DE Karn History of Construction
Bottom Ash Pond

Initial Compiled History Certification by Owner or Operator

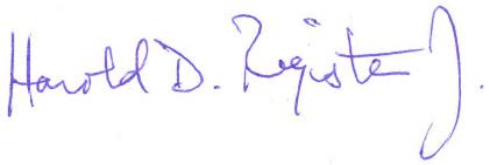
Contents

CERTIFICATION

Certification Statement by Owner or Operator

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this demonstration and all attached documents, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Consumers Energy Company



Signature

October 17, 2016

Date of Report Certification

Harold D. Register, Jr.

Name

1.0 INTRODUCTION

The United States Environmental Protection Agency (EPA) promulgated the Resource Conservation and Recovery Act (RCRA) Coal Combustion Residuals (CCR) Rule ("CCR RCRA Rule") on April 17, 2015. The CCR RCRA Rule requires that owners or operators of existing CCR surface impoundments with a height of five feet or more and a storage volume of 20 acre-feet or more compile a history of construction, which shall contain, to the extent feasible, the information specified in 40 CFR 257.73 (c)(1)(i) through (xii). The history of construction, and any revisions of it, as required by 40 CFR 257.73(c) shall be placed in the operating record and shall be maintained until the CCR unit completes closure of the unit in accordance with 40 CFR 257.102 [40 CFR 257.105(f)(9)].

2.0 40 CFR 257.73 (C)(1)(I)

The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.

Consumers Energy Company
Contact: Caleb Batts
2742 North Weadock Highway
Essexville, MI 48732

Name of CCR Unit: DE Karn Bottom Ash Pond
State Assigned Identification Number: None

3.0 40 CFR 257.73 (C)(1)(II)

The location of the CCR unit identified on the most recent U.S. Geological Survey (USGS) 7½ minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.

Figure 1 – Site Location Map presents the 7 ½ minute USGS quadrangle map Bay City NE, Michigan dated 2014. The location of the CCR unit is denoted on the map with the callout box – Site Location.

4.0 40 CFR 257.73 (C)(1)(III)

A statement of the purpose for which the CCR unit is being used.

According to the "*Potential Failure Mode Analysis (PFMA) Report*" prepared by AECOM (2009), DE Karn power generation facility consists of two coal-fired electric generating units that were put into service in 1959 (Unit 1) and 1961 (Unit 2), and two oil and gas co-fired units that were added in 1975 (Unit 3) and 1977 (Unit 4). The facility is bound by Saginaw Bay to the north and east, the Saginaw River to the west, and the former J.C. Weadock generation facility to the south.

An elevated trestle and pipe system hydraulically conveys sluiced bottom ash to the Bottom Ash Pond. Stored bottom ash is removed from the pond via mechanical equipment as required to maintain storage

capacity. When an overflow condition exists, water is discharged from the Bottom Ash Pond via one 24-inch diameter steel pipe into a series of ditches that convey the flow to the permitted National Pollutant Discharge Elimination System (NPDES) outfall.

5.0 40 CFR 257.73 (C)(1)(IV)

The name and size in acres of the watershed within which the CCR unit is located.

The CCR RCRA Rule requires the name and size (in acres) of the watershed within which the CCR surface impoundment is located. According to the EPA MyWATERS Mapper website (USEPA 2016), the CCR surface impoundment is located within the Walther Drain-Frontal Lake Huron Subwatershed, which encompasses approximately 15,250 acres.

6.0 40 CFR 257.73 (C)(1)(V)

A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed.

As part of a subsurface investigation and sampling program conducted by Golder in 2015 and 2016, soil samples were collected from adjacent locations and from beneath the Bottom Ash Pond, respectively. Sampling locations are visually depicted on **Figure 2** – Existing Conditions Site Map. Physical properties of the soil samples are demonstrated by data included in **Appendix A** – Soil Sample Data.

Engineering properties for the foundation and abutment materials were selected from Cone Penetrometer Test (CPT) correlations, field testing, and laboratory testing that supplemented the structural stability and factor of safety assessments for the Bottom Ash Pond. A portion of the engineering properties of the foundation and abutment materials are presented in the "*Structural Stability and Safety Factor Assessment Report*" (Golder 2016c). Additional engineering properties of the foundation and abutment materials are presented in the "*Summary of Monitoring Well Design, Installation, and Development, D.E. Karn Electric Generation Facility*" (ARCADIS 2016).

7.0 40 CFR 257.73 (C)(1)(VI)

A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; the method of site preparation and construction of each zone of the CCR unit; and the approximate dates of construction of each successive stage of construction of the CCR unit.

7.1 Physical and Engineering Properties

Golder sampled and tested the materials that exists in the exterior berm of the Bottom Ash Pond to gather subsurface information and develop certifications for the structural stability and factor of safety assessment. The physical properties are provided in **Appendix A** – Soil Sample Data. A portion of the

engineering properties of the foundation and abutment materials are presented in the "*Structural Stability and Safety Factor Assessment Report*" (Golder 2016c). Additional engineering properties of the foundation and abutment materials are presented in the "*Summary of Monitoring Well Design, Installation, and Development, D.E. Karn Electric Generation Facility*" (ARCADIS 2016).

7.2 Site Preparation and Construction

Site drawings and historical aerial photographs from 1957, 1959 and 1963 included in the PFMA Report (AECOM 2009) were reviewed, and the following sequence of construction was developed:

- Based on a historical photo from 1957 which depicts the J. C. Weadock facility prior to the construction of the DE Karn facility, original dike structures at the facility were constructed at some time after 1957 and before 1959, when the DE Karn facility was placed in service. The ash disposal area was developed by reclaiming land from Saginaw Bay through the construction of a series of breakwater and perimeter dikes and in-filling with miscellaneous fill (AECOM 2009).
- A historical aerial photograph from 1963 depicts a discharge trestle which conveys ash to the area currently occupied by the Bottom Ash Pond (AECOM 2009).
- In a site development specifications drawing from 1985, the area of the current Bottom Ash Pond is identified as the "Karn Bottom Ash Storage Area". It appears that the Bottom Ash Storage Area is bound on the north by a dike and bound on all other sides by the extent of the historic shoreline.

The site drawings contained no details regarding site construction methods for the Bottom Ash Pond, perimeter dike, and associated foundations.

8.0 40 CFR 257.73 (C)(1)(VII)

At a scale that details engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment, and any identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation.

Golder developed the following figures, which are attached hereto, for the Bottom Ash Pond at DE Karn:

- Figure 2 – Existing Conditions Site Map
- Figure 3 – Bottom Ash Pond Characterization Cross Section A-A'

Cross sections were developed based on an EES Survey (May 2016) and subsurface data collected and interpreted by Golder in 2015 and 2016. These cross sections are not intended to illustrate

a comprehensive conceptual site model representing all data that may be available for the Bottom Ash Pond.

9.0 40 CFR 257.73 (C)(1)(VIII)

A description of the type, purpose, and location of existing instrumentation.

The CCR RCRA Rule requires that a description of the type, purpose, and location of existing instrumentation be provided. Golder included the locations of the known instruments on **Figure 2** – Existing Conditions Site Map.

CEC retained ARCADIS to install RCRA monitoring wells to characterize groundwater quality conditions in the vicinity of the Bottom Ash Pond. The description and location of this existing instrumentation can be found in the "*Summary of Monitoring Well Design, Installation, and Development, DE Karn Electric Generation Facility*" (ARCADIS 2016).

10.0 40 CFR 257.73 (C)(1)(IX)

Area-capacity curves for the CCR unit.

Area capacity curves for the Bottom Ash Pond were calculated by Golder using survey data collected by EES in May 2016. The area capacity curves are included in the "*Inflow Design Flood Control System Plan"* completed by Golder for Pond A (Golder 2016b).

11.0 40 CFR 257.73 (C)(1)(X)

A description of each spillway and diversion design features and capacities and calculations used in their determination.

11.1 Spillway and Diversion Description

Based on the "*Annual RCRA CCR Surface Impoundment Inspection Report*" completed by Golder for the Bottom Ash Pond (Golder 2016), an elevated trestle and pipe system hydraulically conveys sluiced bottom ash to the Bottom Ash Pond. Water is discharged from the pond via one 24-inch steel outflow pipe within the berm into a series of ditches that convey the flow to the NPDES outfall location.

Diversion is provided by the perimeter berm, minimum elevation of 598.00 (NAVD 88) (Golder 2016b), which surrounds the Bottom Ash Pond.

11.2 Capacities and Calculations

Capacities and calculations regarding the spillway and diversion features can be found in Golder's "*Inflow Design Flood Control System Plan*" for the Bottom Ash Pond (2016b).

12.0 40 CFR 257.73 (C)(1)(XI)

The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.

12.1 Construction Specifications

Construction specifications are detailed on drawings included in the PFMA Report (AECOM 2009).

12.2 Surveillance, Maintenance, and Repair

The December 2010 "*Coal Ash Landfill Surveillance and Monitoring Program"* (SMP) (CEC 2010) outlines CEC's surveillance, maintenance, and repair program specific to each CCR surface impoundment at JH Campbell. Beginning in October 2015, Pond A was inspected by a qualified individual at least weekly and by a qualified professional engineer (QPE) annually in accordance with the CCR RCRA Rule.

13.0 40 CFR 257.73 (C)(1)(XII)

Any record or knowledge of structural instability of the CCR unit.

Weekly inspections of the facility are performed by qualified individuals to detect potentially hazardous conditions or structural weakness per the CCR RCRA Rule and documented internally on CCR Weekly Inspection Observations Forms. Annual inspections at the facility have been performed by AECOM (2009a, 2012), Barr Engineering (2014), and Golder (2016, 2016a).

14.0 ATTACHMENTS

Figure 1 – Site Location Map

Figure 2 – Existing Conditions Site Map

Figure 3 – Bottom Ash Pond Characterization Cross Section A-A'

Appendix A – Soil Sample Data

15.0 REFERENCES

AECOM (2009). "*Potential Failure Mode Analysis (PFMA) Report, D.E. Karn Generating Facility Ash Dike Assessment*."

AECOM (2009a). "*Inspection Report D.E. Karn Generating Facility Ash Dike Risk Assessment, Essexville, MI*."

AECOM (2012). "*D.E. Karn Ash Disposal Area 2012 Ash Dike Risk Assessment Final Inspection Report.*"

ARCADIS (2016). "*Summary of Monitoring Well Design, Installation, and Development, D.E. Karn Electric Generation Facility*."

Barr Engineering (2014). "*D.E. Karn Generating Facility Triennial Ash Dike Risk Assessment Report – Spring 2014*."

Consumers Energy (2010). "*Coal Ash Landfill Surveillance and Monitoring Program*."

Golder Associates (2016). "*D.E. Karn Bottom Ash Pond, Annual RCRA CCR Surface Impoundment Inspection Report – January 2016*."

Golder Associates (2016a). "*D.E. Karn Bottom Ash Pond Annual Inspection Report*."

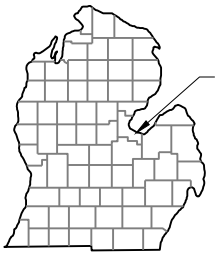
Golder Associates (2016b). "*D.E. Karn Generating Facility Bottom Ash Pond Inflow Design Flood Control System Plan*."

Golder Associates (2016c). "*D.E. Karn Generating Facility Bottom Ash Pond Structural Stability and Safety Factor Assessment Report*."

USEPA 40 CFR Parts 257 and 261; Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, (2015). Environmental Protection Agency, Washington D.C. epa.gov.

USEPA MyWATERS Mapper (2016). https://watersgeo.epa.gov/mwm.

FIGURES



MICHIGAN COUNTIES
NOT TO SCALE

REFERENCE(S)
BASE MAP TAKEN FROM USGS 7.5 MINUTE QUADRANGLE
BAY CITY NE, MICHIGAN
DATED 2014

0 1000 2000 3000
SCALE FEET

CLIENT
CONSUMERS ENERGY COMPANY
2742 NORTH WEADOCK HIGHWAY
ESSEXVILLE, MI. 48732

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-09-12
DESIGNED	MAL
PREPARED	MAL
REVIEWED	JTT
APPROVED	JRP

PROJECT
D.E. KARN HISTORY OF CONSTRUCTION

TITLE
SITE LOCATION MAP

PROJECT NO. 1655284
REV. ----
FIGURE 1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

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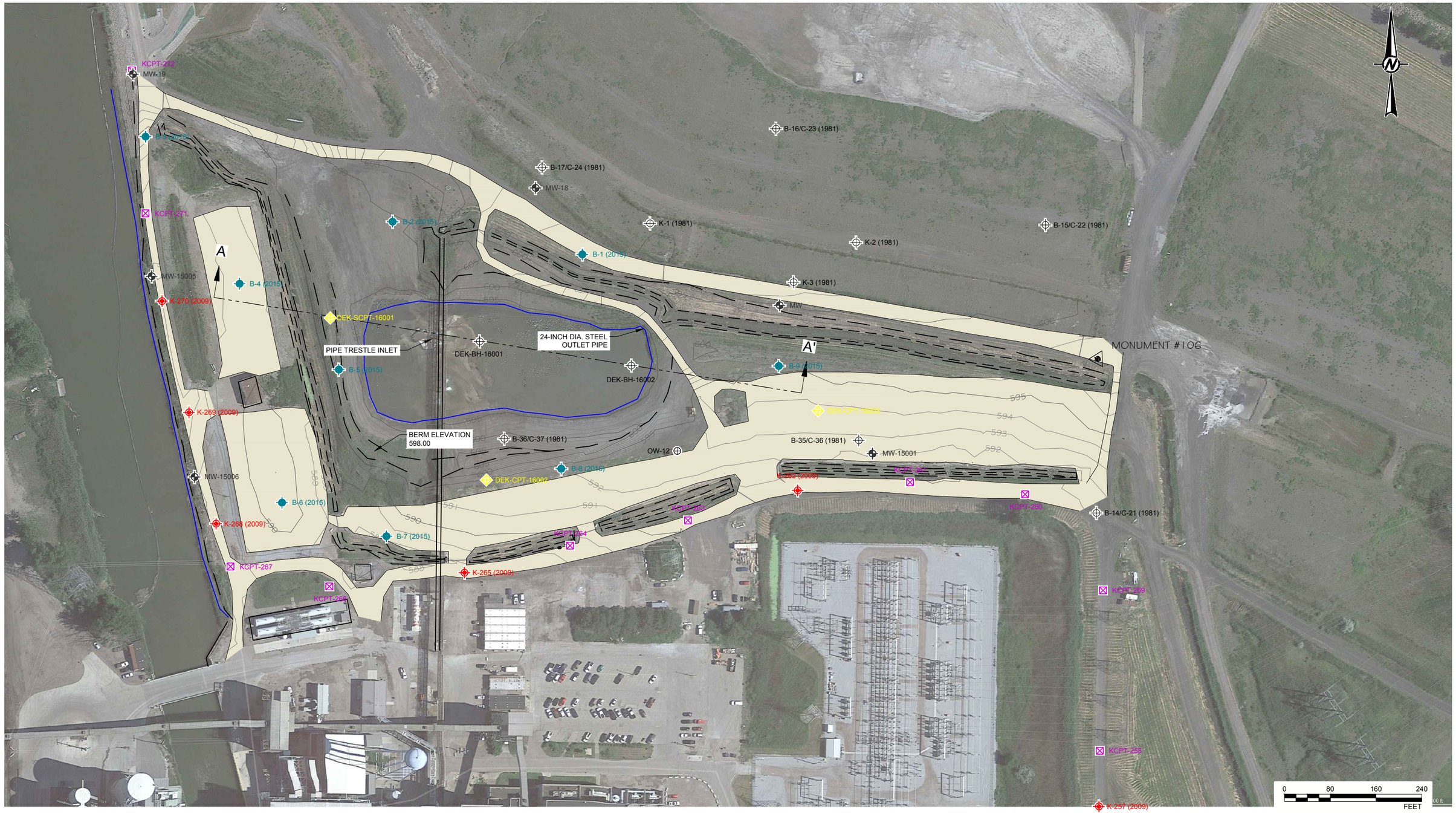


LEGEND

B-35/C-36 (1981)	HISTORIC BOREHOLE/ CPT
K-262 (2009)	HISTORIC AECOM BOREHOLE/ CPT
B-9 (2015)	GOLDER BOREHOLE
DEK-CPT-16003	HISTORIC CONETEC PIEZOCONE PENETRATION TESTING (CPT)
KCPT	HISTORIC CPT LOCATION (BY AECOM, 2009)

GV GAS VALVE	
LIGHT POLE	
POWER POLE	
POST (WOOD/METAL)	

GRAVEL SURFACE / TRAVELED PATHWAY	
ASPHALT SURFACE	
CONCRETE SURFACE	

Elec	OVERHEAD ELECTRIC LINE
GAS	ABOVE GROUND GAS LINE
Storm	UNDERGROUND STORM LINE
	TOP OF BANK
	TOE OF SLOPE

CLIENT
CONSUMERS ENERGY COMPANY
2742 NORTH WEADOCK HIGHWAY
ESSEXVILLE, MI. 48732

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-09-23
DESIGNED	MJ
PREPARED	CMN
REVIEWED	JRP
APPROVED	MAB

PROJECT
D.E. KARN HISTORY OF CONSTRUCTION

TITLE
EXISTING CONDITIONS

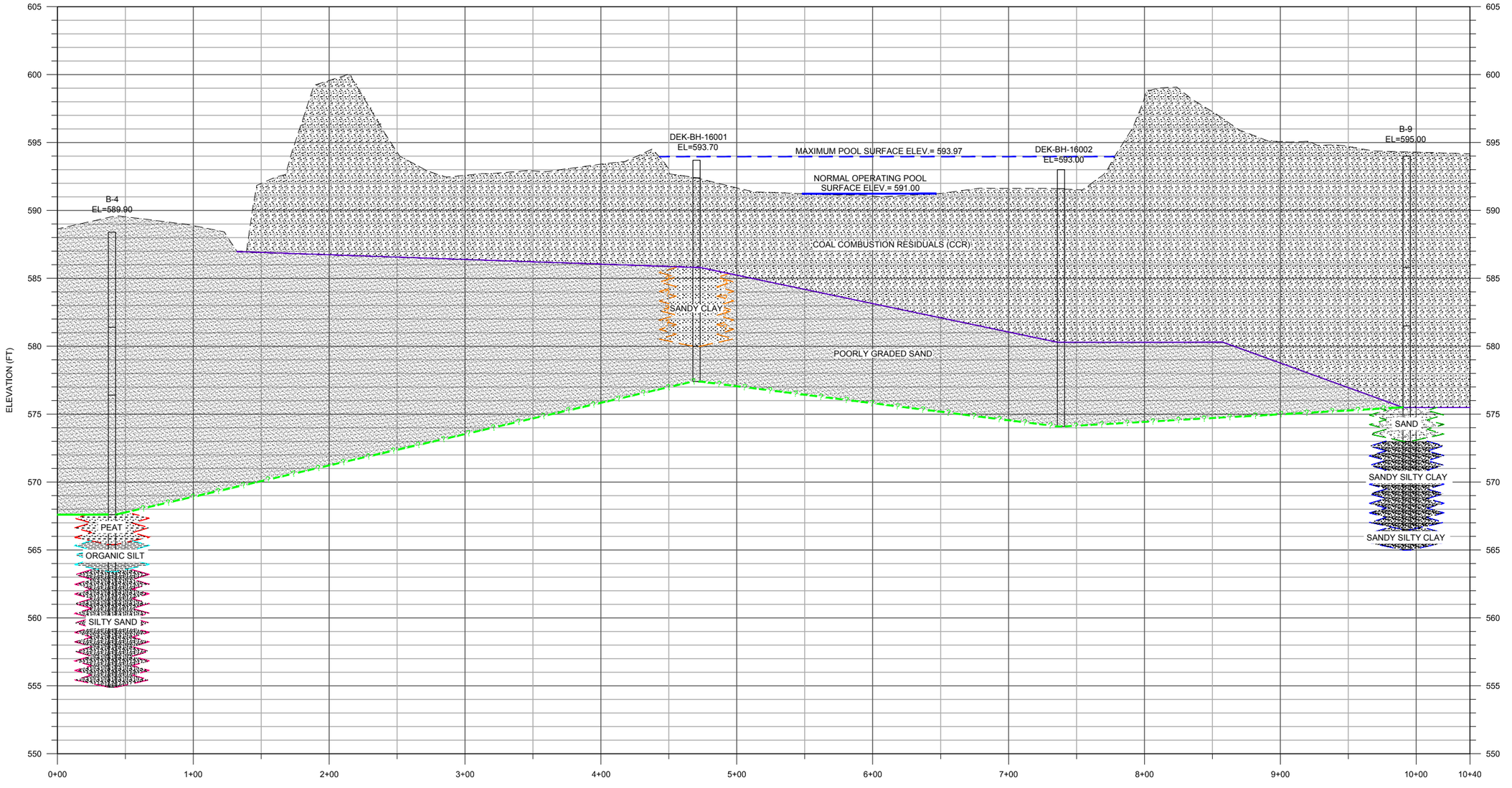
PROJECT NO.	REV.	FIGURE
1655284	----	2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

1 in

0

Path: \\sacramento\acad\Sites_Work for Other Offices\1655284_DE Karn Bottom Ash Pond\CIVIL 3D\History of Construction\ | File Name: 1655284_HOC Figures.dwg



A-A'

LEGEND

- COAL COMBUSTION RESIDUALS (CCR)
- SANDY CLAY
- POORLY GRADED SAND
- BASE OF CCR
- BASE OF SANDY CLAY
- BASE OF POORLY GRADED SAND
- MAXIMUM POOL SURFACE ELEVATION
- NORMAL OPERATING POOL SURFACE ELEVATION
- SAND
- PEAT
- ORGANIC SILT
- SILTY SAND
- SANDY SILTY CLAY

VERTICAL SCALE: 0 40 80 120 SCALE FEET

HORIZONTAL SCALE: 0 60 120 180 SCALE FEET

CLIENT
CONSUMERS ENERGY COMPANY
2742 NORTH WEADOCK HIGHWAY
ESSEXVILLE, MI. 48732

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-09-23
DESIGNED	MJ
PREPARED	CMN
REVIEWED	JRP
APPROVED	MAB

PROJECT
D.E. KARN HISTORY OF CONSTRUCTION

TITLE
BOTTOM ASH POND CHARACTERIZATION CROSS SECTION A-A'

PROJECT NO.	REV.	FIGURE
1655284	----	3

APPENDIX A
SOIL SAMPLE DATA

Golder Associates

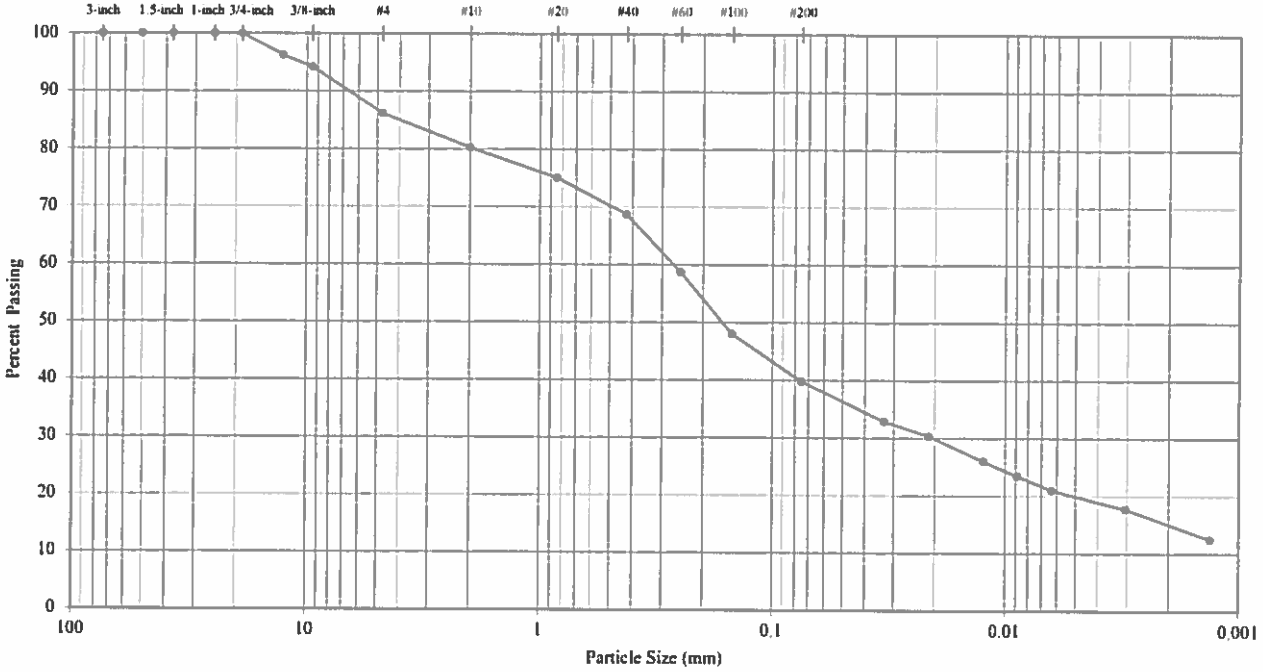
May-16

165-5284

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

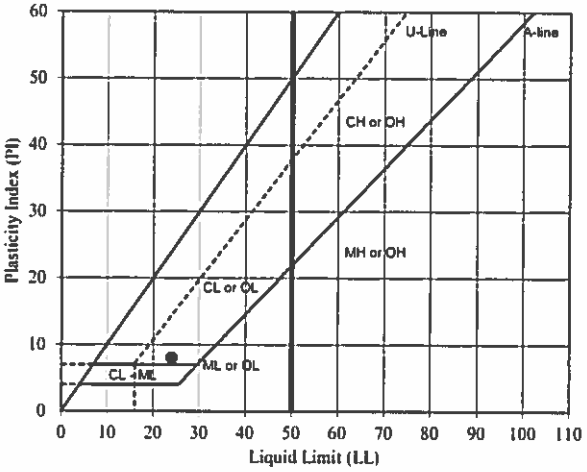
ASTM D421, D422, D4318

PROJECT NAME: DE Karn Ash Pond Characterization
SAMPLE ID: DEK BII-16001 S-4 DEPTH (ft): 7.2
TYPE: Jar



Sieve	Particle Size (mm)	% Passing	Description	Percentage	
3-inch	75.0	100.0	Cobbles	0.00	
2-inch	50.8	100.0	Coarse Gravel	0.00	13.82
1.5-inch	37.5	100.0			
1-inch	25.0	100.0			
3/4-inch	19.0	100.0			
1/2-inch	12.7	96.3	Fine Gravel	13.82	
3/8-inch	9.5	94.2			
#4	4.75	86.2			
#10	2.0	80.2	Coarse Sand	5.95	46.41
#20	0.85	75.0	Medium Sand	11.56	
#40	0.425	68.7			
#60	0.25	58.7	Fine Sand	28.90	
#100	0.15	48.0			
#200	0.075	39.8			
Hydrometer Analysis	0.033	32.9	Silt or Clay Fines	39.76	
	0.021	30.3			
	0.012	26.0			
	0.009	23.4			
	0.006	21.0			
	0.003	17.7			
	0.001	12.5			

Sieve Analysis (Initial Separation on No. 4 Sieve)



LL	PL	PI	LI
24	16	8	0.16

USCS Description (ASTM D 2487):
Brownish gray, CLAYEY SAND, some gravel

As-Received Moisture Content (%): 17.3

USCS Group Symbol: SC

Notes: (1) Particle size analysis sample Mechanically dispersed using Stirring Apparatus A for about 1 Minute.
(2) Sample prepared for Atterberg Limits testing by the dry method. Material retained on No. 40 sieve removed from Atterberg Limits sample by dry sieving. Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using manual device.

TECH	DW
DATE	5/25/2016
CHECK	BS
REVIEW	JSIT

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	D.E. Karn Ash Pond Characterization	**SAMPLE ID**	DEK-BH-16001 S-5
PROJECT NO.	165-5284	**SAMPLE TYPE**	Jar
REMARKS		**SAMPLE DEPTH (ft)**	13.5

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	34.66
Wt Dry Soil & Tare (gm)	(w2)	31.26
Weight of Tare (gm)	(w3)	14.03
Weight of Water (gm)	(w4=w1-w2)	3.40
Weight of Dry Soil (gm)	(w5=w2-w3)	17.23
Moisture Content (%)	(w4/w5)*100	19.73

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	1.00
Dry Soil & Tare (gm)	1.00
Tare Weight (gm)	0.00
Moisture Content (%)	0.00%

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	618.95
	Tare Weight (gm)	317.89
(W6)	Total Dry Weight (gm)	301.06

SIEVE ANALYSIS

Tare Weight: 317.89

	Wt Ret +Tare	Cum. Ret. (Wt-Tare) (dry)	Cumulative (%Retained) ((wt ret/w6)*100)	% PASS (100-%ret)	SIEVE	
3.0"	317.89	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	317.89	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	317.89	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	317.89	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	317.89	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	317.89	0.00	0.00	100.00	0.75"	fine gravel
0.50"	317.89	0.00	0.00	100.00	0.50"	fine gravel
0.375"	317.89	0.00	0.00	100.00	0.375"	fine gravel
#4	318.06	0.17	0.06	99.94	#4	coarse sand
#10	320.47	2.58	0.86	99.14	#10	medium sand
#20	326.32	8.43	2.80	97.20	#20	medium sand
#40	355.05	37.16	12.34	87.66	#40	fine sand
#60	466.00	148.11	49.20	50.80	#60	fine sand
#100	583.53	265.64	88.23	11.77	#100	fine sand
#200	616.78	298.89	99.28	0.72	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.06
% C SAND	0.80
% M SAND	11.49
% F SAND	86.94
% FINES	0.72
% TOTAL	100.00

Descriptive Terms		
trace	0 to 5%	> 10% mostly coarse (c)
little	5 to 12%	> 10% mostly medium (m)
some	12 to 30%	< 10% fine (c-m)
and	30 to 50%	< 10% coarse (m-f)
		< 10% coarse and fine (m)
		< 10% coarse and medium (f)
		> 10% equal amounts each (c-f)

LL	-
PL	-
PI	-
Gs	-

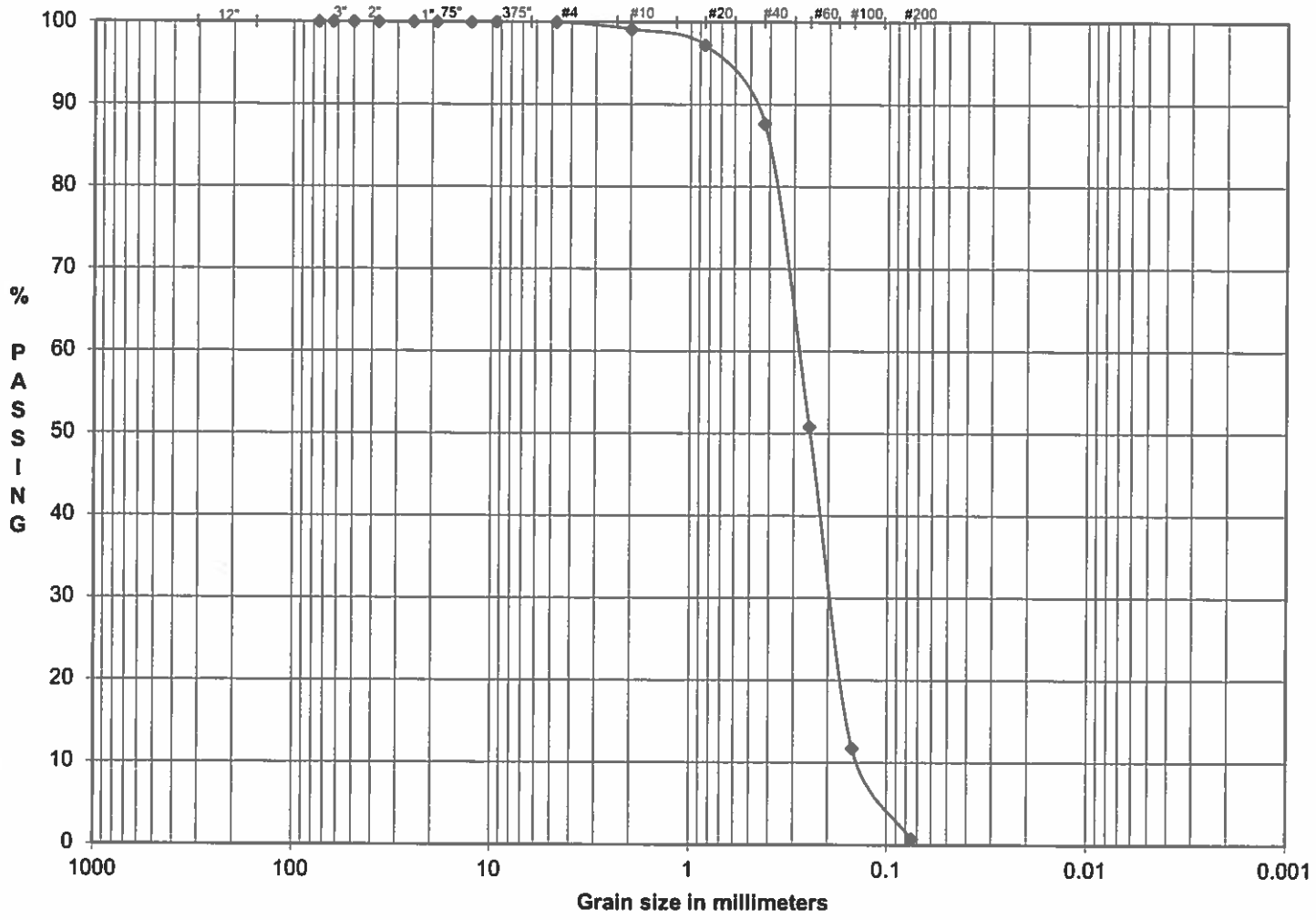
DESCRIPTION: Brown, POORLY GRADED SAND, trace gravel, trace fines

USCS: SP

TECH	DF
DATE	5/26/2016
CHECK	BS
REVIEW	BSJT

**** material finer than #4 sieve corrected for hygroscopic moisture.***

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	GRAVEL		SAND			FINES
	0.00	0.00	0.06	0.80	11.49	86.94	0.72
		0.06		99.22			

SAMPLE ID	DEK-BH-16001 S-5
SAMPLE TYPE	Jar
SAMPLE DEPTH (ft)	13.5

LL	-
PL	-
PI	-

DESCRIPTION	Brown, POORLY GRADED SAND, trace gravel, trace fines
USCS	SP

TECH	DF
DATE	5/26/2016
CHECK	
REVIEW	

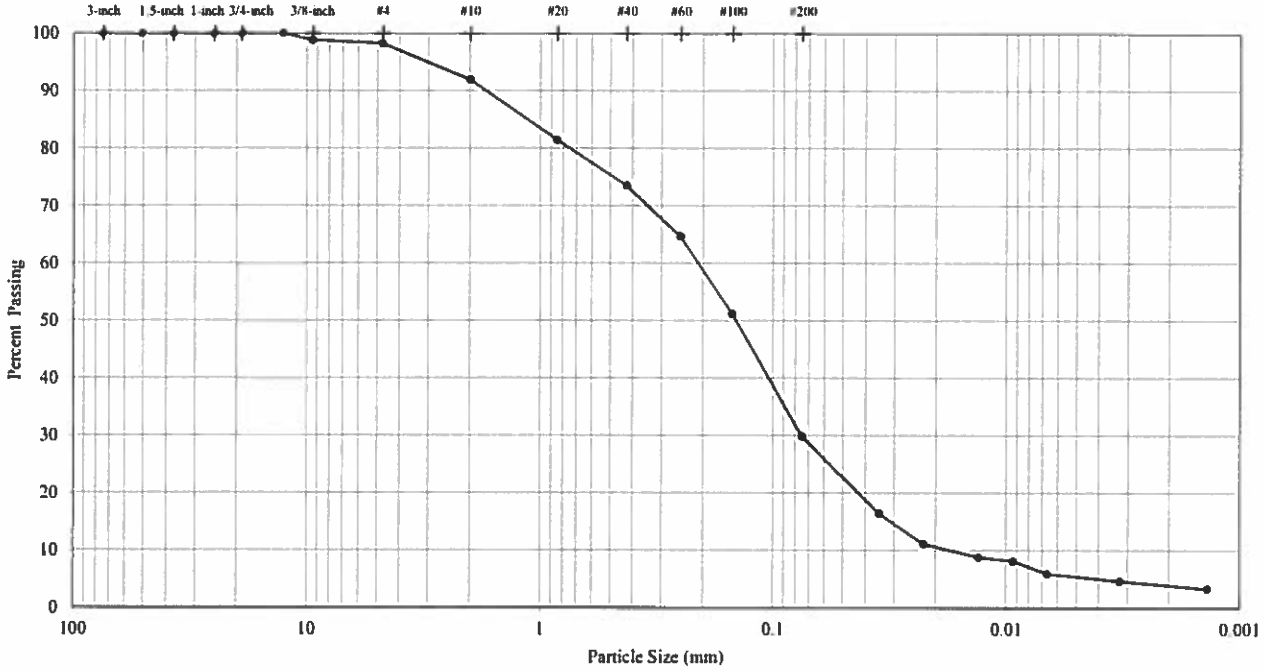
Golder Associates

May-16 165-5284

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

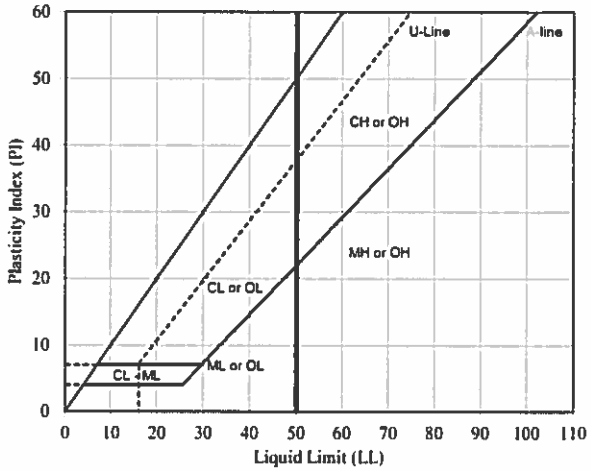
ASTM D421, D422, D4318

PROJECT NAME: DE Karn Ash Pond Characterization
SAMPLE ID: DEK BH-16002 S-2 DEPTH (ft): 7.0
TYPE: Jar



Sieve	Particle Size (mm)	% Passing	Description	Percentage	
3-inch	75.0	100.0	Cobbles	0.00	
2-inch	50.8	100.0	Coarse Gravel	0.00	1.82
1.5-inch	37.5	100.0			
1-inch	25.0	100.0			
3/4-inch	19.0	100.0			
1/2-inch	12.7	100.0	Fine Gravel	1.82	
3/8-inch	9.5	98.8			
#4	4.75	98.2			
#10	2.0	91.9	Coarse Sand	6.29	68.34
#20	0.85	81.4	Medium Sand	18.43	
#40	0.425	73.5			
#60	0.25	64.6	Fine Sand	43.62	
#100	0.15	51.2			
#200	0.075	29.8			
Hydrometer Analysis	0.035	16.5	Silt or Clay Fines	29.84	
	0.023	11.1			
	0.013	8.8			
	0.009	8.2			
	0.007	5.9			
	0.003	4.6			
	0.001	3.3			

Sieve Analysis (Initial Separation on No. 4 Sieve)



LL	PL	PI	LI
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As-Received Moisture Content (%): 69.7

USCS Group Symbol: -

Visual Description:
Very dark gray, CCR, trace gravel

Notes: (1) Particle size analysis sample Mechanically dispersed using Stirring Apparatus A for about 1 Minute.

(2) Sample prepared for Atterberg Limits testing by the dry method. Material retained on No. 40 sieve removed from Atterberg Limits sample by dry sieving. Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using manual device.

TECH	DW
DATE	5/24/2016
CHECK	
REVIEW	

Golder Associates

March-15

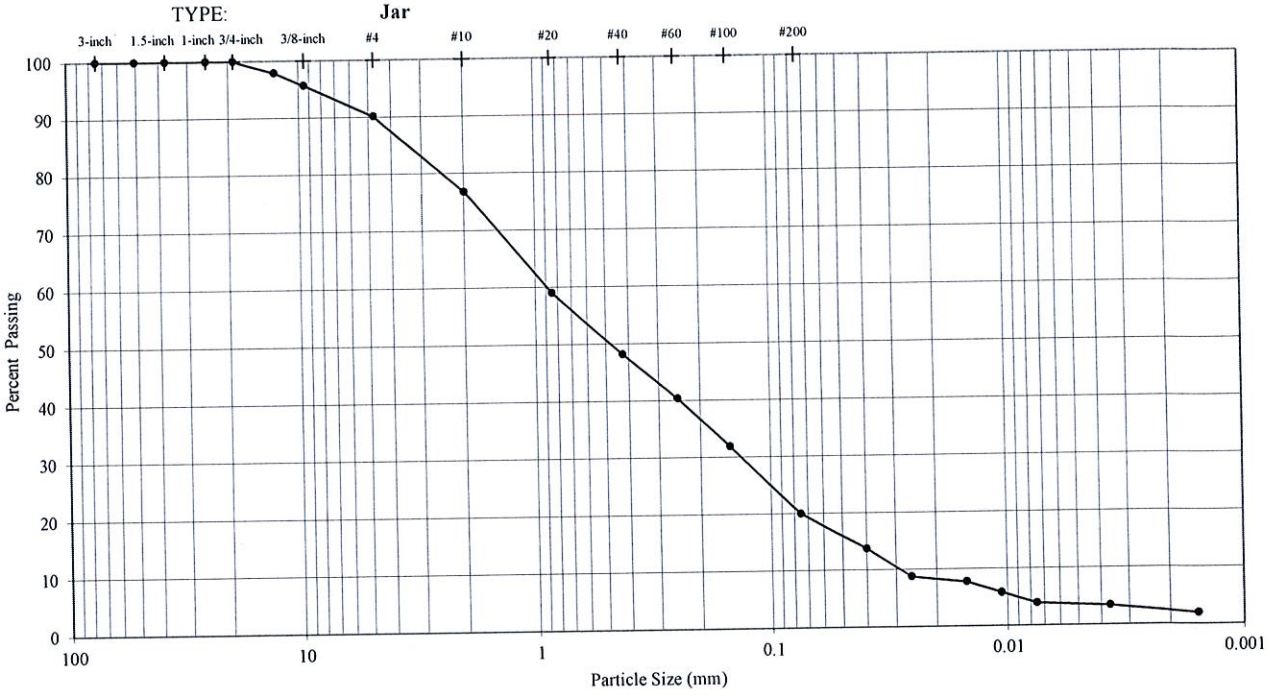
152-4652

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **D.E. Karn**
SAMPLE ID: **B-1**
TYPE: **Jar**

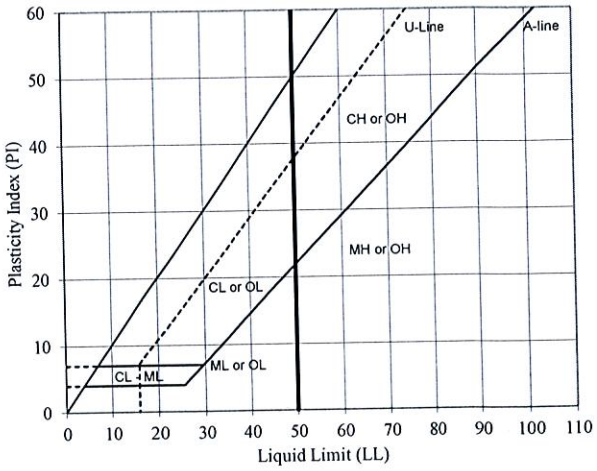
DEPTH (ft): **9.5-10.0**



Sieve	Particle Size (mm)	% Passing	Description	Percentage	
3-inch	75.0	100.0	Cobbles	0.00	
2-inch	50.8	100.0	Coarse Gravel	0.00	9.85
1.5-inch	37.5	100.0			
1-inch	25.0	100.0			
3/4-inch	19.0	100.0			
1/2-inch	12.7	97.9	Fine Gravel	9.85	
3/8-inch	9.5	95.7			
#4	4.75	90.2			
#10	2.0	76.8	Coarse Sand	13.36	70.16
#20	0.85	59.0	Medium Sand	28.59	
#40	0.425	48.2			
#60	0.25	40.4	Fine Sand	28.21	
#100	0.15	31.9			
#200	0.075	20.0			
	0.040	13.7	Silt or Clay Fines	20.00	
	0.026	8.8			
	0.015	7.8			
	0.011	5.9			
	0.008	4.0			
	0.004	3.4			
	0.002	2.0			

Sieve Analysis (Initial Separation on No. 4 Sieve)

Hydrometer Analysis



LL	PL	PI	LI
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Visual Description:

Very dark gray, BOTTOM ASH

As-Received Moisture Content (%): **16.2**

USCS Group Symbol: **-**

Notes: (1) Particle size analysis sample Mechanically dispersed using Stirring Apparatus A for about 1 Minute.

(2) Sample prepared for Atterberg Limits testing by the dry method. Material retained on No. 40 sieve removed from Atterberg Limits sample by dry sieving. Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using manual device.

TECH	HD
DATE	3/16/2015
CHECK	
REVIEW	

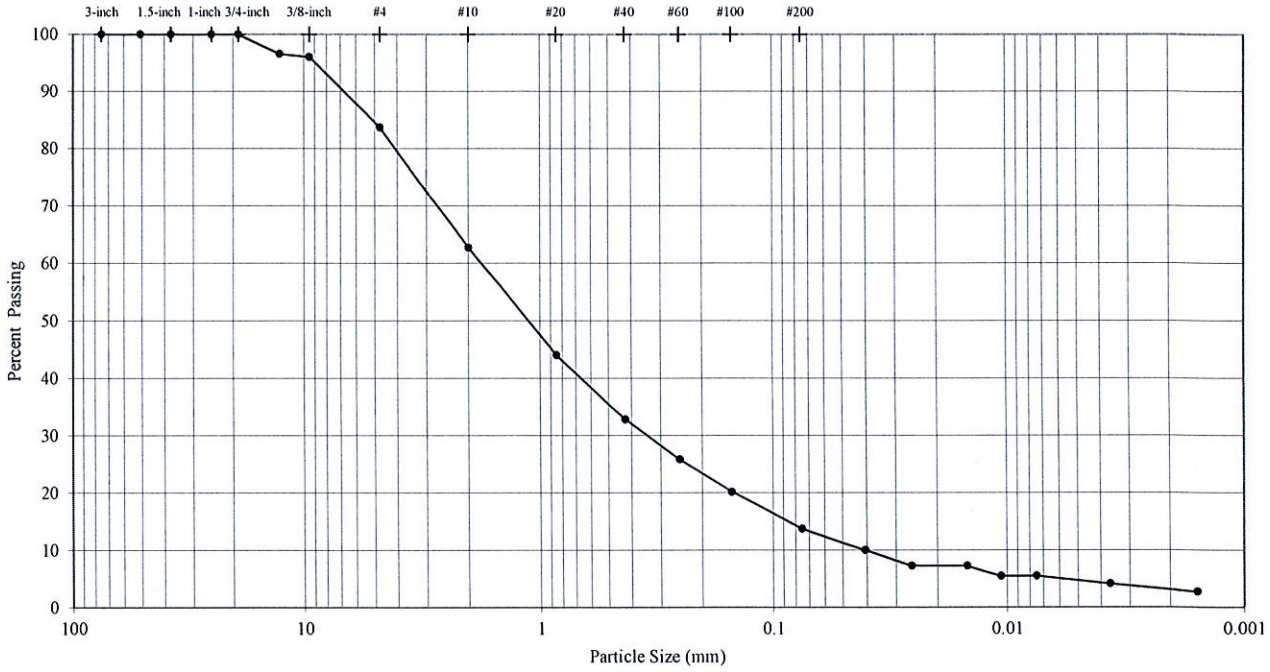
Golder Associates

March-15 152-4652

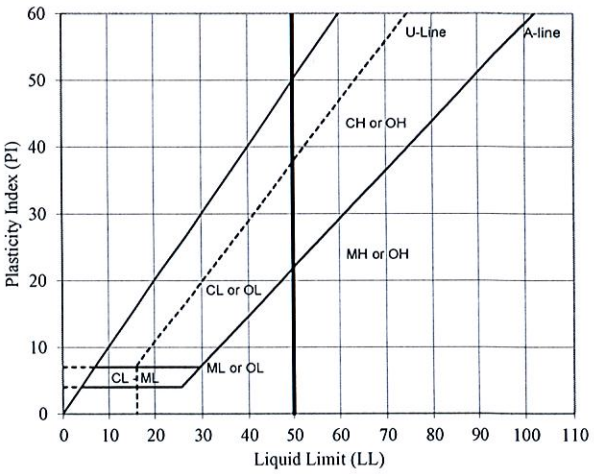
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **D.E. Karn**
SAMPLE ID: **B-1** DEPTH (ft): **13.5-14.5**
TYPE: **Jar**



	Sieve	Particle Size (mm)	% Passing	Description	Percentage	
Sieve Analysis (Initial Separation on No. 4 Sieve)	3-inch	75.0	100.0	Cobbles	0.00	
	2-inch	50.8	100.0	Coarse Gravel	0.00	16.34
	1.5-inch	37.5	100.0			
	1-inch	25.0	100.0			
	3/4-inch	19.0	100.0			
	1/2-inch	12.7	96.6	Fine Gravel	16.34	
	3/8-inch	9.5	96.1			
	#4	4.75	83.7			
	#10	2.0	62.7	Coarse Sand	21.00	69.92
	#20	0.85	44.0	Medium Sand	29.83	
	#40	0.425	32.8			
	#60	0.25	25.8	Fine Sand	19.09	
	#100	0.15	20.2			
	#200	0.075	13.7			
Hydrometer Analysis		0.041	10.0	Silt or Clay Fines	13.74	
		0.026	7.3			
		0.015	7.3			
		0.011	5.5			
		0.007	5.5			
		0.004	4.1			
		0.002	2.8			



LL	PL	PI	LI
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Visual Description:
Very dark gray, BOTTOM ASH

As-Received Moisture Content (%): 23.7

USCS Group Symbol: -

Notes: (1) Particle size analysis sample Mechanically dispersed using Stirring Apparatus A for about 1 Minute.

(2) Sample prepared for Atterberg Limits testing by the dry method. Material retained on No. 40 sieve removed from Atterberg Limits sample by dry sieving. Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using manual device.

TECH	HD
DATE	3/16/2015
CHECK	PJ
REVIEW	CAS

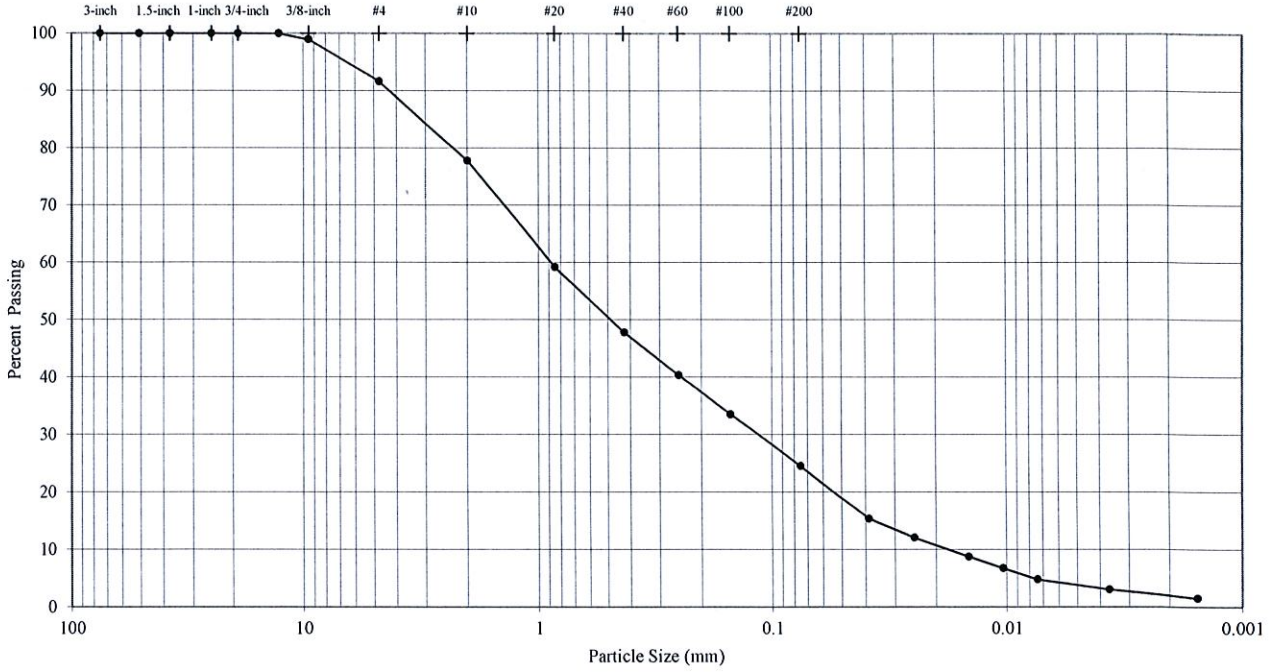
Golder Associates

March-15 152-4652

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

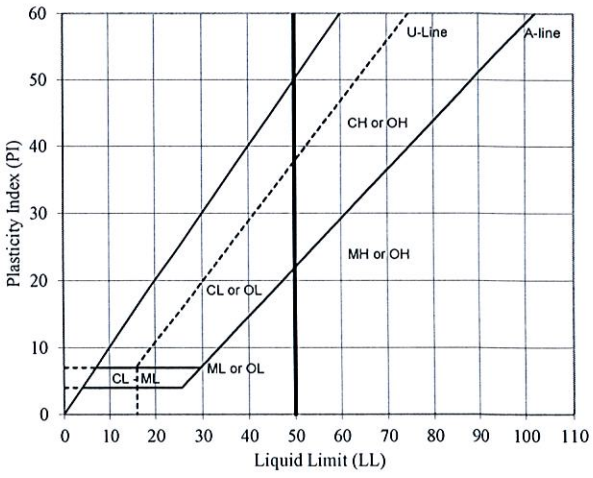
PROJECT NAME: **D.E. Karn**
SAMPLE ID: **B-1** DEPTH (ft): **18.5-20.0**
TYPE: **Jar**



Sieve	Particle Size (mm)	% Passing	Description	Percentage	
3-inch	75.0	100.0	Cobbles	0.00	
2-inch	50.8	100.0	Coarse Gravel	0.00	8.37
1.5-inch	37.5	100.0			
1-inch	25.0	100.0			
3/4-inch	19.0	100.0			
1/2-inch	12.7	100.0	Fine Gravel	8.37	
3/8-inch	9.5	98.9			
#4	4.75	91.6			
#10	2.0	77.8	Coarse Sand	13.85	67.09
#20	0.85	59.2	Medium Sand	30.02	
#40	0.425	47.8			
#60	0.25	40.3	Fine Sand	23.23	
#100	0.15	33.5			
#200	0.075	24.5			
	0.039	15.4	Silt or Clay Fines	24.54	
	0.025	12.1			
	0.015	8.8			
	0.010	6.8			
	0.007	4.8			
	0.004	3.1			
	0.002	1.5			

Sieve Analysis (Initial Separation on No. 4 Sieve)

Hydrometer Analysis



Visual Description:

Very dark grayish brown, BOTTOM ASH

LL	PL	PI	LI
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As-Received Moisture Content (%): **24.6**

USCS Group Symbol: **-**

Notes: (1) Particle size analysis sample Mechanically dispersed using Stirring Apparatus A for about 1 Minute.

(2) Sample prepared for Atterberg Limits testing by the dry method. Material retained on No. 40 sieve removed from Atterberg Limits sample by dry sieving. Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using manual device.

TECH	HD
DATE	3/9/2015
CHECK	
REVIEW	GRS

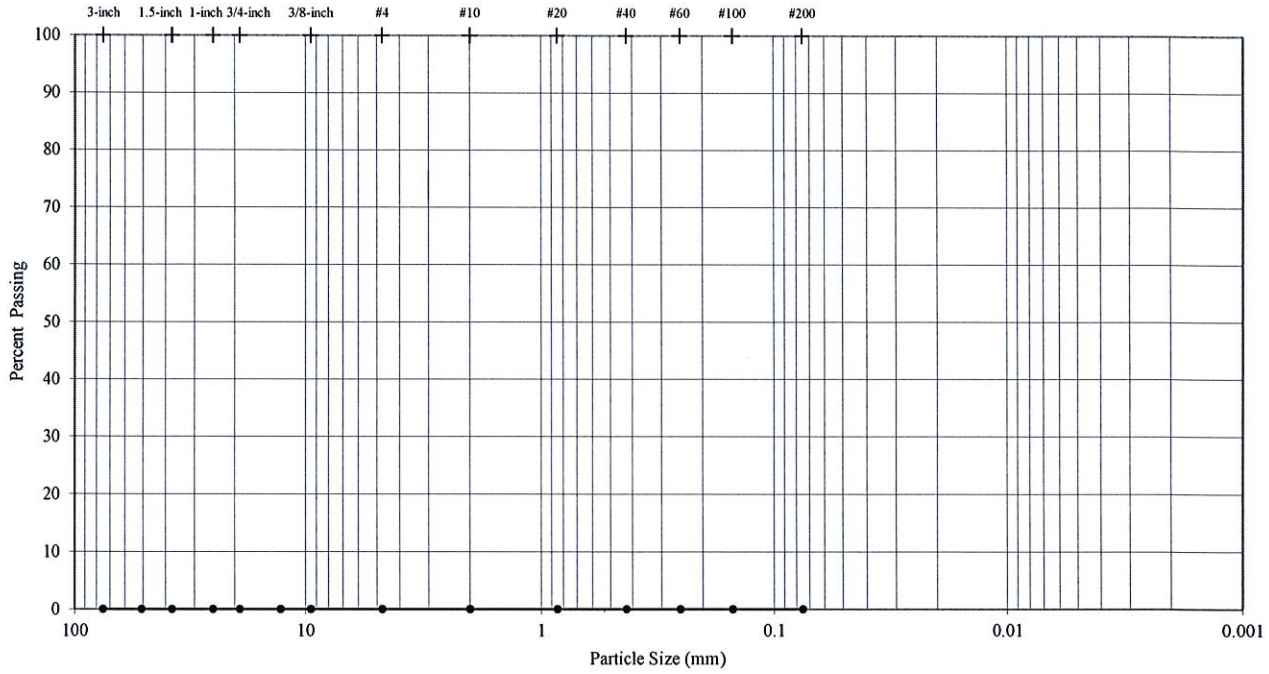
Golder Associates

March-15 152-4652

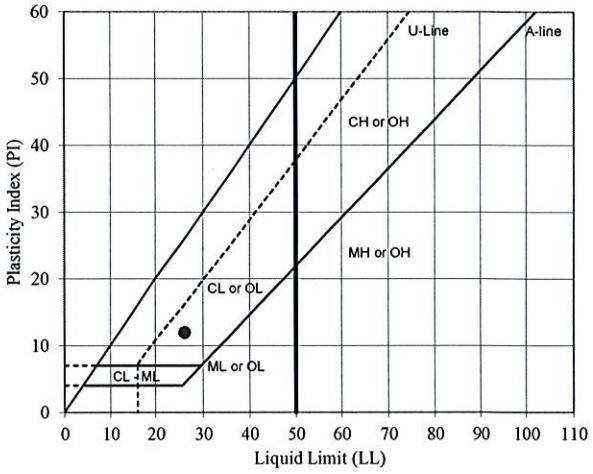
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **D.E. Karn**
SAMPLE ID: **B-1** DEPTH (ft): **39.3-40.0**
TYPE: **Jar**



	Sieve	Particle Size (mm)	% Passing	Description	Percentage	
Sieve Analysis (Initial Separation on No. 4 Sieve)	3-inch	75.0	-	Cobbles	-	
	2-inch	50.8	-	Coarse Gravel	-	-
	1.5-inch	37.5	-			
	1-inch	25.0	-			
	3/4-inch	19.0	-			
	1/2-inch	12.7	-	Fine Gravel	-	
	3/8-inch	9.5	-			
	#4	4.75	-			
	#10	2.0	-	Coarse Sand	-	-
	#20	0.85	-	Medium Sand	-	
	#40	0.425	-			
	#60	0.25	-	Fine Sand	-	
	#100	0.15	-			
	#200	0.075	-			
Hydrometer Analysis		-	-	Silt or Clay Fines	-	
		-	-			
		-	-			
		-	-			
		-	-			
		-	-			
		-	-			



Visual Description:

Grayish brown, CLAY

LL	PL	PI	LI
26	14	12	0.03

As-Received Moisture Content (%): 14.4

USCS Group Symbol: CL

Notes: (1) Particle size analysis sample Mechanically dispersed using Stirring Apparatus A for about 1 Minute.

(2) Sample prepared for Atterberg Limits testing by the dry method. Material retained on No. 40 sieve removed from Atterberg Limits sample by dry sieving. Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using manual device.

TECH	HD
DATE	3/12/2015
CHECK	
REVIEW	

Golder Associates

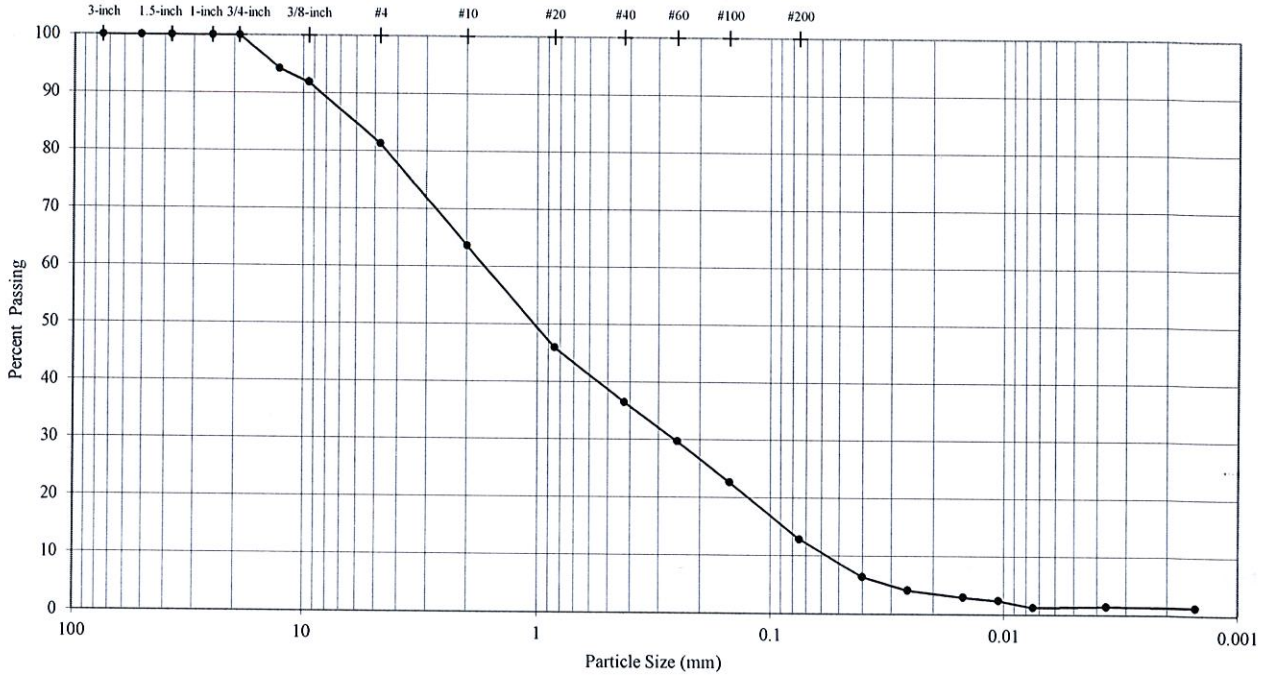
March-15

152-4652

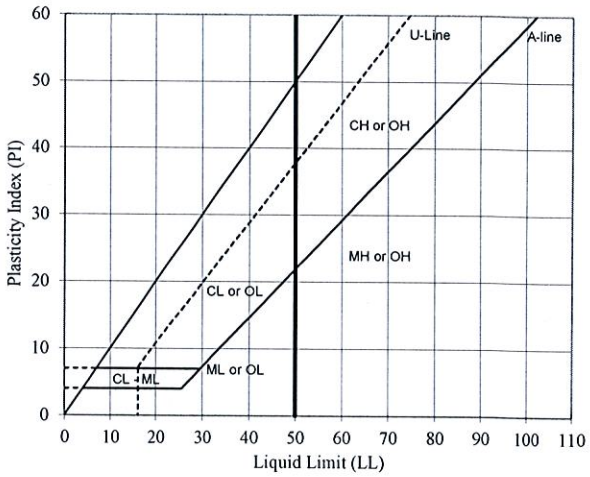
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **D.E. Karn**
SAMPLE ID: **B-2**
TYPE: **Jar**
DEPTH (ft): **18.5-20.0**



	Sieve	Particle Size (mm)	% Passing	Description	Percentage	
Sieve Analysis (Initial Separation on No. 4 Sieve)	3-inch	75.0	100.0	Cobbles	0.00	
	2-inch	50.8	100.0	Coarse Gravel	0.00	18.72
	1.5-inch	37.5	100.0			
	1-inch	25.0	100.0			
	3/4-inch	19.0	100.0			
	1/2-inch	12.7	94.3	Fine Gravel	18.72	
	3/8-inch	9.5	91.9			
	#4	4.75	81.3			
	#10	2.0	63.6	Coarse Sand	17.65	68.45
	#20	0.85	46.0	Medium Sand	27.17	
	#40	0.425	36.5			
	#60	0.25	29.7	Fine Sand	23.63	
	#100	0.15	22.6			
	#200	0.075	12.8			
Hydrometer Analysis		0.040	6.4	Silt or Clay Fines	12.83	
		0.026	4.1			
		0.015	3.0			
		0.011	2.4			
		0.007	1.3			
		0.004	1.5			
		0.002	1.3			



Visual Description:

Black, BOTTOM ASH

LL	PL	PI	LI
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As-Received Moisture Content (%): **18.7**

USCS Group Symbol: **-**

Notes: (1) Particle size analysis sample Mechanically dispersed using Stirring Apparatus A for about 1 Minute.

(2) Sample prepared for Atterberg Limits testing by the dry method. Material retained on No. 40 sieve removed from Atterberg Limits sample by dry sieving. Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using manual device.

TECH	HD
DATE	3/9/2015
CHECK	RDS
REVIEW	GKS

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	D.E. Karn Ash Tank	**SAMPLE ID**	B-2
PROJECT NO.	152-4652	**SAMPLE TYPE**	Jar
REMARKS		**SAMPLE DEPTH**	26.0'-27.5'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	336.71
Wt Dry Soil & Tare (gm)	(w2)	280.90
Weight of Tare (gm)	(w3)	52.05
Weight of Water (gm)	(w4=w1-w2)	55.81
Weight of Dry Soil (gm)	(w5=w2-w3)	228.85
Moisture Content (%)	(w4/w5)*100	24.39

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	1.00
Dry Soil & Tare (gm)	1.00
Tare Weight (gm)	0.00
Moisture Content (%)	0.00%

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	280.90
	Tare Weight (gm)	52.05
(W6)	Total Dry Weight (gm)	228.85

SIEVE ANALYSIS

Tare Weight: 52.06

	Wt Ret +Tare	Cum. Ret. (Wt-Tare) (dry)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	52.06	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	52.06	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	52.06	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	52.06	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	52.06	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	52.06	0.00	0.00	100.00	0.75"	fine gravel
0.50"	52.06	0.00	0.00	100.00	0.50"	fine gravel
0.375"	52.06	0.00	0.00	100.00	0.375"	fine gravel
#4	52.06	0.00	0.00	100.00	#4	coarse sand
#10	52.71	0.65	0.28	99.72	#10	medium sand
#20	54.24	2.18	0.95	99.05	#20	medium sand
#40	59.82	7.76	3.39	96.61	#40	fine sand
#60	76.18	24.12	10.54	89.46	#60	fine sand
#100	190.58	138.52	60.53	39.47	#100	fine sand
#200	269.13	217.07	94.85	5.15	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.00
% C SAND	0.28
% M SAND	3.11
% F SAND	91.46
% FINES	5.15
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

LL	-
PL	-
PI	-
Gs	-

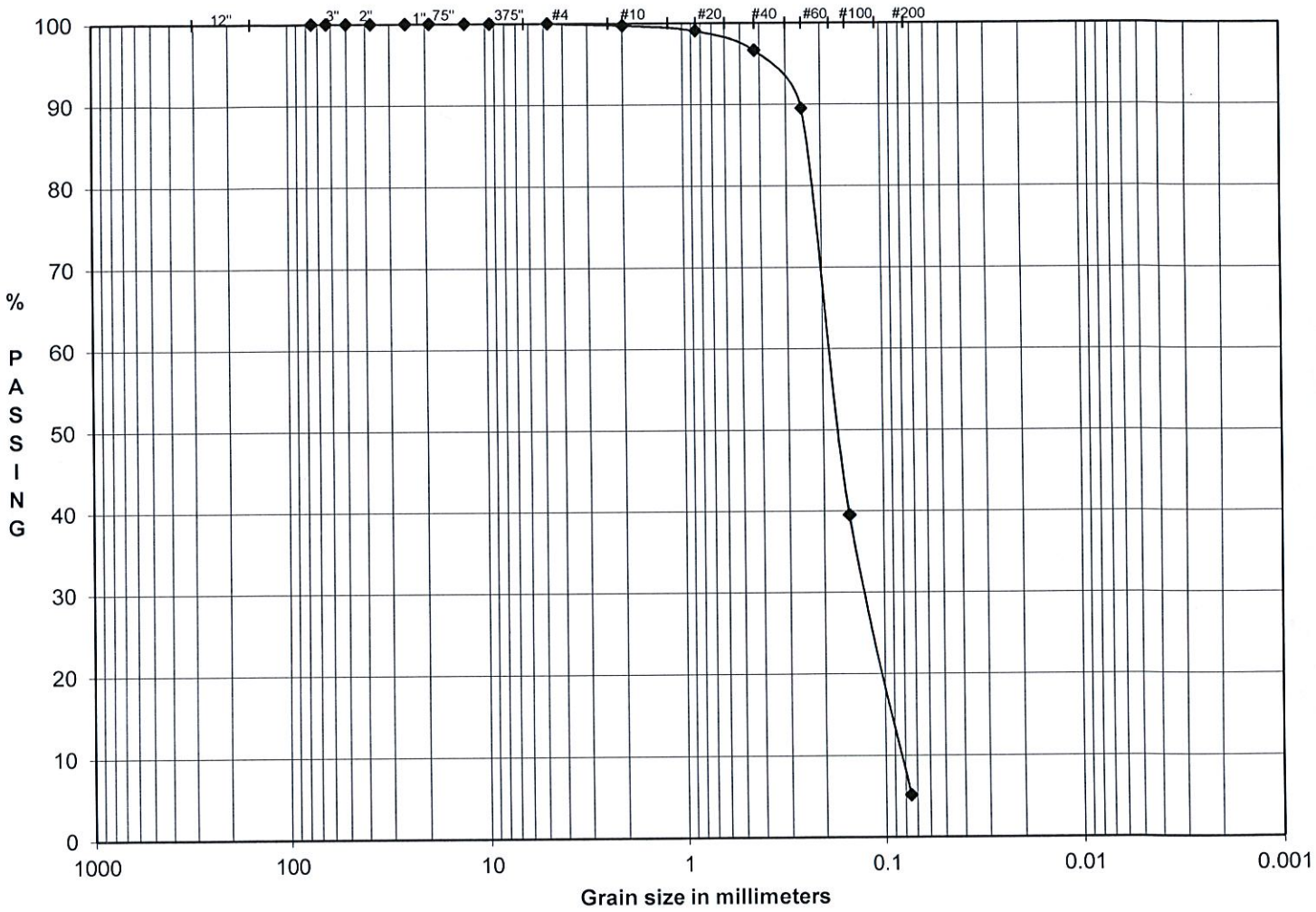
DESCRIPTION Light brown, POORLY GRADED SAND WITH SILT

USCS SP-SM

TECH	HD
DATE	3/9/2015
CHECK	PS
REVIEW	GRS

** material finer than #4 sieve corrected for hygroscopic moisture.*

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	GRAVEL		SAND			FINES
	0.00	0.00	0.00	0.28	3.11	91.46	5.15
		0.00		94.85			

SAMPLE ID	B-2
SAMPLE TYPE	Jar
SAMPLE DEPTH	26.0'-27.5'

LL	-
PL	-
PI	-

DESCRIPTION	Light brown, POORLY GRADED SAND WITH SILT
USCS	SP-SM

TECH	HD
DATE	3/9/2015
CHECK	DS
REVIEW	GAS

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	D.E. Karn Ash Tank	**SAMPLE ID**	B-4
PROJECT NO.	152-4652	**SAMPLE TYPE**	Jar
REMARKS		**SAMPLE DEPTH**	28.5'-30.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	292.73
Wt Dry Soil & Tare (gm)	(w2)	252.17
Weight of Tare (gm)	(w3)	51.65
Weight of Water (gm)	(w4=w1-w2)	40.56
Weight of Dry Soil (gm)	(w5=w2-w3)	200.52
Moisture Content (%)	(w4/w5)*100	20.23

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	1.00
Dry Soil & Tare (gm)	1.00
Tare Weight (gm)	0.00
Moisture Content (%)	0.00%

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	252.17
	Tare Weight (gm)	51.65
(W6)	Total Dry Weight (gm)	200.52

SIEVE ANALYSIS

Tare Weight: 51.57

	Wt Ret +Tare	Cum. Ret. (Wt-Tare) (dry)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	51.67	0.10	0.05	99.95	3.0"	coarse gravel
2.5"	51.67	0.10	0.05	99.95	2.5"	coarse gravel
2.0"	51.67	0.10	0.05	99.95	2.0"	coarse gravel
1.5"	51.67	0.10	0.05	99.95	1.5"	coarse gravel
1.0"	51.67	0.10	0.05	99.95	1.0"	coarse gravel
0.75"	51.67	0.10	0.05	99.95	0.75"	fine gravel
0.50"	51.67	0.10	0.05	99.95	0.50"	fine gravel
0.375"	51.67	0.10	0.05	99.95	0.375"	fine gravel
#4	51.67	0.10	0.05	99.95	#4	coarse sand
#10	52.08	0.51	0.25	99.75	#10	medium sand
#20	52.42	0.85	0.42	99.58	#20	medium sand
#40	53.50	1.93	0.96	99.04	#40	fine sand
#60	65.61	14.04	7.00	93.00	#60	fine sand
#100	141.68	90.11	44.94	55.06	#100	fine sand
#200	201.13	149.56	74.59	25.41	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.00
% C SAND	0.20
% M SAND	0.71
% F SAND	73.62
% FINES	25.41
% TOTAL	99.95

Descriptive Terms		
trace	0 to 5%	
little	5 to 12%	
some	12 to 30%	
and	30 to 50%	

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

LL	-
PL	-
PI	-
Gs	-

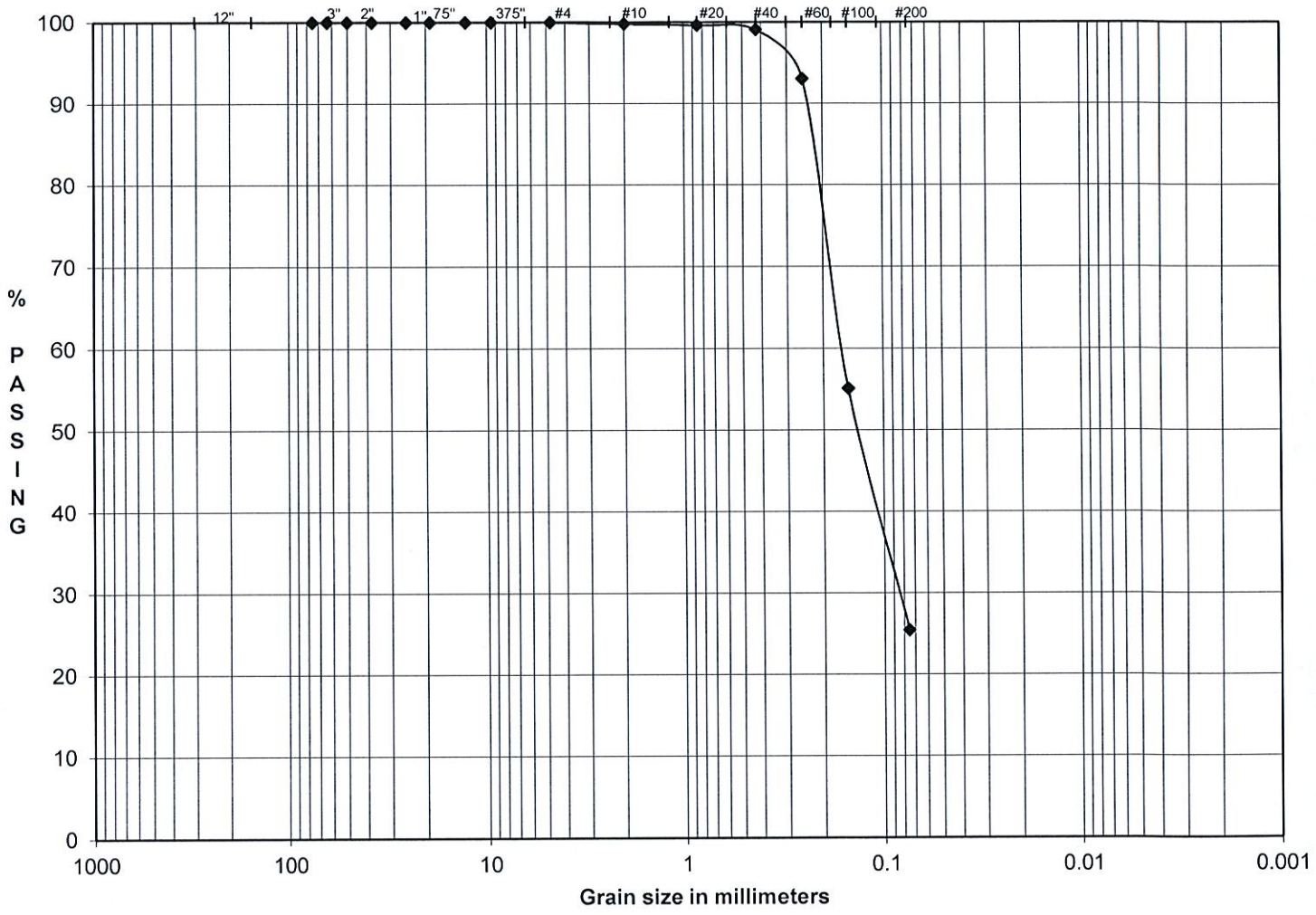
VISDUAL DESCRIPTION: Light brown, SILTY SAND

USCS: SM

TECH	HD
DATE	3/9/2015
CHECK	TDS
REVIEW	GRS

** material finer than #4 sieve corrected for hygroscopic moisture.*

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	GRAVEL		SAND			FINES
	0.00	0.00	0.00	0.20	0.71	73.62	25.41
		0.00		74.54			

SAMPLE ID	B-4
SAMPLE TYPE	Jar
SAMPLE DEPTH	28.5'-30.0'

LL	-
PL	-
PI	-

VISUAL DESCRIPTION	Light brown, SILTY SAND
USCS	SM

TECH	HD
DATE	3/9/2015
CHECK	RS
REVIEW	RS

Golder Associates

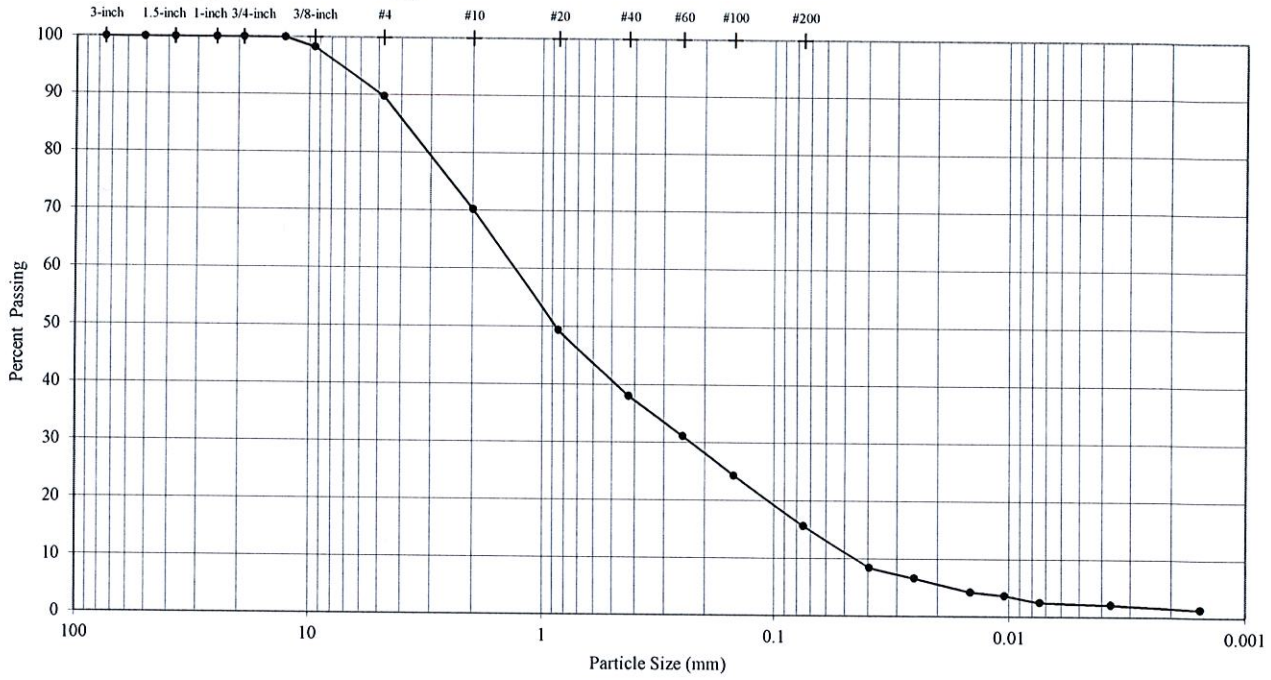
March-15

152-4652

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

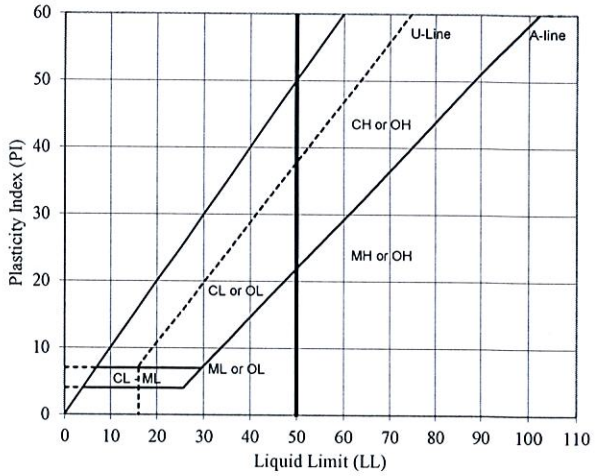
PROJECT NAME: **D.E. Karn**
SAMPLE ID: **B-5**
TYPE: **Jar**
DEPTH (ft): **13.5-15.0**



Sieve	Particle Size (mm)	% Passing	Description	Percentage	
3-inch	75.0	100.0	Cobbles	0.00	
2-inch	50.8	100.0	Coarse Gravel	0.00	10.26
1.5-inch	37.5	100.0			
1-inch	25.0	100.0			
3/4-inch	19.0	100.0			
1/2-inch	12.7	100.0	Fine Gravel	10.26	
3/8-inch	9.5	98.3			
#4	4.75	89.7			
#10	2.0	70.2	Coarse Sand	19.58	74.09
#20	0.85	49.4	Medium Sand	32.10	
#40	0.425	38.1			
#60	0.25	31.1	Fine Sand	22.41	
#100	0.15	24.3			
#200	0.075	15.6			
	0.040	8.5	Silt or Clay Fines	15.65	
	0.025	6.7			
	0.015	4.3			
	0.010	3.7			
	0.007	2.5			
	0.004	2.1			
	0.002	1.4			

Sieve Analysis (Initial Separation on No. 4 Sieve)

Hydrometer Analysis



Visual Description:

Very dark grayish brown, BOTTOM ASH

LL	PL	PI	LI
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As-Received Moisture Content (%): **24.8**

USCS Group Symbol: **-**

Notes: (1) Particle size analysis sample Mechanically dispersed using Stirring Apparatus A for about 1 Minute.

(2) Sample prepared for Atterberg Limits testing by the dry method. Material retained on No. 40 sieve removed from Atterberg Limits sample by dry sieving. Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using manual device.

TECH	HD
DATE	3/9/2015
CHECK	
REVIEW	

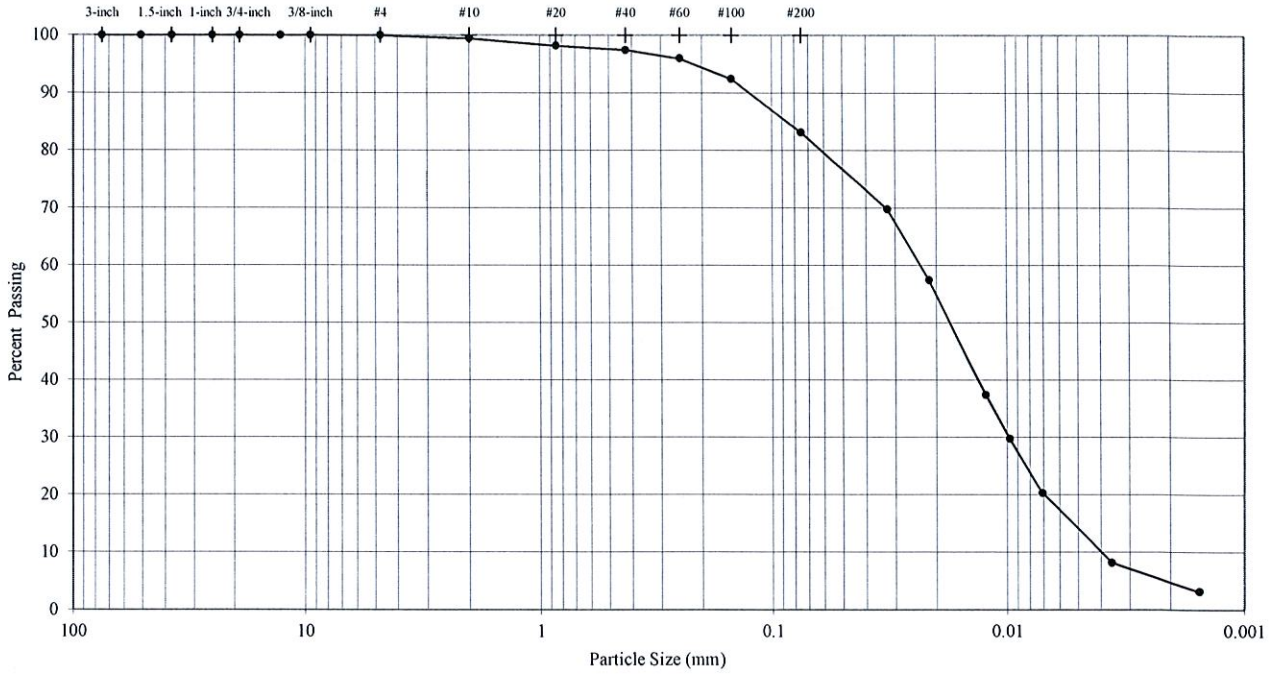
Golder Associates

March-15 152-4652

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

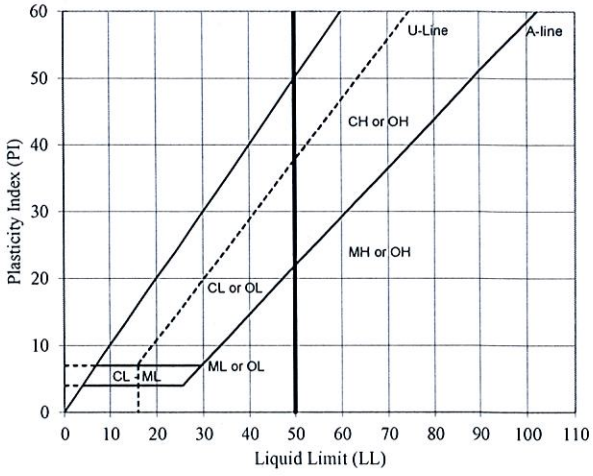
ASTM D421, D422, D4318

PROJECT NAME: **D.E. Karn**
SAMPLE ID: **B-5** DEPTH (ft): **18.5-20.0**
TYPE: **Jar**



Sieve	Particle Size (mm)	% Passing	Description	Percentage	
3-inch	75.0	100.0	Cobbles	0.00	
2-inch	50.8	100.0	Coarse Gravel	0.00	0.00
1.5-inch	37.5	100.0			
1-inch	25.0	100.0			
3/4-inch	19.0	100.0			
1/2-inch	12.7	100.0	Fine Gravel	0.00	
3/8-inch	9.5	100.0			
#4	4.75	100.0			
#10	2.0	99.4	Coarse Sand	0.55	16.84
#20	0.85	98.2	Medium Sand	2.01	
#40	0.425	97.4			
#60	0.25	96.0	Fine Sand	14.28	
#100	0.15	92.4			
#200	0.075	83.2			
Hydrometer Analysis	0.032	69.8	Silt or Clay Fines	83.16	
	0.022	57.4			
	0.012	37.4			
	0.010	29.7			
	0.007	20.3			
	0.004	8.2			
	0.002	3.2			

Sieve Analysis (Initial Separation on No. 4 Sieve)



Visual Description:

Dark gray, FLY ASH

LL	PL	PI	LI
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As-Received Moisture Content (%): **58.4**

USCS Group Symbol: **-**

Notes: (1) Particle size analysis sample Mechanically dispersed using Stirring Apparatus A for about 1 Minute.

(2) Sample prepared for Atterberg Limits testing by the dry method. Material retained on No. 40 sieve removed from Atterberg Limits sample by dry sieving. Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using manual device.

TECH	HD
DATE	3/9/2015
CHECK	DJS
REVIEW	GRS

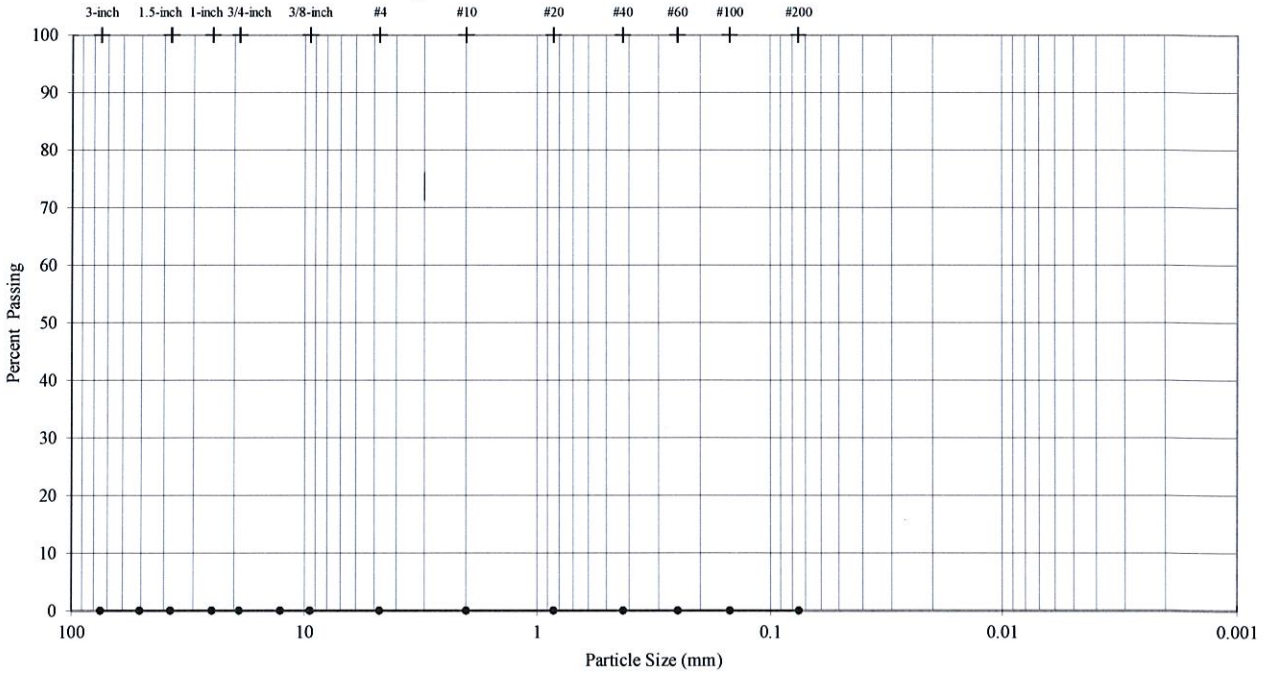
Golder Associates

March-15 152-4652

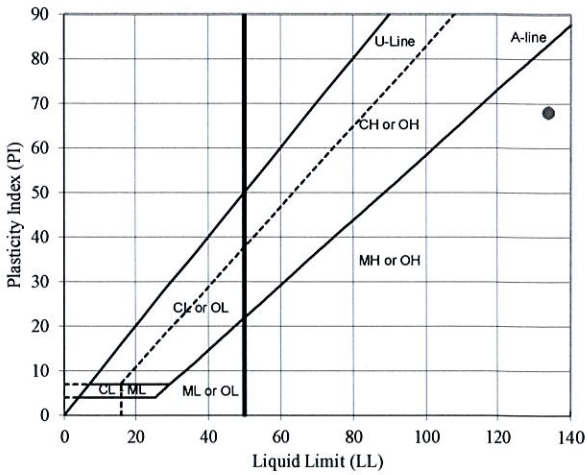
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS (WET)

ASTM D421, D422, D4318

PROJECT NAME: **D.E. Karn**
SAMPLE ID: **B-5** DEPTH (ft): **33.5-35.0**
TYPE: **Bag**



	Sieve	Particle Size (mm)	% Passing	Description	Percentage	
Sieve Analysis (Initial Separation on No. 4 Sieve)	3-inch	75.0	-	Cobbles	-	
	2-inch	50.8	-	Coarse Gravel	-	-
	1.5-inch	37.5	-			
	1-inch	25.0	-			
	3/4-inch	19.0	-			
	1/2-inch	12.7	-	Fine Gravel	-	
	3/8-inch	9.5	-			
	#4	4.75	-			
	#10	2.0	-	Coarse Sand	-	-
	#20	0.85	-	Medium Sand	-	
	#40	0.425	-			
	#60	0.25	-	Fine Sand	-	
	#100	0.15	-			
	#200	0.075	-			
Hydrometer Analysis		-	-	Silt or Clay Fines	-	
		-	-			
		-	-			
		-	-			
		-	-			
		-	-			
		-	-			



LL	PL	PI	LI
134	66	68	0.76

USCS Description (ASTM D 2487):

Very dark gray, PEAT

As-Received Moisture Content (%): **117.5**

USCS Group Symbol: **PT**

Notes: (1) Particle size analysis sample Mechanically dispersed using Stirring Apparatus A for about 1 Minute.

(2) Sample prepared for Atterberg Limits testing by the dry method. Material retained on No. 40 sieve removed from Atterberg Limits sample by dry sieving. Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using manual device.

TECH	HD
DATE	3/12/2015
CHECK	BT
REVIEW	ESD

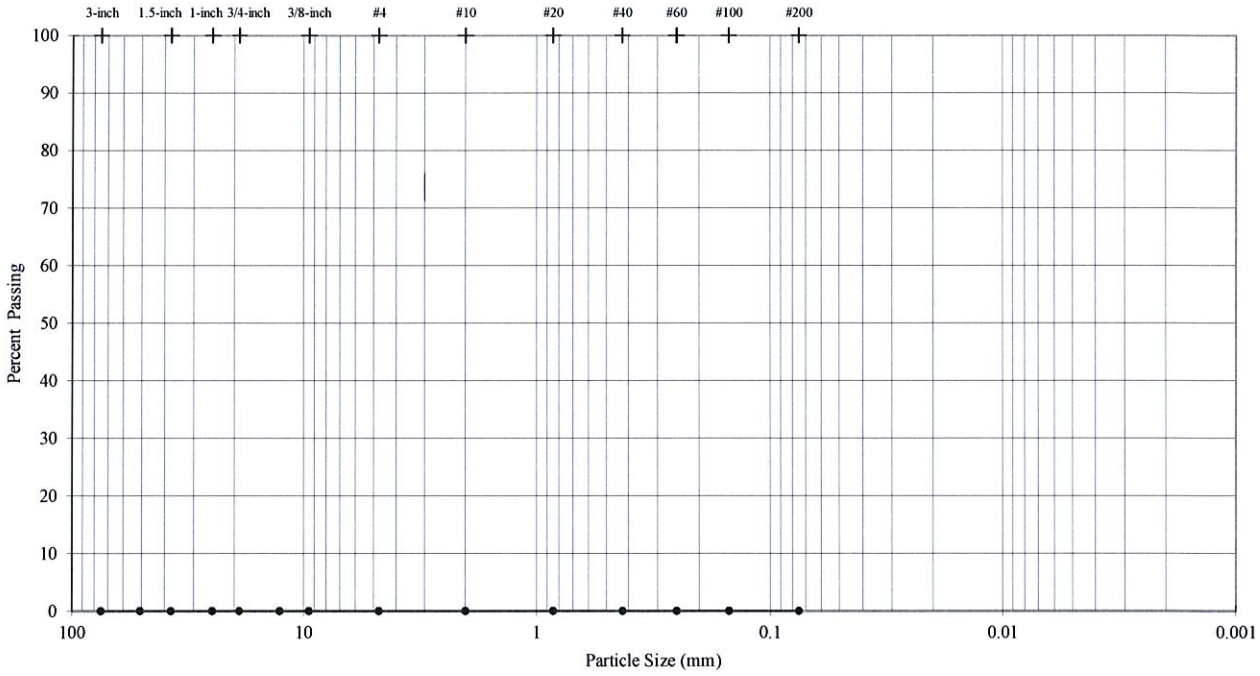
Golder Associates

March-15 152-4652

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS (WET)

ASTM D421, D422, D4318

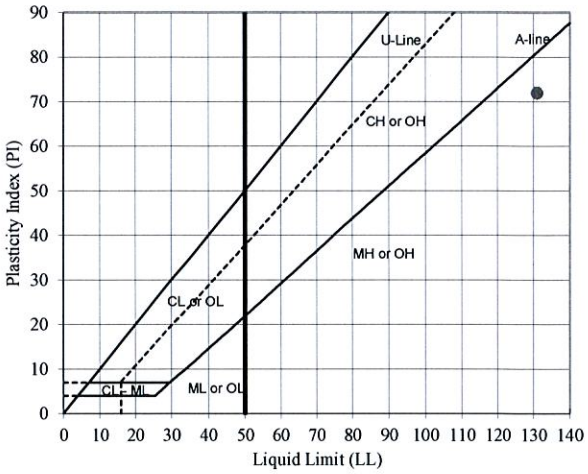
PROJECT NAME: **D.E. Karn**
SAMPLE ID: **B-5 ST-1** DEPTH (ft): **35.0-35.5**
TYPE: **Tube**



Sieve	Particle Size (mm)	% Passing	Description	Percentage	
3-inch	75.0	-	Cobbles	-	
2-inch	50.8	-	Coarse Gravel	-	-
1.5-inch	37.5	-			
1-inch	25.0	-			
3/4-inch	19.0	-			
1/2-inch	12.7	-	Fine Gravel	-	
3/8-inch	9.5	-			
#4	4.75	-			
#10	2.0	-	Coarse Sand	-	-
#20	0.85	-	Medium Sand	-	
#40	0.425	-			
#60	0.25	-	Fine Sand	-	
#100	0.15	-			
#200	0.075	-			
	-	-	Silt or Clay Fines	-	
	-	-			
	-	-			
	-	-			
	-	-			
	-	-			
	-	-			

Sieve Analysis (Initial Separation on No. 4 Sieve)

Hydrometer Analysis



LL	PL	PI	LI
131	59	72	0.40

USCS Description (ASTM D 2487):

Black, PEAT

As-Received Moisture Content (%): **87.7**

USCS Group Symbol: PT

Notes: (1) Particle size analysis sample Mechanically dispersed using Stirring Apparatus A for about 1 Minute.

(2) Sample prepared for Atterberg Limits testing by the dry method. Material retained on No. 40 sieve removed from Atterberg Limits sample by dry sieving. Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using manual device.

TECH	HD
DATE	3/13/2015
CHECK	DS
REVIEW	ESD

SPECIFIC GRAVITY OF SOIL SOLIDS

ASTM D 854

PROJECT NAME: D.E. Karn
PROJECT NUMBER: 152-4652
SAMPLE ID: B-5 ST-1
SAMPLE TYPE: Tube
SAMPLE DEPTH (ft): 35.0-35.5

SAMPLE PREPARATION

Wet (A) or Dry (B)	B

% Passing #4 Sieve	#DIV/0!

SAMPLE DESCRIPTION

Black, PEAT

NOTES

CALCULATIONS

Test Temperature, T_t	18.5	°C
Density of Water @ T_t	0.99850	g/mL
Pycnometer Number	10	
Mass of Pycnometer, Water, & Soil (M_{pws} @ T_t)	383.98	g
Mass of Pycnometer & Water (M_{pw} @ T_t)	362.75	g
Mass of Dish & Dry Soil	404.43	g
Mass of Dish	367.99	g
Mass of Oven Dry Soil (M_s)	36.44	g
Specific Gravity (G_s @ T_t)	2.40	
Temperature coefficient (K)	1.00030	
Specific Gravity (G_s @ 20 °C)	2.40	

Golder Associates Inc.
Lansing, Michigan

TECH	HD
DATE	3/13/2015
CHECK	
REVIEW	

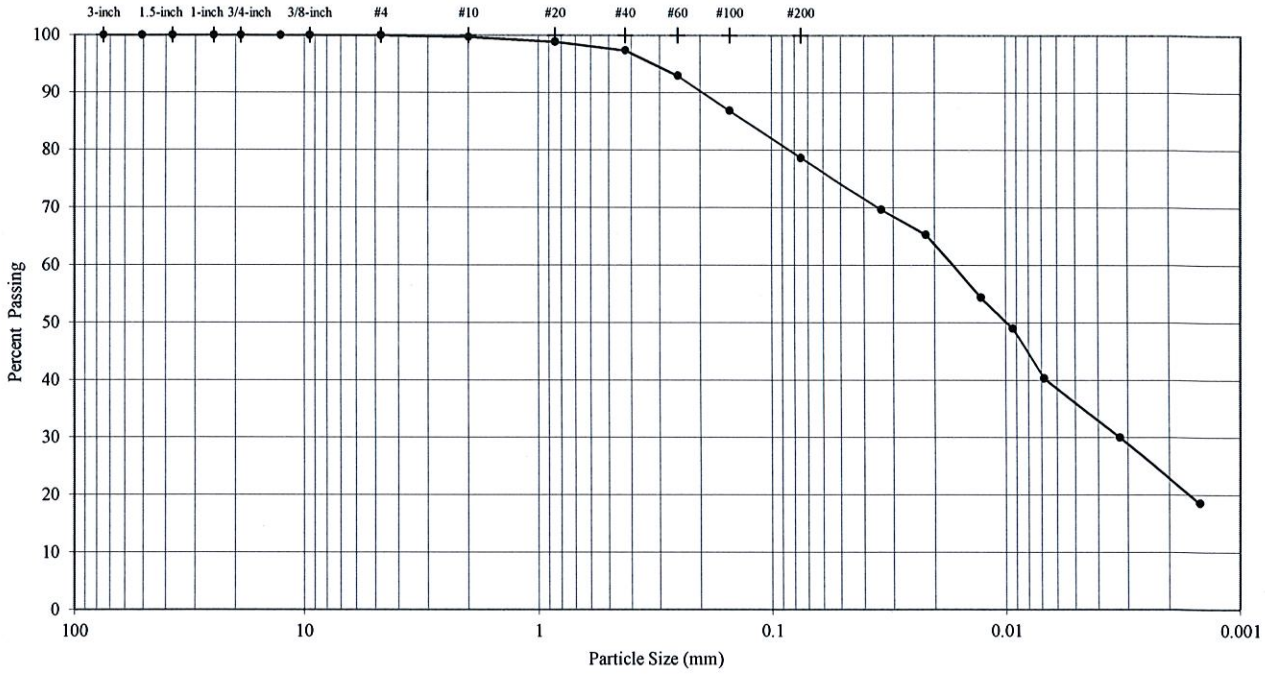
Golder Associates

March-15 152-4652

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS (WET)

ASTM D421, D422, D4318

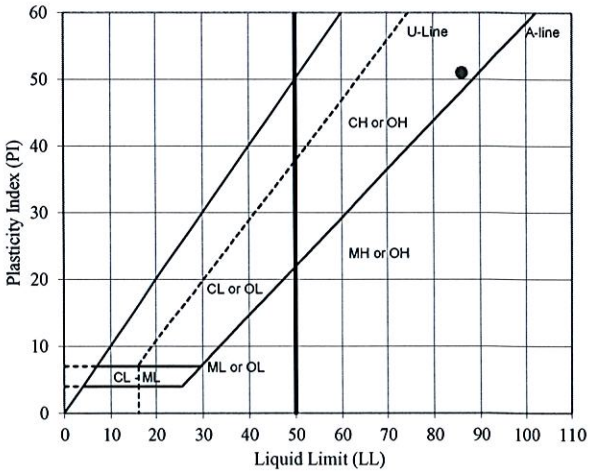
PROJECT NAME: **D.E. Karn**
SAMPLE ID: **B-5 ST-1** DEPTH (ft): **35.5-36.0**
TYPE: **Tube**



Sieve	Particle Size (mm)	% Passing	Description	Percentage	
3-inch	75.0	100.0	Cobbles	0.00	
2-inch	50.8	100.0	Coarse Gravel	0.00	0.00
1.5-inch	37.5	100.0			
1-inch	25.0	100.0			
3/4-inch	19.0	100.0			
1/2-inch	12.7	100.0	Fine Gravel	0.00	
3/8-inch	9.5	100.0			
#4	4.75	100.0			
#10	2.0	99.7	Coarse Sand	0.28	21.37
#20	0.85	98.9	Medium Sand	2.36	
#40	0.425	97.4			
#60	0.25	93.0	Fine Sand	18.73	
#100	0.15	86.8			
#200	0.075	78.6			
	0.034	69.6	Silt or Clay Fines	78.63	
	0.022	65.3			
	0.013	54.4			
	0.009	49.0			
	0.007	40.4			
	0.003	30.0			
	0.001	18.6			

Sieve Analysis (Initial Separation on No. 4 Sieve)

Hydrometer Analysis



LL	PL	PI	LI
86	35	51	0.14

USCS Description (ASTM D 2487):

Dark grayish brown, ORGANIC CLAY WITH SAND

As-Received Moisture Content (%): **42.3**

USCS Group Symbol: **OH**

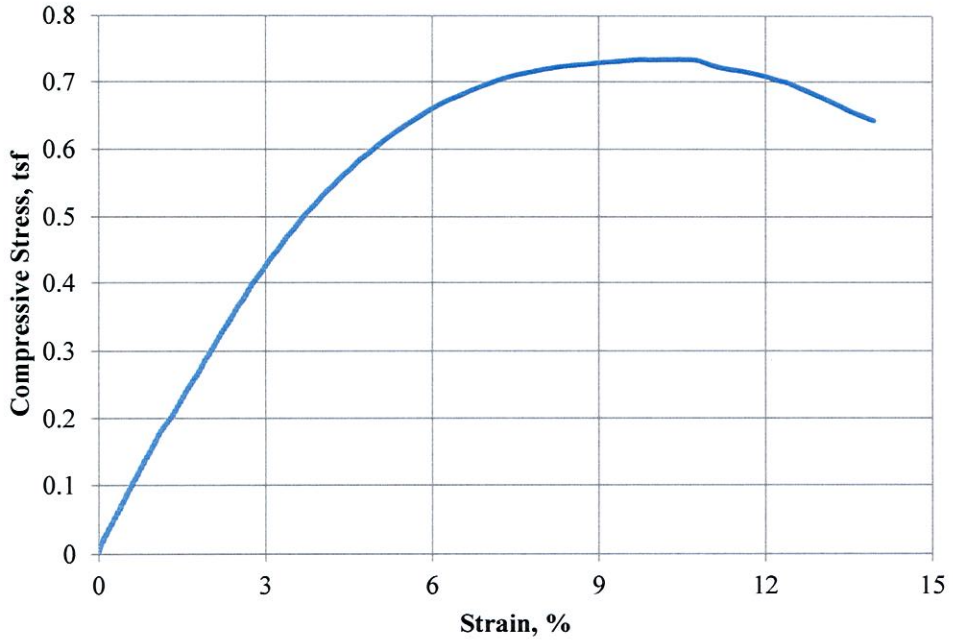
Notes: (1) Particle size analysis sample Mechanically dispersed using Stirring Apparatus A for about 1 Minute.

(2) Sample prepared for Atterberg Limits testing by the dry method. Material retained on No. 40 sieve removed from Atterberg Limits sample by dry sieving. Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using manual device.

TECH	HD
DATE	3/13/2015
CHECK	
REVIEW	

USCS Description (ASTM D 2487):

(OH) Dark grayish brown. ORGANIC CLAY WITH SAND



Sample Data		
Average Height =	6.144	in
Average Diameter =	2.830	in
Height to Diameter Ratio =	2.17	H:D
Water Content =	67.7	%
Initial Dry Unit Weight =	58.3	pcf
Saturation =	103.5	%
Unconfined Compressive Strength =	**0.73**	**tsf**
Shear Strength =	**0.37**	**tsf**
Strain at Failure =	**10.5**	**%**

Picture of Failed Specimen:

Notes

Water content evaluated using trimmings from the specimen after shear. Specimen tested was intact. Average rate of strain was 1%/min.

Golder Associates Inc.		Title: **UNCONFINED COMPRESSIVE STRENGTH ASTM D2166 TEST RESULTS**				
Project Name: **D.E. Karn**						
Sample ID: **B-5 ST-1 35'-37'**	Depth: **35.5-36 ft**	Job Number: **1524652**	Date: **10/30/2014**	Checked: RT	Reviewed: EJH	Figure: **1**

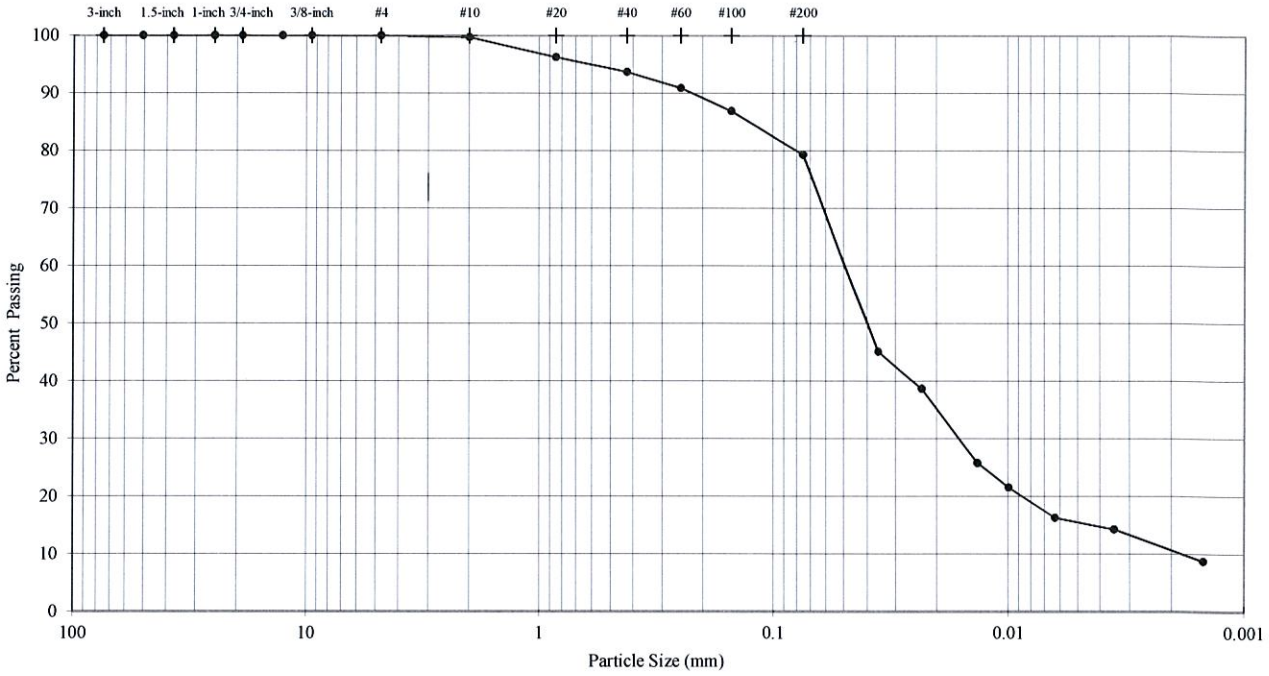
Golder Associates

March-15 | 152-4652

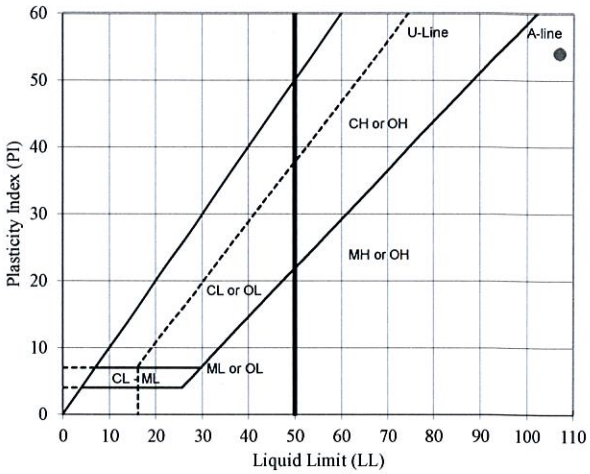
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS WET

ASTM D421, D422, D4318

PROJECT NAME: **D.E. Karn**
SAMPLE ID: **B-4 ST-1**
TYPE: **Tube**
DEPTH (ft): **24.0-26.0**



	Sieve	Particle Size (mm)	% Passing	Description	Percentage	
Sieve Analysis (Initial Separation on No. 4 Sieve)	3-inch	75.0	100.0	Cobbles	0.00	
	2-inch	50.8	100.0	Coarse Gravel	0.00	0.00
	1.5-inch	37.5	100.0			
	1-inch	25.0	100.0			
	3/4-inch	19.0	100.0			
	1/2-inch	12.7	100.0	Fine Gravel	0.00	
	3/8-inch	9.5	100.0			
	#4	4.75	100.0			
	#10	2.0	99.7	Coarse Sand	0.28	20.72
	#20	0.85	96.2	Medium Sand	6.03	
	#40	0.425	93.7			
	#60	0.25	90.9	Fine Sand	14.40	
	#100	0.15	86.9			
	#200	0.075	79.3			
Hydrometer Analysis		0.036	45.1	Silt or Clay Fines	79.28	
		0.023	38.7			
		0.013	25.8			
		0.010	21.5			
		0.006	16.3			
		0.003	14.3			
		0.001	8.7			



LL	PL	PI	LI
107	53	54	0.19

USCS Description (ASTM D 2487):
Dark brown, ORGANIC CLAY WITH SAND

As-Received Moisture Content (%): **63.4**

USCS Group Symbol: **OH**

Notes: (1) Particle size analysis sample Mechanically dispersed using Stirring Apparatus A for about 1 Minute.

(2) Sample prepared for Atterberg Limits testing by the dry method. Material retained on No. 40 sieve removed from Atterberg Limits sample by dry sieving. Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using manual device.

TECH	HD
DATE	3/17/2015
CHECK	BS
REVIEW	EJP

SPECIFIC GRAVITY OF SOIL SOLIDS

ASTM D 854

PROJECT NAME: D.E. Karn
PROJECT NUMBER: 152-4652
SAMPLE ID: B-4 ST-1
SAMPLE TYPE: Tube
SAMPLE DEPTH (ft): 24.0-26.0

SAMPLE PREPARATION

Wet (A) or Dry (B)	B

% Passing #4 Sieve	100.0

SAMPLE DESCRIPTION

Dark brown, ORGANIC CLAY WITH SAND

NOTES

CALCULATIONS

Test Temperature, T_t	18.5	°C
Density of Water @ T_t	0.99850	g/mL
Pycnometer Number	3	
Mass of Pycnometer, Water, & Soil (M_{pws} @ T_t)	371.76	g
Mass of Pycnometer & Water (M_{pw} @ T_t)	350.95	g
Mass of Dish & Dry Soil	350.49	g
Mass of Dish	314.86	g
Mass of Oven Dry Soil (M_s)	35.63	g
Specific Gravity (G_s @ T_t)	2.40	
Temperature coefficient (K)	1.00030	
Specific Gravity (G_s @ 20 °C)	2.40	

Golder Associates Inc.
Lansing, Michigan

TECH	HD
DATE	3/17/2015
CHECK	
REVIEW	

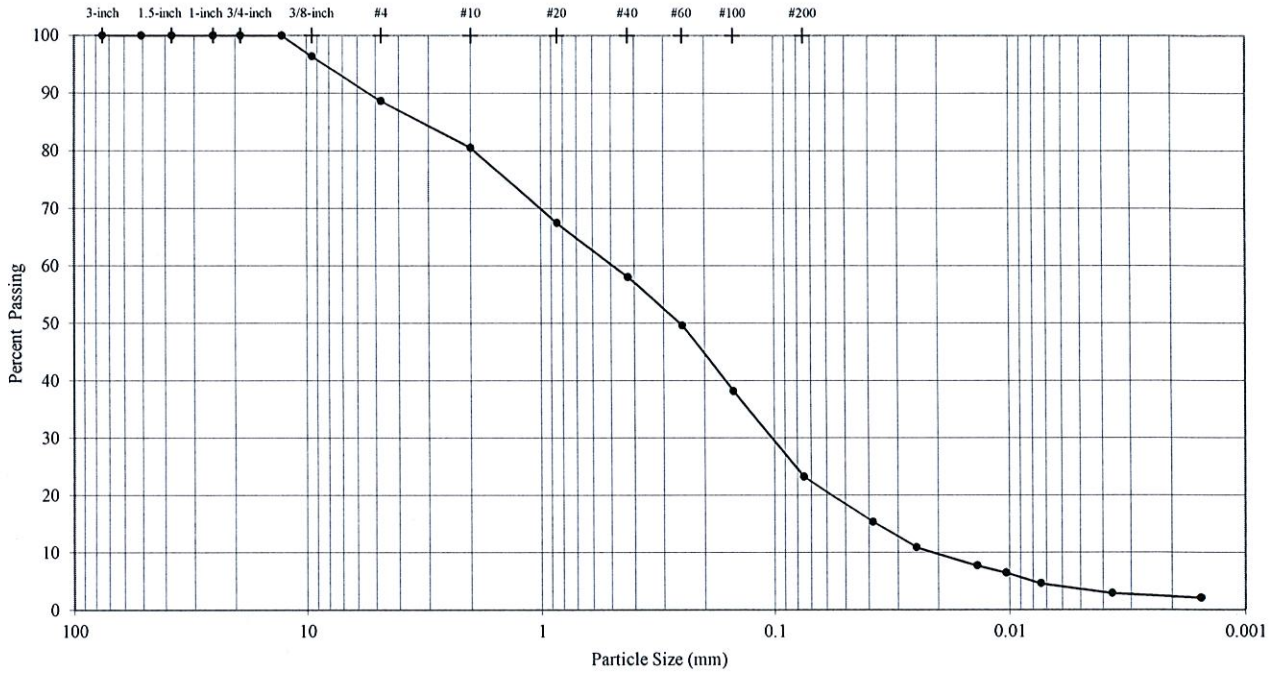
Golder Associates

March-15 152-4652

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

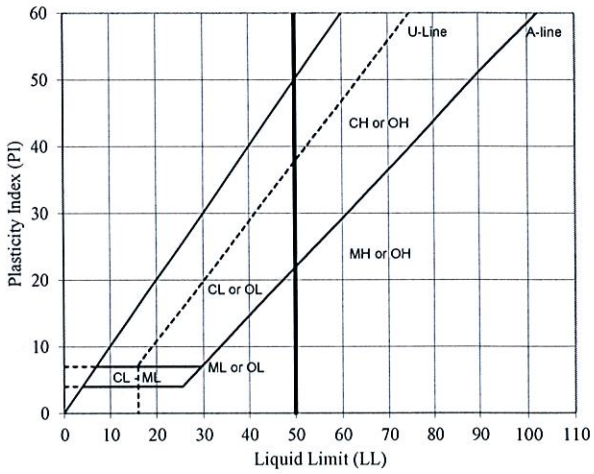
ASTM D421, D422, D4318

PROJECT NAME: **D.E. Karn**
SAMPLE ID: **B-9** DEPTH (ft): **8.5-10.0**
TYPE: **Jar**



Sieve	Particle Size (mm)	% Passing	Description	Percentage	
3-inch	75.0	100.0	Cobbles	0.00	
2-inch	50.8	100.0	Coarse Gravel	0.00	11.36
1.5-inch	37.5	100.0			
1-inch	25.0	100.0			
3/4-inch	19.0	100.0			
1/2-inch	12.7	100.0	Fine Gravel	11.36	
3/8-inch	9.5	96.4			
#4	4.75	88.6			
#10	2.0	80.6	Coarse Sand	8.09	65.41
#20	0.85	67.5	Medium Sand	22.51	
#40	0.425	58.0			
#60	0.25	49.6	Fine Sand	34.81	
#100	0.15	38.2			
#200	0.075	23.2			
	0.038	15.3	Silt or Clay Fines	23.23	
	0.025	10.9			
	0.014	7.7			
	0.010	6.5			
	0.007	4.6			
	0.004	2.9			
	0.002	2.1			

Sieve Analysis (Initial Separation on No. 4 Sieve)
Hydrometer Analysis



Visual Description:

Very dark gray, BOTTOM ASH

LL	PL	PI	LI
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As-Received Moisture Content (%): **57.0**

USCS Group Symbol: **-**

Notes: (1) Particle size analysis sample Mechanically dispersed using Stirring Apparatus A for about 1 Minute.

(2) Sample prepared for Atterberg Limits testing by the dry method. Material retained on No. 40 sieve removed from Atterberg Limits sample by dry sieving. Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using manual device.

TECH	HD
DATE	3/9/2015
CHECK	
REVIEW	

ORGANIC CONTENT

ASTM D2974, METHOD C

JOB NAME: D.E. Karn | DATE: March-15

JOB NUMBER: 152-4652 | TECH: TDS

REVIEW: EJP

MOISTURE CONTENT DETERMINATION						
sample #	**B-2**	**B-4**	**B-4**	**B-5**	**B-5**	**B-7**
depth (ft)	33.5-35.0	21.5-23.0	24.0-26.0	33.5-35.0	35.5-36.0	18.5-20.0
tare #	1	2	2	3	1	4
wt wet soil & tare (g)	181.14	169.55	165.85	172.19	178.12	162.52
wt dry soil & tare (g)	142.41	131.44	141.00	124.70	175.37	116.05
wt tare (g)	80.82	81.93	81.92	83.69	83.69	79.89
wt lost (g)	38.73	38.11	24.85	47.49	2.75	46.47
wt soil, dry (g)	61.59	49.51	59.08	41.01	91.68	36.16
% moisture	**62.9%**	**77.0%**	**42.1%**	**115.8%**	**3.0%**	**128.5%**
ASH & ORGANIC CONTENT DETERMINATION						
wt soil & tare, dry (g)	142.41	131.44	141.00	124.70	175.37	116.05
wt soil & tare, burnt (g)	137.16	125.71	132.77	116.90	168.00	108.93
wt tare (g)	80.82	81.93	81.92	83.69	83.69	79.89
wt lost (g)	5.25	5.73	8.23	7.80	7.37	7.12
wt soil, dry (g)	61.59	49.51	59.08	41.01	91.68	36.16
% ash	**91.5%**	**88.4%**	**86.1%**	**81.0%**	**92.0%**	**80.3%**
% Volatile organics	**8.5%**	**11.6%**	**13.9%**	**19.0%**	**8.0%**	**19.7%**

Note: Gravel removed from test specimen prior to moisture content determination

Furnace temperature for ash content determination was approximately 450° C

GOLDER ASSOCIATES
LANSING, MI

MOISTURE CONTENT DETERMINATIONS

Project Number	152-4652
Project Name	D.E. Karn Bottom Ash Tank
Tech	HD
Date	3/15/2015
Checked	RP/
Reviewed	GES

Borehole Number	Sample Depth (ft)	Sample Number	Wt. of Wet Soil & Tare (g)	Wt. of Dry Soil & Tare (g)	Weight of Tare (g)	Weight of Water (g)	Weight of Dry Soil (g)	Water Content (%)
B-1	3.5-5.0	-	62.92	50.44	13.51	12.48	36.93	33.8
B-1	14.5-14.9	-	54.49	39.65	13.71	14.84	25.94	57.2
B-1	24.5-25.0	-	69.40	61.57	13.82	7.83	47.75	16.4
B-1	28.5-30.0	-	66.12	55.88	13.64	10.24	42.24	24.2
B-1	33.5-35.0	-	72.20	62.65	13.52	9.55	49.13	19.4
B-2	3.5-5.0	-	33.11	28.30	14.76	4.81	13.54	35.5
B-2	8.5-10.0	-	35.31	30.93	13.46	4.38	17.47	25.1
B-2	13.5-14.5	-	50.47	38.78	14.82	11.69	23.96	48.8
B-2	14.5-15.0	-	43.71	25.70	13.56	18.01	12.14	148.4
B-2	21.0-22.5	-	67.67	57.29	14.85	10.38	42.44	24.5
B-2	23.5-24.0	-	78.54	61.05	13.59	17.49	47.46	36.9
B-2	28.5-30.0	-	95.85	82.67	13.72	13.18	68.95	19.1
B-2	33.5-35.0	-	43.66	31.80	13.76	11.86	18.04	65.7
B-2	35.0-35.5	-	82.36	71.98	13.75	10.38	58.23	17.8
B-3	1.0-2.5	-	45.99	39.80	13.73	6.19	26.07	23.7
B-3	3.5-5.0	-	75.31	68.24	13.79	7.07	54.45	13.0
B-3	8.5-10.0	-	105.35	87.44	13.67	17.91	73.77	24.3
B-3	13.5-15.0	-	53.81	44.51	13.74	9.30	30.77	30.2
B-3	18.5-20.0	-	63.33	53.68	14.97	9.65	38.71	24.9
B-3	23.5-25.0	-	51.22	43.28	13.53	7.94	29.75	26.7
B-4	1.0-2.5	-	74.39	66.43	13.61	7.96	52.82	15.1
B-4	3.5-5.0	-	63.68	57.87	13.83	5.81	44.04	13.2
B-4	8.5-10.0	-	72.15	64.87	13.86	7.28	51.01	14.3
B-4	13.5-15.0	-	58.99	51.15	14.73	7.84	36.42	21.5
B-4	18.5-20.0	-	57.56	49.84	13.86	7.72	35.98	21.5
B-4	20.0-21.5	-	62.73	51.94	13.59	10.79	38.35	28.1
B-4	33.5-35.0	-	54.38	47.71	13.72	6.67	33.99	19.6
B-5	1.0-2.5	-	39.38	35.87	13.60	3.51	22.27	15.8
B-5	3.5-5.0	-	42.57	37.40	13.69	5.17	23.71	21.8
B-5	6.0-7.5	-	36.45	30.87	13.50	5.58	17.37	32.1
B-5	9.5-10.0	-	43.22	31.18	13.71	12.04	17.47	68.9
B-5	12.0-15.5	-	36.45	30.87	13.50	5.58	17.37	32.1
B-5	23.5-25.0	-	64.61	49.50	13.86	15.11	35.64	42.4
B-5	28.3-29.5	-	48.11	38.45	13.86	9.66	24.59	39.3
B-5	29.5-30.0	-	45.83	39.48	14.80	6.35	24.68	25.7
B-5	33.5-35.0	-	36.36	25.99	13.60	10.37	12.39	83.7
B-5	37.5-39.0	-	43.49	39.14	13.71	4.35	25.43	17.1
B-6	3.5-5.0	-	42.52	38.81	13.74	3.71	25.07	14.8
B-6	8.5-10.0	-	40.60	37.17	13.56	3.43	23.61	14.5
B-6	13.5-15.0	-	46.72	42.61	13.62	4.11	28.99	14.2
B-6	18.5-20.0	-	46.96	40.02	13.60	6.94	26.42	26.3

MOISTURE CONTENT DETERMINATIONS

Project Number	152-4652
Project Name	D.E. Karn Bottom Ash Tank

Tech	HD
Date	3/15/2015
Checked	DS
Reviewed	GRS

Borehole Number	Sample Depth (ft)	Sample Number	Wt. of Wet Soil & Tare (g)	Wt. of Dry Soil & Tare (g)	Weight of Tare (g)	Weight of Water (g)	Weight of Dry Soil (g)	Water Content (%)
B-7	3.5-5.0	-	62.92	53.21	13.71	9.71	39.50	24.6
B-7	8.5-10.0	-	45.85	38.17	13.00	7.68	25.17	30.5
B-7	13.5-15.0	-	45.89	39.85	13.75	6.04	26.10	23.1
B-7	18.5-20.0	-	32.32	23.24	13.81	9.08	9.43	96.3
B-7	20.0-21.5	-	47.84	42.13	14.86	5.71	27.27	20.9
B-8	3.5-5.0	-	31.94	25.16	13.51	6.78	11.65	58.2
B-8	8.5-10.0	-	52.66	45.18	13.61	7.48	31.57	23.7
B-8	13.5-15.0	-	49.41	41.59	13.64	7.82	27.95	28.0
B-8	18.5-20.0	-	44.37	39.63	14.91	4.74	24.72	19.2
B-8	23.5-25.0	-	65.96	61.02	13.85	4.94	47.17	10.5
B-8	25.0-26.5	-	55.37	50.99	13.61	4.38	37.38	11.7
B-9	3.5-5.0	-	40.39	30.78	14.80	9.61	15.98	60.1
B-9	13.5-14.5	-	52.65	40.82	13.92	11.83	26.90	44.0
B-9	14.5-15.0	-	36.92	30.32	14.85	6.60	15.47	42.7
B-9	18.5-20.0	-	54.87	47.71	13.91	7.16	33.80	21.2
B-9	23.5-25.0	-	67.56	62.54	13.56	5.02	48.98	10.2
B-9	28.5-30.0	-	45.33	41.61	13.73	3.72	27.88	13.3