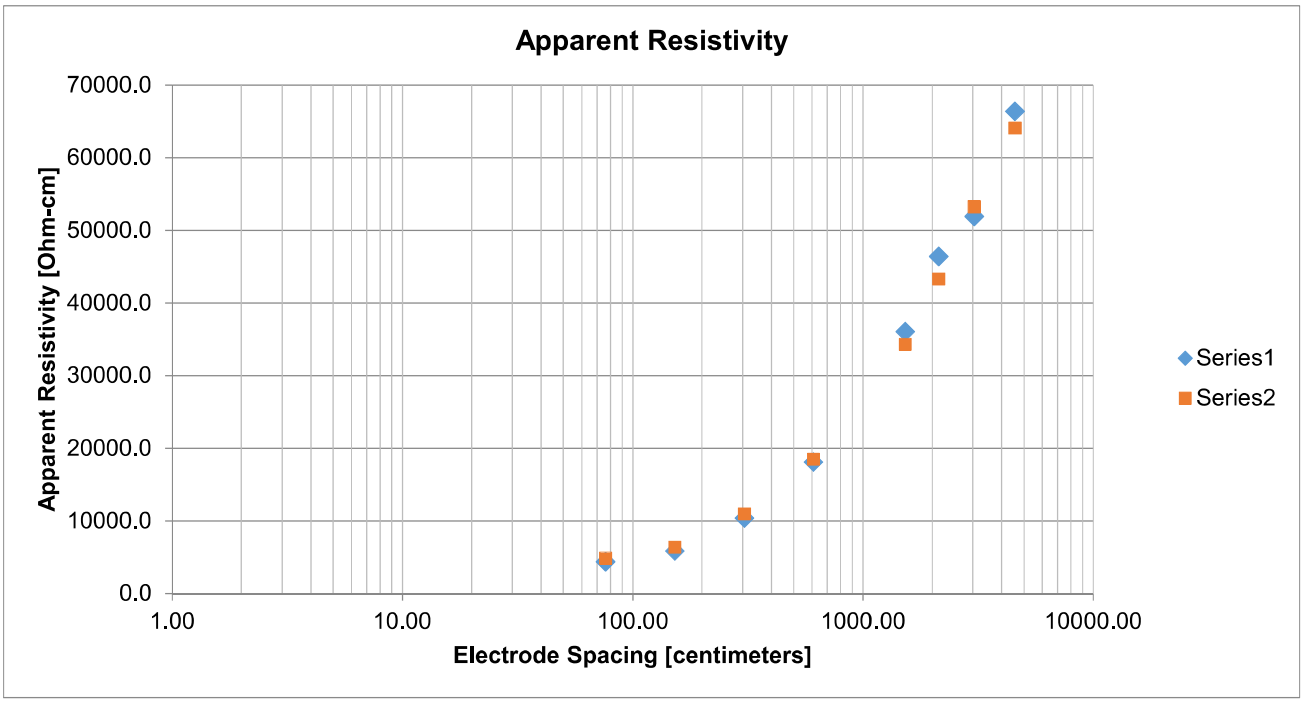
FIELD ELECTRICAL RESISTIVITY TEST DATA

Test Line at B-2 location with approximate center point: 36.671607°, -86.548049°

Project	**Project**	Hoffman Solar Project	**Weather**	Partially Cloudy
Location	**Location**	Franklin, KY	**Surface Soil**	Lean Clay
Project #	**Project #**	57205066	**Instrument**	AEMC Model 6471
Test Date	**Test Date**	January 18, 2021	**Tested By**	Isaac Hardesty

Electrode Spacing "a"		**Electrode Depth "b"**		**"A" Test (Extended E-W)**		**"B" Test (Extended N-S)**	
[feet]	[centimeters]	[feet]	[centimeters]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]
2.5	76.20	0.5	15.24	8.58	4378.6	9.52	4858.3
5	152.40	0.5	15.24	5.98	5824.9	6.54	6370.3
10	304.80	0.5	15.24	5.39	10367.5	5.70	10963.7
20	609.60	0.5	15.24	4.72	18098.4	4.82	18481.9
50	1524.00	1	30.48	3.760	36029.3	3.580	34304.5
70	2133.60	1	30.48	3.460	46400.6	3.230	43316.2
100	3048.00	1	30.48	2.710	51908.7	2.780	53249.5
150	4572.00	1	30.48	2.310	66363.9	2.230	64065.6

Apparent resistivity p is calculated as : $$\rho = \frac{4\pi a R}{1 + \frac{2a}{\sqrt{a^2 + 4b^2}} - \frac{a}{\sqrt{a^2 + b^2}}}$$



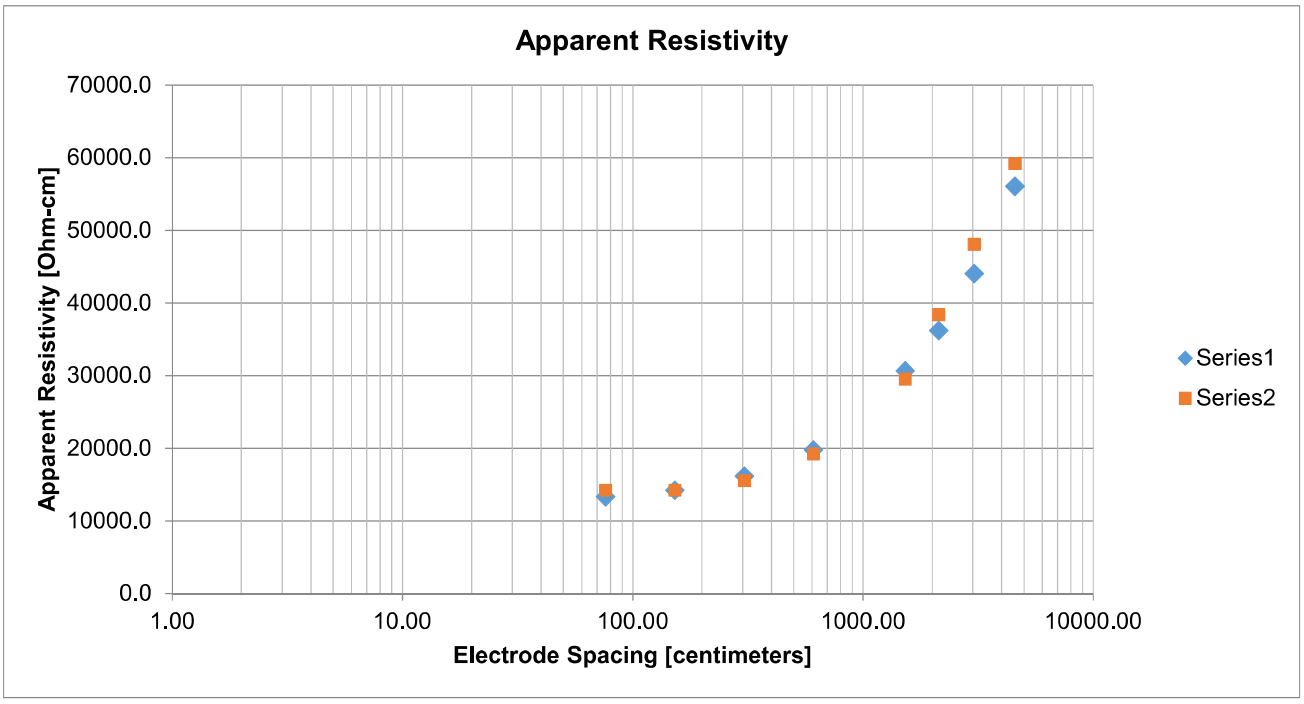
FIELD ELECTRICAL RESISTIVITY TEST DATA

Test Line at B-3 location with approximate center point: 36.670587°, -86.542737°

Project	**Project**	Hoffman Solar Project	**Weather**	Partially Cloudy
Location	**Location**	Franklin, KY	**Surface Soil**	Lean Clay
Project #	**Project #**	57205066	**Instrument**	AEMC Model 6471
Test Date	**Test Date**	January 18, 2021	**Tested By**	Isaac Hardesty

Electrode Spacing "a"		**Electrode Depth "b"**		**"A" Test (Extended E-W)**		**"B" Test (Extended N-S)**	
[feet]	[centimeters]	[feet]	[centimeters]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]
2.5	76.20	0.5	15.24	26.10	13319.4	27.90	14238.0
5	152.40	0.5	15.24	14.60	14221.2	14.60	14221.2
10	304.80	0.5	15.24	8.40	16157.1	8.08	15541.6
20	609.60	0.5	15.24	5.16	19785.6	5.02	19248.8
50	1524.00	1	30.48	3.200	30663.3	3.080	29513.4
70	2133.60	1	30.48	2.700	36208.6	2.860	38354.3
100	3048.00	1	30.48	2.300	44055.3	2.510	48077.8
150	4572.00	1	30.48	1.950	56021.5	2.060	59181.7

Apparent resistivity p is calculated as : $$\rho = \frac{4\pi aR}{1 + \frac{2a}{\sqrt{a^2+4b^2}} - \frac{a}{\sqrt{a^2+b^2}}}$$



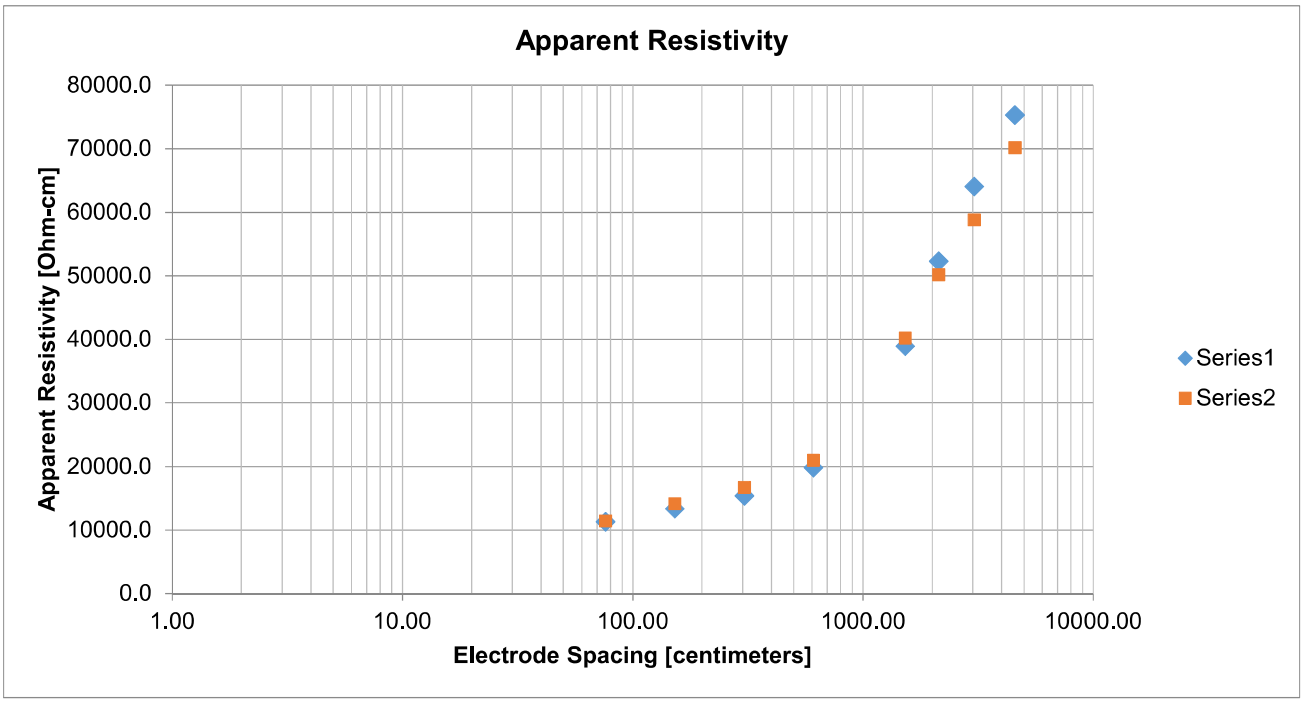
FIELD ELECTRICAL RESISTIVITY TEST DATA

Test Line at B-5 location with approximate center point: 36.666815°, -86.548623°

Project	**Project**	Hoffman Solar Project	**Weather**	Partially Cloudy
Location	**Location**	Franklin, KY	**Surface Soil**	Lean Clay
Project #	**Project #**	57205066	**Instrument**	AEMC Model 6471
Test Date	**Test Date**	January 18, 2021	**Tested By**	Isaac Hardesty

Electrode Spacing "a"		**Electrode Depth "b"**		**"A" Test (Extended E-W)**		**"B" Test (Extended N-S)**	
[feet]	[centimeters]	[feet]	[centimeters]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]
2.5	76.20	0.5	15.24	22.10	11278.2	22.40	11431.3
5	152.40	0.5	15.24	13.70	13344.6	14.50	14123.8
10	304.80	0.5	15.24	7.99	15368.5	8.68	16695.6
20	609.60	0.5	15.24	5.17	19823.9	5.47	20974.2
50	1524.00	1	30.48	4.060	38904.0	4.190	40149.7
70	2133.60	1	30.48	3.900	52301.3	3.740	50155.6
100	3048.00	1	30.48	3.340	63976.0	3.070	58804.3
150	4572.00	1	30.48	2.620	75269.9	2.440	70098.7

Apparent resistivity p is calculated as : $$\rho = \frac{4\pi aR}{1 + \frac{2a}{\sqrt{a^2 + 4b^2}} - \frac{a}{\sqrt{a^2 + b^2}}}$$



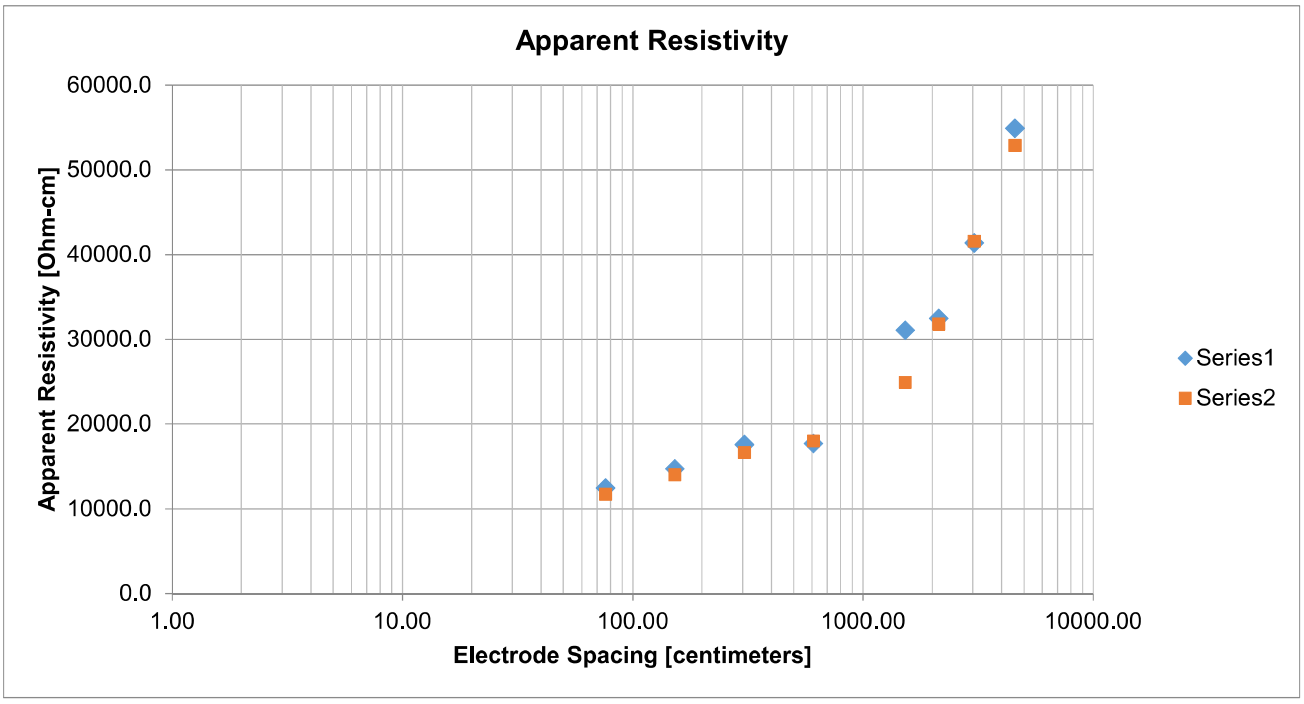
FIELD ELECTRICAL RESISTIVITY TEST DATA

Test Line at B-8 location with approximate center point: 36.661973°, -86.545814°

Project	Hoffman Solar Project	**Weather**	Partially Cloudy
Location	Franklin, KY	**Surface Soil**	Lean Clay
Project #	57205066	**Instrument**	AEMC Model 6471
Test Date	January 18, 2021	**Tested By**	Isaac Hardesty

Electrode Spacing "a"		Electrode Depth "b"		"A" Test (Extended E-W)		"B" Test (Extended N-S)	
[feet]	[centimeters]	[feet]	[centimeters]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]
2.5	76.20	0.5	15.24	24.40	12451.9	23.00	11737.4
5	152.40	0.5	15.24	15.10	14708.2	14.40	14026.4
10	304.80	0.5	15.24	9.14	17580.4	8.65	16637.9
20	609.60	0.5	15.24	4.62	17715.0	4.70	18021.8
50	1524.00	1	30.48	3.240	31046.6	2.600	24913.9
70	2133.60	1	30.48	2.420	32453.6	2.370	31783.1
100	3048.00	1	30.48	2.160	41373.7	2.170	41565.3
150	4572.00	1	30.48	1.910	54872.3	1.840	52861.3

Apparent resistivity p is calculated as : $$\rho = \frac{4\pi aR}{1 + \frac{2a}{\sqrt{a^2+4b^2}} - \frac{a}{\sqrt{a^2+b^2}}}$$



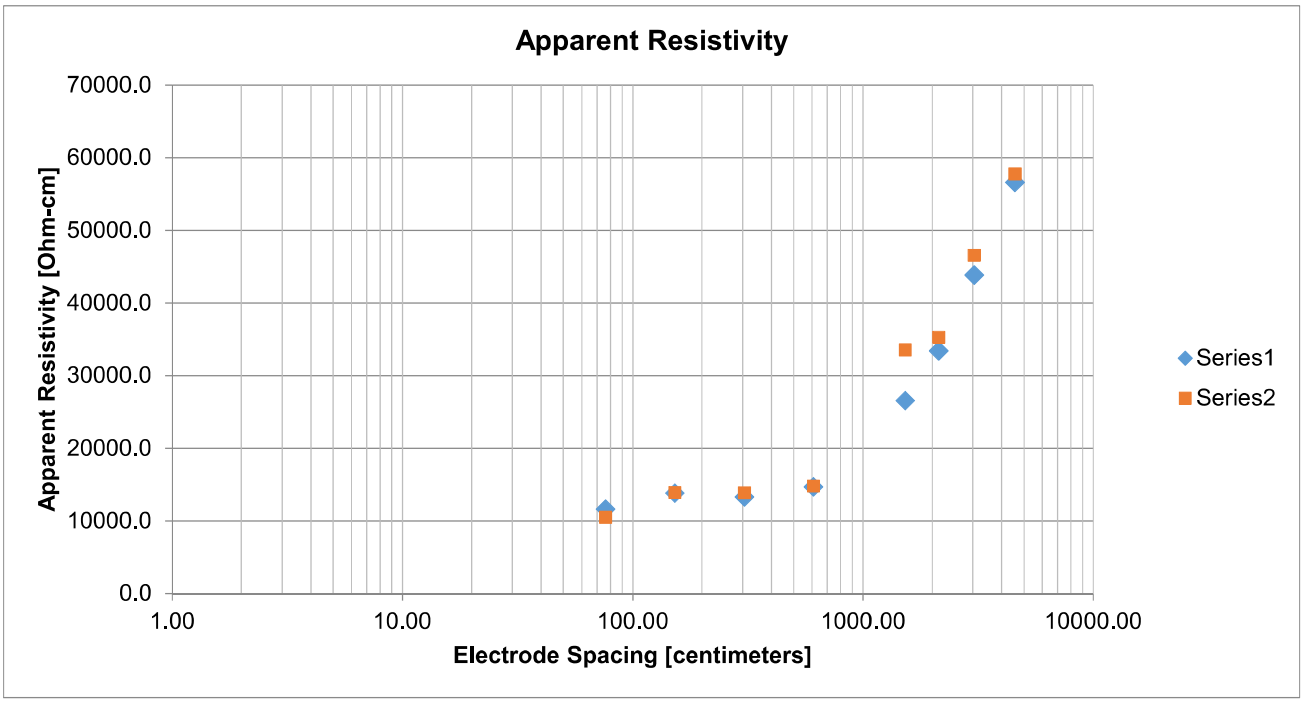
FIELD ELECTRICAL RESISTIVITY TEST DATA

Test Line at B-10 location with approximate center point: 36.662143°, -86.539902°

Project	**Project**	Hoffman Solar Project	**Weather**	Partially Cloudy
Location	**Location**	Franklin, KY	**Surface Soil**	Lean Clay
Project #	**Project #**	57205066	**Instrument**	AEMC Model 6471
Test Date	**Test Date**	January 15, 2021	**Tested By**	Isaac Hardesty

Electrode Spacing "a"		**Electrode Depth "b"**		**"A" Test (Extended E-W)**		**"B" Test (Extended N-S)**	
[feet]	[centimeters]	[feet]	[centimeters]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]
2.5	76.20	0.5	15.24	22.80	11635.4	20.60	10512.7
5	152.40	0.5	15.24	14.20	13831.6	14.30	13929.0
10	304.80	0.5	15.24	6.91	13291.1	7.22	13887.4
20	609.60	0.5	15.24	3.83	14685.8	3.86	14800.8
50	1524.00	1	30.48	2.770	26542.9	3.500	33538.0
70	2133.60	1	30.48	2.490	33392.4	2.630	35269.9
100	3048.00	1	30.48	2.290	43863.8	2.430	46545.4
150	4572.00	1	30.48	1.970	56596.0	2.010	57745.2

Apparent resistivity p is calculated as : $$\rho = \frac{4\pi a R}{1 + \frac{2a}{\sqrt{a^2 + 4b^2}} - \frac{a}{\sqrt{a^2 + b^2}}}$$



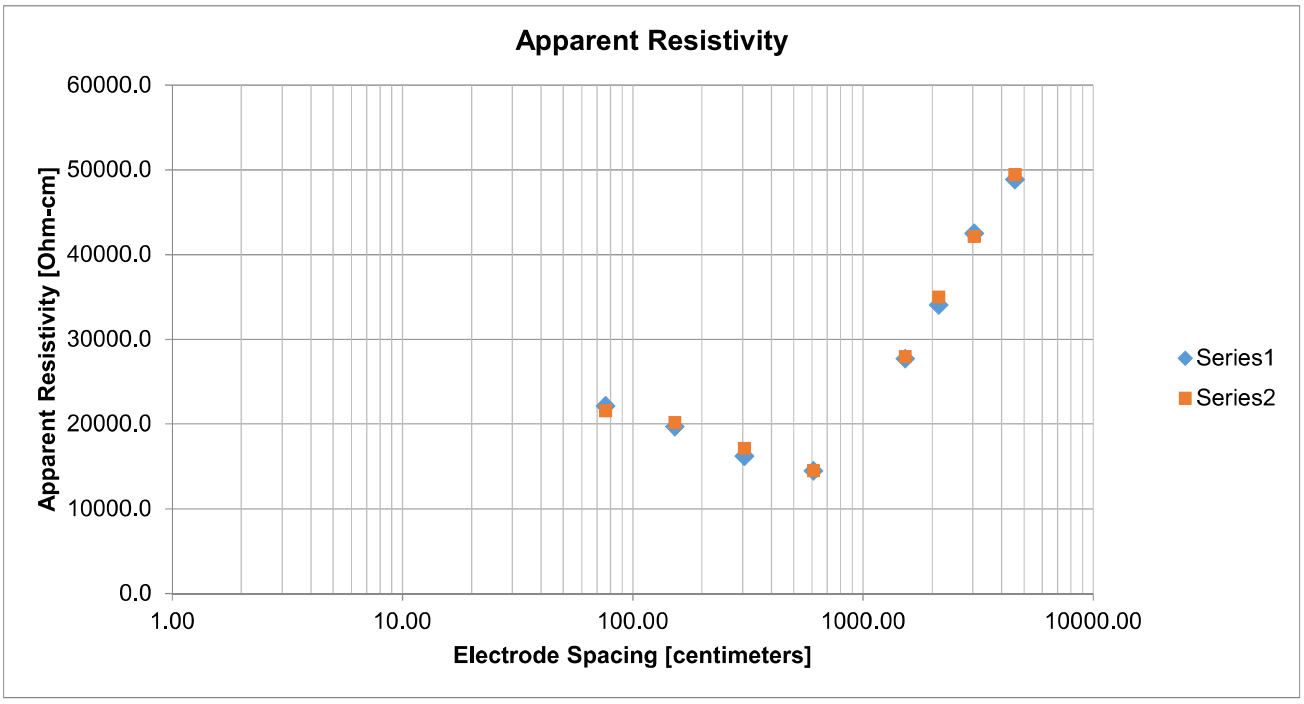
FIELD ELECTRICAL RESISTIVITY TEST DATA

Test Line at B-10 location with approximate center point: 36.657026°, -86.535807°

Project	**Project**	Hoffman Solar Project	**Weather**	Partially Cloudy
Location	**Location**	Franklin, KY	**Surface Soil**	Lean Clay
Project #	**Project #**	57205066	**Instrument**	AEMC Model 6471
Test Date	**Test Date**	January 15, 2021	**Tested By**	Isaac Hardesty

Electrode Spacing "a"		**Electrode Depth "b"**		**"A" Test (Extended E-W)**		**"B" Test (Extended N-S)**	
[feet]	[centimeters]	[feet]	[centimeters]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]
2.5	76.20	0.5	15.24	43.30	22097.0	42.20	21535.7
5	152.40	0.5	15.24	20.20	19675.9	20.70	20163.0
10	304.80	0.5	15.24	8.43	16214.8	8.91	17138.0
20	609.60	0.5	15.24	3.78	14494.1	3.79	14532.4
50	1524.00	1	30.48	2.890	27692.8	2.920	27980.2
70	2133.60	1	30.48	2.540	34062.9	2.610	35001.6
100	3048.00	1	30.48	2.220	42523.0	2.200	42139.9
150	4572.00	1	30.48	1.700	48839.2	1.720	49413.8

Apparent resistivity p is calculated as : $$\rho = \frac{4\pi a R}{1 + \frac{2a}{\sqrt{a^2 + 4b^2}} - \frac{a}{\sqrt{a^2 + b^2}}}$$



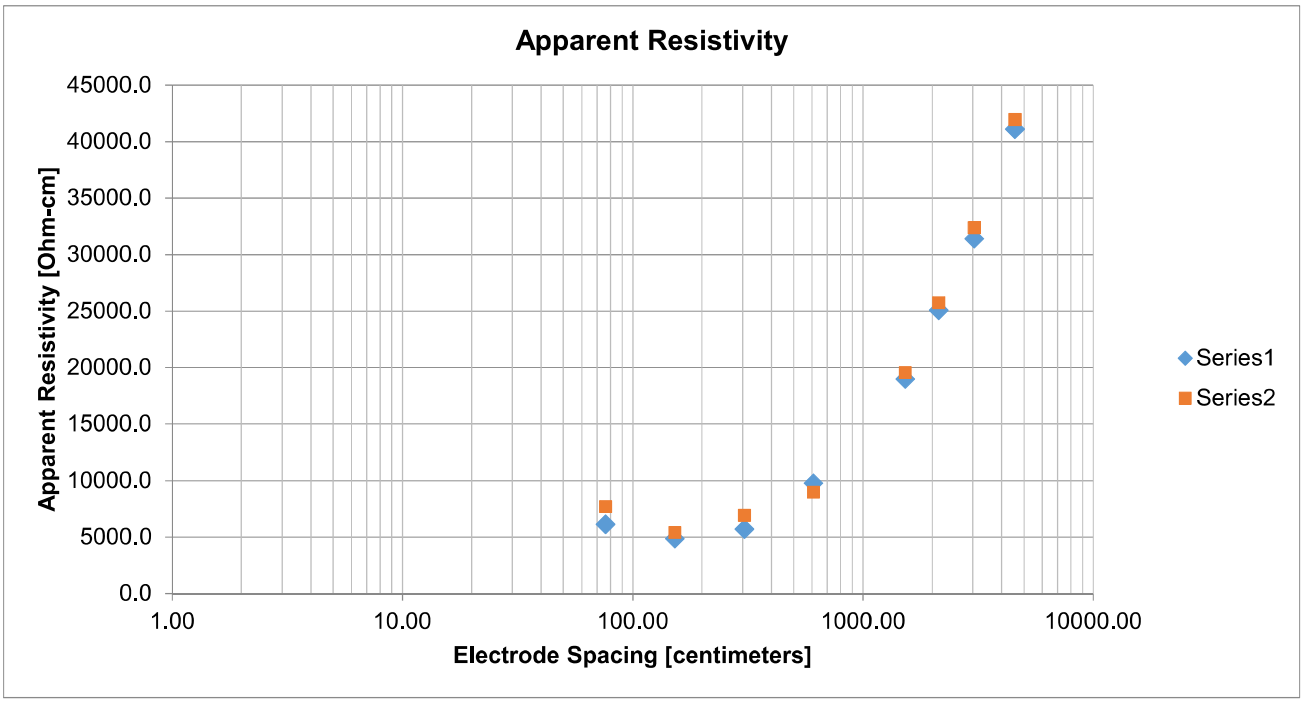
FIELD ELECTRICAL RESISTIVITY TEST DATA

Test Line at B-12 location with approximate center point: 36.655711°, -86.531708°

Project	**Project**	Hoffman Solar Project	**Weather**	Partially Cloudy
Location	**Location**	Franklin, KY	**Surface Soil**	Lean Clay
Project #	**Project #**	57205066	**Instrument**	AEMC Model 6471
Test Date	**Test Date**	January 15, 2021	**Tested By**	Isaac Hardesty

Electrode Spacing "a"		**Electrode Depth "b"**		**"A" Test (Extended E-W)**		**"B" Test (Extended N-S)**	
[feet]	[centimeters]	[feet]	[centimeters]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]
2.5	76.20	0.5	15.24	12.00	6123.9	15.10	7705.9
5	152.40	0.5	15.24	4.99	4860.5	5.54	5396.3
10	304.80	0.5	15.24	2.96	5693.4	3.60	6924.5
20	609.60	0.5	15.24	2.55	9777.8	2.34	8972.5
50	1524.00	1	30.48	1.980	18972.9	2.040	19547.8
70	2133.60	1	30.48	1.870	25077.8	1.920	25748.3
100	3048.00	1	30.48	1.640	31413.4	1.690	32371.1
150	4572.00	1	30.48	1.430	41082.4	1.460	41944.3

Apparent resistivity p is calculated as : $$\rho = \frac{4\pi aR}{1 + \frac{2a}{\sqrt{a^2+4b^2}} - \frac{a}{\sqrt{a^2+b^2}}}$$



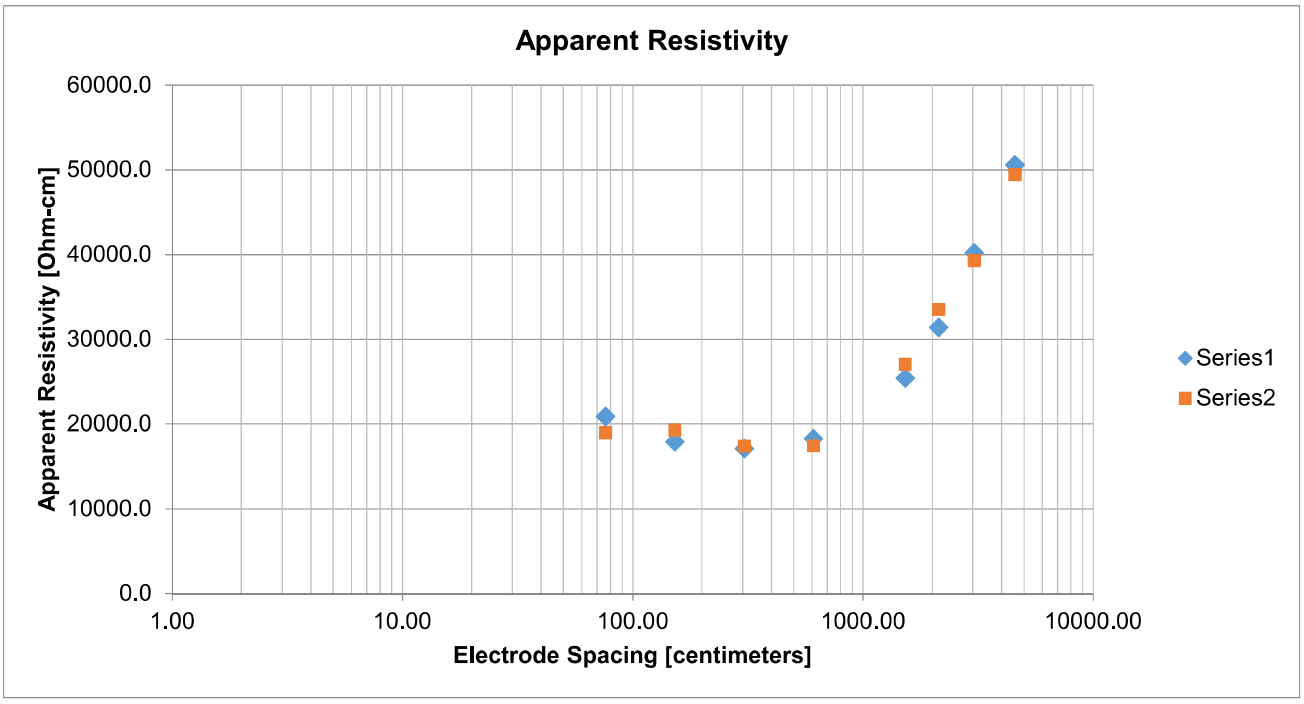
FIELD ELECTRICAL RESISTIVITY TEST DATA

Test Line at B-15 location with approximate center point: 36.661194°, -86.532490°

Project	**Project**	Hoffman Solar Project	**Weather**	Partially Cloudy
Location	**Location**	Franklin, KY	**Surface Soil**	Lean Clay
Project #	**Project #**	57205066	**Instrument**	AEMC Model 6471
Test Date	**Test Date**	January 18, 2021	**Tested By**	Isaac Hardesty

Electrode Spacing "a"		**Electrode Depth "b"**		**"A" Test (Extended E-W)**		**"B" Test (Extended N-S)**	
[feet]	[centimeters]	[feet]	[centimeters]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]
2.5	76.20	0.5	15.24	40.90	20872.2	37.20	18984.0
5	152.40	0.5	15.24	18.40	17922.6	19.80	19286.3
10	304.80	0.5	15.24	8.90	17118.8	9.06	17426.6
20	609.60	0.5	15.24	4.77	18290.2	4.55	17446.6
50	1524.00	1	30.48	2.650	25393.0	2.820	27022.0
70	2133.60	1	30.48	2.340	31380.8	2.500	33526.5
100	3048.00	1	30.48	2.100	40224.4	2.050	39266.7
150	4572.00	1	30.48	1.760	50563.0	1.720	49413.8

Apparent resistivity p is calculated as : $$\rho = \frac{4\pi a R}{1 + \frac{2a}{\sqrt{a^2 + 4b^2}} - \frac{a}{\sqrt{a^2 + b^2}}}$$



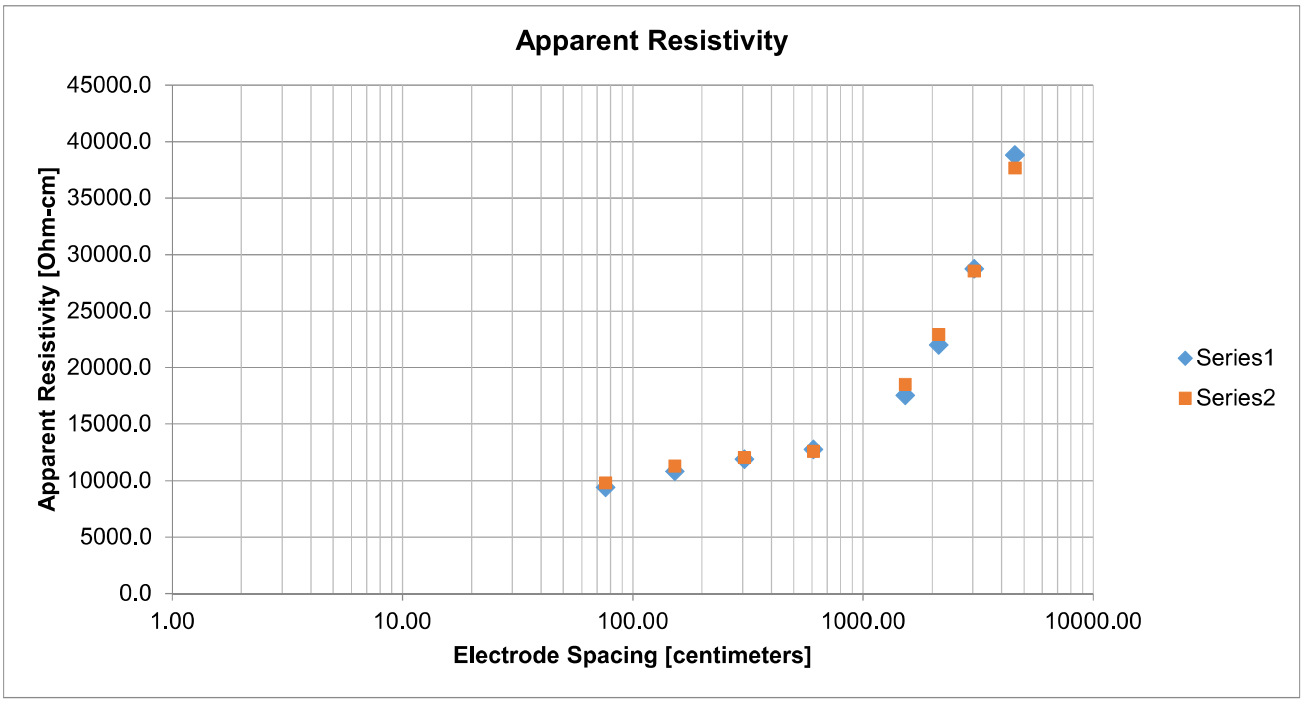
FIELD ELECTRICAL RESISTIVITY TEST DATA

Test Line at B-20 location with approximate center point: 36.666317°, -86.533106°

Project	**Project**	Hoffman Solar Project	**Weather**	Partially Cloudy
Location	**Location**	Franklin, KY	**Surface Soil**	Lean Clay
Project #	**Project #**	57205066	**Instrument**	AEMC Model 6471
Test Date	**Test Date**	January 14, 2021	**Tested By**	Isaac Hardesty

Electrode Spacing "a"		**Electrode Depth "b"**		**"A" Test (Extended E-W)**		**"B" Test (Extended N-S)**	
[feet]	[centimeters]	[feet]	[centimeters]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]
2.5	76.20	0.5	15.24	18.40	9390.0	19.20	9798.2
5	152.40	0.5	15.24	11.10	10812.0	11.60	11299.0
10	304.80	0.5	15.24	6.18	11887.0	6.26	12040.9
20	609.60	0.5	15.24	3.33	12768.6	3.28	12576.9
50	1524.00	1	30.48	1.830	17535.6	1.930	18493.8
70	2133.60	1	30.48	1.640	21993.4	1.710	22932.1
100	3048.00	1	30.48	1.500	28731.7	1.490	28540.2
150	4572.00	1	30.48	1.350	38784.1	1.310	37634.9

Apparent resistivity p is calculated as : $$\rho = \frac{4\pi aR}{1 + \frac{2a}{\sqrt{a^2+4b^2}} - \frac{a}{\sqrt{a^2+b^2}}}$$



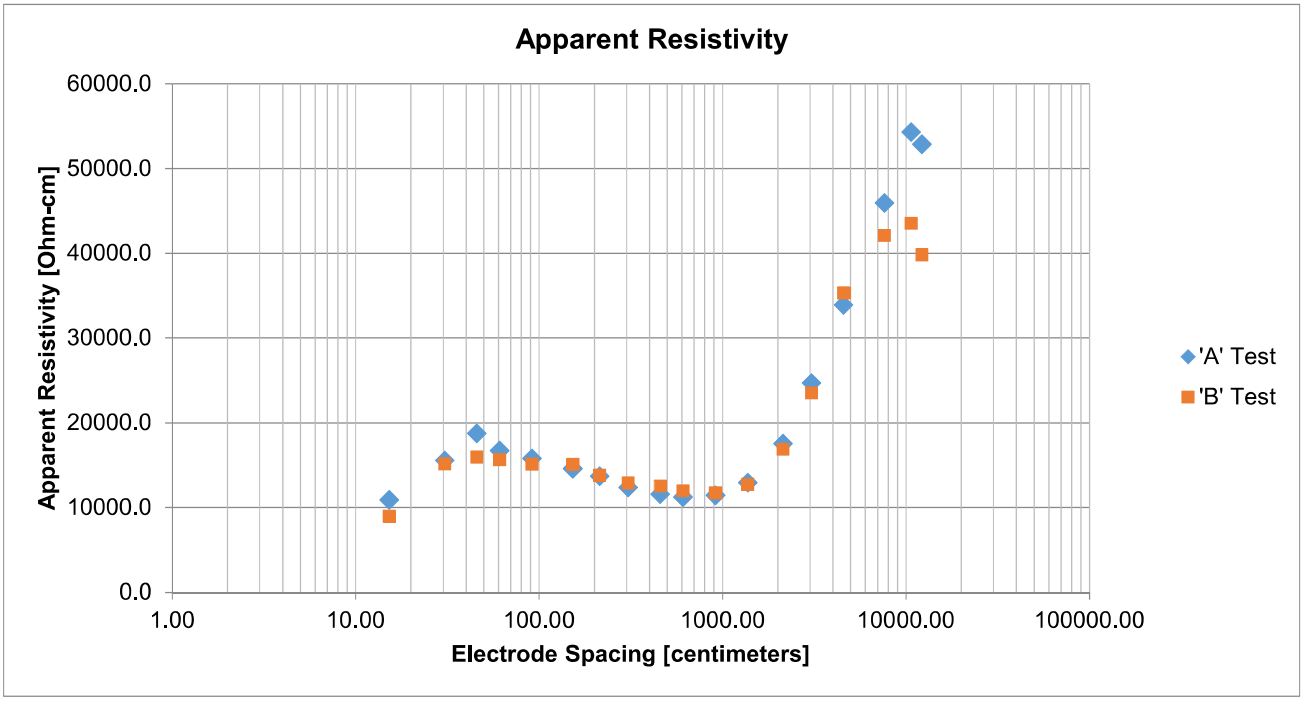
FIELD ELECTRICAL RESISTIVITY TEST DATA

Test Line at the Substation location with approximate center point: 36.665383°, -86.536537°

Project	**Project**	Hoffman Solar Project	**Weather**	Partially Cloudy
Location	**Location**	Franklin, KY	**Surface Soil**	Lean Clay
Project #	**Project #**	57205066	**Instrument**	AEMC Model 6471
Test Date	**Test Date**	January 14, 2021	**Tested By**	Isaac Hardesty

Electrode Spacing "a"		**Electrode Depth "b"**		**"A" Test (Extended E-W)**		**"B" Test (Extended N-S)**	
[feet]	[centimeters]	[feet]	[centimeters]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-cm]
0.5	15.24	0.5	15.24	67.60	10903.7	55.60	8968.1
1	30.48	1	30.48	48.30	15581.3	47.00	15161.9
1.5	45.72	1	30.48	44.70	18773.9	38.00	15959.9
2	60.96	1	30.48	33.20	16734.4	31.10	15675.9
3	91.44	1	30.48	23.600	15808.4	22.600	15138.6
5	152.40	1	30.48	14.300	14595.3	14.800	15105.6
7	213.36	1	30.48	9.890	13717.2	9.990	13855.9
10	304.80	1	30.48	6.350	12370.5	6.630	12916.0
15	457.20	1	30.48	4.00	11579.4	4.33	12534.7
20	609.60	1	30.48	2.92	11233.0	3.11	11963.9
30	914.40	1	30.48	1.99	11455.4	2.04	11743.3
45	1371.60	1	30.48	1.50	12938.2	1.48	12765.7
70	2133.60	1	30.48	1.310	17567.9	1.260	16897.3
100	3048.00	1	30.48	1.290	24709.3	1.230	23560.0
150	4572.00	1	30.48	1.180	33900.2	1.230	35336.6
250	7620.00	1	30.48	0.960	45964.0	0.880	42133.7
350	10668.00	1	30.48	0.810	54294.3	0.650	43569.5
400	12192.00	1	30.48	0.690	52857.7	0.520	39834.8

Apparent resistivity p is calculated as : $$\rho = \frac{4\pi a R}{1 + \frac{2a}{\sqrt{a^2 + 4b^2}} - \frac{a}{\sqrt{a^2 + b^2}}}$$



GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS
Hoffman Solar Project ■ Franklin, KY
Terracon Project No. 57205066

Terracon GeoReport

SAMPLING


Grab Sample


Shelby Tube


Split Spoon

WATER LEVEL


Water Initially Encountered


Water Level After a Specified Period of Time


Water Level After a Specified Period of Time


Cave In Encountered

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

N	Standard Penetration Test Resistance (Blows/Ft.)
(HP)	Hand Penetrometer
(T)	Torvane
(DCP)	Dynamic Cone Penetrometer
UC	Unconfined Compressive Strength
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

LOCATION AND ELEVATION NOTES

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELEVANCE OF SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or [$Cc<1$ or $Cc>3.0$] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or [$Cc<1$ or $Cc>3.0$] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OL	Organic clay [K, L, M, N] / Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OH	Organic clay [K, L, M, P] / Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

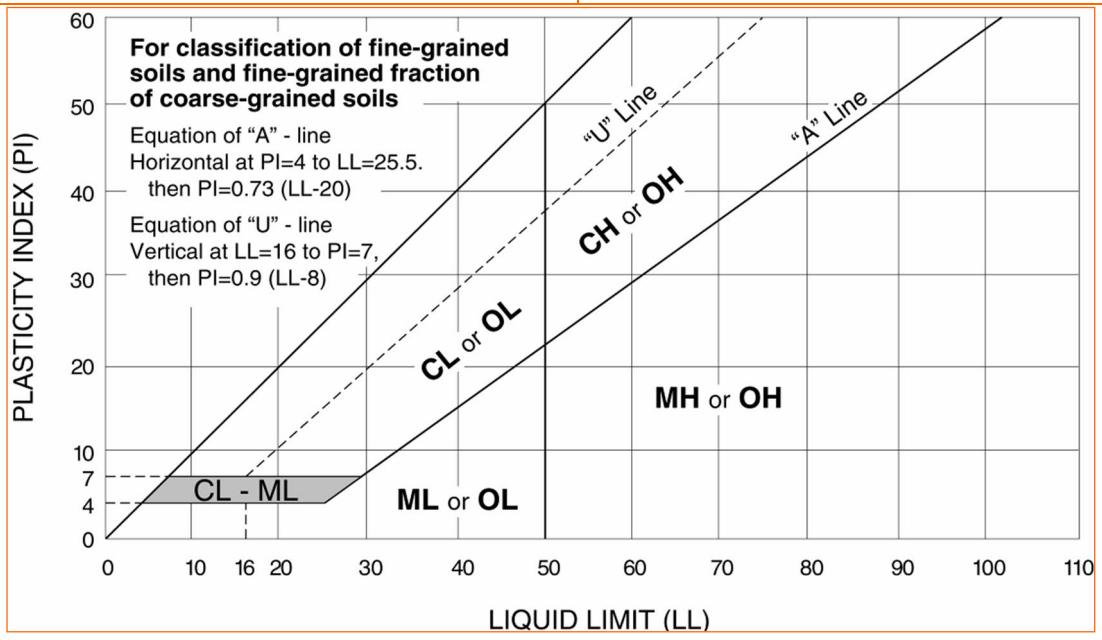
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



Karst Site Assessment

Proposed Hoffman Solar Project
Franklin, Simpson County, Kentucky
August 4, 2020
Terracon Project No. 57195114

Prepared for:
OPDE Energy C/O
Newton, Massachusetts

Prepared by:
Terracon Consultants, Inc.
Louisville, Kentucky

August 4, 2020

OPDE Energy C/O
Horus Renewables Corporation
168 Mt. Vernon St.
Newton, Massachusetts 02465

Attn: Mr. Braden Houston, Sr. Director – Project Development
P: (617) 530 0029
E: bhouston@opdenergy.com

Re: Karst Site Assessment
Proposed Hoffman Solar Project
Tyree Chapel Road
Franklin, Simpson County, Kentucky
Terracon Project No. 57195114

Dear Mr. Houston:

We have completed the karst assessment for the above referenced project. The objective of these services was to identify and delineate existing karst features at the site and provide recommendations for development avoidance areas. Our services were completed in general accordance with our Master Service Agreement Task Order dated February 13, 2020. For more detailed project information, refer to Terracon's Report of Expected Geotechnical Conditions (REGC) GR195145 dated May 6, 2019.

This report summarizes our karst assessment at the proposed Hoffman Solar Facility in Franklin, Simpson County, Kentucky. Project mapping information can be accessed through this web page: https://geodata.terracon.com/HorusRenewables/57195114/

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Sadra Javadi, Ph.D.
Geotechnical Engineer

Benjamin W. Taylor, P.E.
Senior Associate

REPORT TOPICS

Note: This report was originally delivered in a web-based format. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

Note: Refer to each individual Attachment for a listing of contents.

SCOPE OF SERVICES

The site was identified by the project boundary in ***KY_Simpson_Hoffman_Solar.kmz*** received from OPDE Energy during the proposal stage of this study. Our karst assessment was generally limited to the area proposed for array development as indicated by ***300 ACRE PV SITE LAYOUT.pdf*** provided by Mr. Rivera with OPDE Energy via email on March 6, 2020. At this time, a thorough review of the site outside of the proposed array areas has not been performed. Our karst assessment was performed as a phased approach, consisting of:

- Desktop data review,
- Field reconnaissance,
- Subsurface exploration
  - Geophysical Electrical Resistivity Imaging (ERI), and
  - Air-track probe drilling.

Desktop Data Review

We performed a desktop data review of readily available resources (listed below) to identify documented karst features (e.g., sinkholes, closed depressions, and sinking and losing streams). The review of the existing feature locations within the site boundaries was accomplished by examining data from the following sources:

- Maps of selected karst features (sinkholes and springs) available from the Kentucky Geological Survey (KGS),
- Division of Mines and Mineral Resources and the United State Geological Survey,
- Spring and well locations on and/or within 1,000 feet of the site, provided by the Kentucky Department of Environmental Quality (KDEQ),
- Digital Elevation Models (DEMs),
- LIDAR generated 2-foot contour interval maps for the site and surrounding area within minimum 1,500 ft from site boundaries,
- Aerial photographs (both recent and historical), and
- USGS Topographic 7.5-minute topographic quadrangles.
- National Wetland Inventory (NWI) map developed by US Fish & Wildlife Service 2015.

Field Survey

Upon completion of the desktop data review, Terracon initiated the field reconnaissance activities. The field reconnaissance entailed walking the site in a systematic manner to locate and delineate visible surface karst features (e.g., sinkholes and subsidence, closed depressions, and sinking and losing streams). Particular emphasis was on features inferred to have direct communication with the phreatic zone such as “open-throat” sinkholes, karst windows, cave entrances, and sinking streams. Specifically, the field reconnaissance entailed:

- Verification and delineation of potential surface features identified by desktop review, and

- Identification and delineation of uncatalogued or previously unidentified surface features, specifically sinkholes, cave entrances, dry runs, sinking streams, etc.

The locations and outlines of all relevant features were recorded using a hand-held, recreational-grade, GPS device. Identified karst features were located and delineated with the outline of the closed depression defined as the last closed descending contour at a 2-foot mapping interval. Each feature was assigned a unique identifier as presented by the **Karst Feature Inventory** in the Appendix of this report and the **Karst Feature** tab of the project map viewer. Features delineated during the field reconnaissance were designated by an F- number.

Subsurface Exploration

Terracon conducted a phased subsurface exploration using geophysical and drilling methods. Geophysical exploration using Electrical Resistivity Imaging (ERI) was performed across the site with an emphasis on karst features identified during the desktop data review and site reconnaissance. Drilling exploration by air-track probe (ATP) was performed at areas delineated with possible karst activity and along the ERI lines to calibrate the resistivity profiles, investigate anomalies revealed by the ERI, determine depth to bedrock, and explore for soil filled solution channels or voids.

Subsurface exploration scope for this project included:

- 13 geophysical ERI arrays with lengths ranging from 500 to 1,050 feet, and
- 31 ATP borings were advanced to depths ranging from approximately 17 to 47 feet below existing site grades.

Maps of the site and exploration locations are presented by the **Site Location** and **Exploration Plan**, respectively. Conditions encountered at each exploration location are indicated on the ERI profiles and individual boring logs in the **Exploration Results**.

GEOLOGY AND TERRAIN

Physiography

The site is located within the Mississippian Plateau Physiographic Region of Kentucky, specifically within the Western Pennyroyal subsection. The Pennyroyal is largely farmland where underlain by limestone bedrock, particularly the St. Louis Limestone or Ste. Genevieve Limestone. In some areas of the Pennyroyal, the limestone is capped with an overlying sandstone stratum. Where the capping sandstone is intact the land surface is usually forested, with rugged hills. In many places the sandstone has collapsed into the underlying karst-forming carbonate bedrock.

The Pennyroyal region, consists of a limestone plain characterized by karst terrain, including sinkholes, sinking streams, streamless valleys, springs, and caverns. Sinkholes or closed depressions on the ground surface are usually circular and often funnel-shaped and range in size

from a few feet to hundreds of feet in diameter. There are relatively few surface streams in the region, and the sinkholes are often the principal surface drains. The karst terrain occurs in the eastern and southern parts of the region due to the presence of thick deposits of Mississippian-age limestones.

Topography

Referencing the USGS 7.5-minute topographic quadrangles for Frankfort, KY-TN (5/24/2019), the parcels comprising the survey area are in a broad, gently rolling lowland with numerous depressions. The ground surface within the survey area ranges from about elevation 689 feet to 771 feet. Refer to the **Topographic Overview**, **Elevation Contours**, and **Kentucky Elevation** tab of project map viewer. The site at some locations is internally drained by the sinkholes. There is one perennial surface water body at the site (pond water).

Geology

The site is mapped as underlain by bedrock of the Ste. Genevieve Limestone (Msg) and St. Louis Limestone (Msl) formations, both dated to the Upper Mississippian Sub-Period of the Carboniferous Geologic Period. These limestones are ranked by the Kentucky Geological Survey (KGS) as having a very high karst potential. The Ste. Genevieve is a thick-bedded oolitic limestone overlying the St Louis limestone formation characterized by scattered chert beds. Refer to **USGS Geology**, **Kentucky Geology**, and **Karst Hazards** tabs of project map viewer. The below rock unit descriptions are referenced from KGS.

Ste. Genevieve Limestone (Msg): Predominantly oolitic; some crystalline, argillaceous, and fossiliferous, detrital interbeds. Light-gray to almost white, oolitic, medium crystalline, massive to thin-bedded or slightly cross bedded; contains thin shale partings. Gray to white, weathers slightly darker; where exposed to much direct sunlight, weathered rock may be white, commonly speckled red-brown by iron oxide stain; mostly thick bedded and massive but ranges to thin bedded. Upper limestone layers weather to a thick deep-red or maroon clay containing abundant residual chert. Much of residual chert weathers to chalky fragments. Ste. Genevieve grades imperceptibly into underlying St. Louis Limestone.

St. Louis Limestone (Msl): Limestone, light- to dark-gray, fine- to medium -crystalline; contains blue gray chert nodules, particularly abundant in uppermost part; several light- to medium-gray, oolitic limestone beds in upper part of unit; scattered colonies of corals in middle and lower part; scattered gypsum and anhydrite seams in lower part. Formation weathers to dark-reddish -brown chert residuum. Grades upward into Ste. Genevieve.

SURVEY RESULTS AND DISCUSSION

Desktop Data Review

The parcels appear to be primarily used for agricultural purposes. From our desktop data review Terracon identified 47 suspect features across the site. Closed depression areas were the predominate karst features identified. In addition, multiple vegetated areas that were suspected to be sinkholes were identified during our desktop study. Review of the topographic mapping indicated signs of water drainage that could be developing erosion rills draining water to the sinkholes or causing land subsidence.

Two small closed depressions with standing water (F-5 and F-25) were observed on the west side and center of the project area. Based on review of historic aerial imagery, feature F-5 appears to have been the location of the farm pond. Review of the LIDAR generated 2-foot contour map, it appears that F-25 is a closed depression area with surface water draining into the feature. Data review did not indicate any springs or caverns reported by data available through KGS and KDEQ.

Field Survey and Subsurface Exploration

The field survey was performed on February 27, and 28 2020 by Terracon representatives, Staff Geologist Sean Vanderhoff. A summary of the karst features delineated during the field survey is presented by the **Karst Feature Inventory**. Survey results for the proposed parcels for solar development are discussed below.

During our field survey, 24 suspected features identified during desktop data review were confirmed and delineated as karst feature. In addition, 27 other features were identified and delineated during our field survey. The majority of the features identified were relatively broad, closed depressions, assumed to be mature sinkholes with soil-clogged throats, and surface water drainage with erosion rills.

Multiple closed depressions (F-1, F-3, F-7) identified on the parcel located to the west side of Tyree Chapel Road, were observed outside of the area proposed for array development. Two recently active sinkholes were identified at the parcel located to the west side of Tyree Chapel Road, designated F-2 and F-4. Feature F-2 was covered with vegetation and filled with soil and rock, located far west side of the site outside of the site. Feature F-4 was approximately 18 feet long, 10 feet wide, and 15 feet deep filled with debris. Based on the review of LIDAR generated 2-foot contour map, we identified a closed depression area (F-3) on the east side of the feature (F-2) during our desktop review. This feature (F-3) was confirmed and delineated as a closed depression area during our field survey.

We performed three ERI arrays on the parcel located to the west side of Tyree Chapel Road; ERI-1, 2, and 3. All three ERI lines indicated multiple anomalies indicating possible karst features. Based on the review of the ERI results and on-field observations, we proposed multiple locations for ATP exploration along the ERI lines at the west parcel. Based on ATP boring results, we

encountered voids within the underlying bedrock at boring locations B-1 (located on the south side of feature F-2) and B-3 (located within the feature F-4). The voids encountered at boring locations B-1 and B-3 were from 19 to 26 feet (7 feet void) and 16 to 22 feet (6 feet void) below the existing ground surface, respectively.

Figure 1: View of feature F-2 vegetated sinkhole filled with soil and rock located far west end of the project site

Figure 2: View of feature F-4, sinkhole filled with debris located on the west side of the project site

Figure 3: View of feature F-5 broad, flat-bottomed, closed depression with standing water located on the west side of the project site

The tree-covered area on the west side of the project area was outside of the primary area considered for the proposed array development. However, we had a general observation over this area during our site reconnaissance and identified a broad flat-bottomed closed depression area (F-7) on the west side of the tree covered area.

Figure 4. View of feature F-7 broad, flat-bottomed, closed depression on the west side of the tree-covered area

Figure 5: View of feature F-7 broad, flat-bottomed, closed depression on the west side of the tree-covered area

A broad flat-bottom closed depression area (F-12) and erosion rill (F-9) identified at the northeast corner of the site, was observed with standing water and appeared to be draining water from offsite. Exposed bedrock (F-10 & F-11) areas were observed at multiple locations within 1,000 feet on the west side of the depression area.

Figure 6: View of feature F-12 broad, flat-bottomed, closed depression on the northeast side of the project site


Figure 7, and 8: View of feature F-10 exposed bedrock and feature F-9 erosion rill draining water into the feature F-12 closed depression area on the northeast side of the project site

Based on the review of ***300 ACRE PV SITE LAYOUT.pdf*** provided by Mr. Rivera with OPDE Energy via email on March 6, 2020, the tree-covered area on the center of the project site was outside of the primary area considered for the proposed array development. Our desktop study indicated a closed depression area (F-25) with standing water and a couple of erosion rills (F-21 and F-22) on the northwest side of this area. We identified a two recently active sinkholes on the edge of the tree line during our site reconnaissance. One of the sinkholes (F-18) with a diameter of approximately 10 feet and a depth of about 8 feet, appears to be recently active with an open throat, fresh subsidence cracks, and erosion. The second sinkhole (F-19) was observed to have an open throat with exposed bedrock. Also, a relatively broad, closed depression, vegetated sinkhole was identified along the tree lines (F-20) right on the south side of the features F-18 and F-19.

We performed two ERI lines on the north-east side of this area; ERI -9 and 10. Based on the anomalies detected in our ERI study and the delineated karst features during our field survey, we performed four ATP borings along ERI-9 and 10 (B-7, 8, 11, and 12) to confirm the depth of bedrock and possible karst related feature developing in this area. The results of ERI and ATP explorations indicated the bedrock depth varies from about 8 feet at B-7 to about 34 feet below ground surface at B-8. Our ATP exploration results indicated a 1-foot thick void at boring location B-7 from 10 to 11 feet below the ground surface. Boring B-7 is located on the south of the feature F-22 which is an erosion rill draining surface water into the wooded area.

Figure 9: Aerial image of features F-17, F-18, F-19, and F-20.

Figure 10: View of feature F-18 a sinkhole with open throat and approximate dimension of 10 feet long, 10 feet wide, and 8 feet deep

Figure 11 & 12: View of feature F-19 a sinkhole with open throat and exposed bedrock at the bottom of the sinkhole

Figure 13: View of feature F-20 a broad, flat-bottomed, closed depression on the south side of the existing sinkholes

A recently active vegetated sinkhole (F-26) with open throat was identified toward the center of the project site, outside of the proposed area for development. The feature is covered with trees and tall vegetation. A heavily-eroded erosion ditch drains the surface water into the sinkhole.

Figure 14: View of feature F-26 a vegetated sinkhole with open throat with an erosion ditch heavily eroded and bare of vegetation.

Based on **National Wetland Inventory** database and review of LIDAR generated 2-foot contour map, there is a broad closed depression area that was designated as features F-30 and F-31 during our desktop study. The ground condition at this area appeared wet indicating water ponding during precipitation events. This area is located at southeast side of feature F-26 and was outside of the primary area considered for array development. We performed ERI-8 along feature F-26 through F-31. The results of ERI study indicated two anomalies at vicinity of the features F-26 and F-30. We performed three ATP borings along ERI-8 (B-13, 14, and 15) to explore the anomalies identified by the ERI. The results of ATP explorations indicated the bedrock depth varies from about 28 feet (B-13) to about 22 feet below ground surface (B-15). Our ATP borings did not encounter voids at these locations.

Figure 15: View of features F-30 and F-31 a broad closed depression with signs of holding water during precipitation events

On the south-central portion of the site, a sinkhole (F-35) that was not identified in desktop data review was delineated during the review of our ERI study results. The results for ERI-6 indicated eight anomalies over a length of about 710 ft starting from about 100 feet on the north side of B-24 and extending along ERI-6 for 710 ft toward north. The anomalies along ERI-6 extending to the depths of about 39 feet to below the depth of our exploration. Based on our site observations, feature F-35 is a closed depression with open throat with surface water drainage channel that flows into the feature has a dimension of about 180 ft by 220 ft and appears to be associated to the anomalies detected by ERI-6. The depth and extent of the throat could not be determined during site reconnaissance. Our ATP exploration results at boring locations B-19, 20, 21, 22, and B-24 indicated variable depth of the bedrock along ERI-6 varies from about 1.5 to 25 feet below the ground surface. Our ATP results indicated five voids within the underlying bedrock. The detected voids at B-19 and B-24 were 1 to 2 feet thick voids encountered at about 11 to 12 feet and 17 to 19 feet below the ground surface. Also, we encountered 5 feet thick voids at B-20 and B-21 at a depth about 32 to 27 feet, and 19 to 24 feet below the ground surface, respectively.

Figure 16: View of feature F-35 a sinkhole with open throat and surface water draining into it

The tree-covered area on the south-central side of the project area was outside of the primary area considered for the proposed array development. Our desktop study indicated possible erosion rills draining surface water through this area. During our site reconnaissance we identified an approximately 350 feet elongated feature (F-38) with apparent soil, rock, and debris fill and covered with trees and vegetation. Due to the thick vegetation, we were not able to completely delineate the feature. Nearby we identified another closed depression feature F-33 with diameter of about 155 feet on the north side of feature F-38. We performed ERI-7 along feature F-33 and F-38. The ERI results indicated a variable bedrock depth ranging between about 6 to 20 feet below the ground surface on the west side of feature F-37. ATP boring B-17 located at west side of feature 37 indicated three 2-foot thick voids within the underlying bedrock at depths of about 9 to 11 feet, 18 to 20 feet, and 30 to 32 feet below the ground surface.

Figure 17 and 18: View of feature F-38 a broad vegetated sinkhole

Near to the mid-point of ERI-13 on the south portion of the site, a sinkhole (F-39) was identified in desktop data review and delineated during the field work for ERI study. The results of ERI-13 identified an anomaly at vicinity of feature F-39 that starts at about 24 feet below the ground surface and extends to a depth of about 70 feet below the ground surface. The sinkhole had an open throat with surface water draining into the subsurface. The depth and extent of the sinkhole throat could not be determined during site reconnaissance. In addition, ERI study identified an approximately 100 feet long anomaly on the northwest side of the feature F-48 that extends below the depth of our exploration. The extent of the anomaly could not be estimated by ERI study results. Our ATP boring (B-23) at vicinity of this anomaly did not indicate any voids within underlying bedrock.


Figure 19, 20, and 21: View of feature F-39 a sinkhole with open throat and surface water draining into subsurface

During our desktop study, we identified a closed depression (F-51) within the tree-covered area outside of the area proposed for array development located on the south side of the project. Also, our desktop study indicated that the surface water drains into this area through a drainage channel (F-49) located on southwest side of this area. Because these features were outside of the area proposed for array development, we did not explore this area thoroughly during our site reconnaissance. During our limited reconnaissance on this area, we delineated a sinkhole (F-48) on the north side of this area. if this area would be considered for development, we recommend a thorough field reconnaissance be performed at this area to identify and delineate other potential karst activity.

Figure 22.: View of a karst features within the wooded area located outside of the area proposed for array development on the south side of the project site

Figure 23, and 24: View of feature F-48 a sinkhole features within the wooded area located outside of the area proposed for array development on the south side of the project site

SUBSURFACE EXPLORATION FINDINGS

The geophysical ERI arrays developed electrical resistivity profiles ranging between approximately 55 to 100 feet at the array mid-point. ATP borings were advanced to depths of approximately 17 to 47 feet below existing grade. Bedrock was encountered at depths of about 1½ to 34 feet below existing ground surface. All ATP locations were terminated upon encountering at least 10 feet of bedrock without indications of voids or soil filled seams that was.